Environmental Impact Assessment Report

for

ONGOING 2X 660 MW UDANGUDI SUPERCRITICAL THERMAL POWER PROJECT STAGE-1 AT UDANGUDI VILLAGE, TIRUCHENDUR TALUK, TUTICORIN DISTRICT, TAMIL NADU

Project/Activity Sl. No. 1(d), Category – A

Project proponent

Tamil Nadu Power Generation Corporation Limited (TNPGCL) (TANGEDCO)

Environmental consultant

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November 2024

PROJECT DETAILS			
Name of Project	**Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village, Tiruchendur Taluk, Tuticorin District, Tamil Nadu**		
Project Number	**ABC/EIA/2024/ Udangudi Thermal Power Plant/R01**	**Released**	**November 2024**

CONTACT DETAILS

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DISCLAIMER

DECLARATON BY EIA CONSULTANT

This EIA report has been prepared by ABC Techno Labs India Private Limited in line with EIA Notification, dated 14th September 2006, seeking prior Environmental Clearance from the Ministry of Environment, Forests and Climate Change, New Delhi.

This work has been undertaken in accordance with ISO 9001:2008 Quality Management System with all reasonable skill, care and diligence within the terms of the contract with the client, incorporating our General Terms & Conditions of Business and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

Further, this report is confidential to the client and the use of this report by unauthorized third parties without written authorization from ABC Techno Labs will be at their own risk.

Name : G. Murugesh

Sign : 

Designation : Chairman & Managing Director

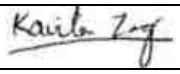
Date : 27/11/2024

DECLARATION OF EXPERTS

Name of the Project	Environmental Impact Assessment Report for Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village, Tiruchendur Taluk, Tuticorin District, Tamil Nadu
Schedule as per EIA notification 2006	1 (d)
NABET Sector No.	4 - Thermal Power Plant

DECLARATION

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

EIA Coordinator (EC)		
Name	:	**Miss Kavita Zog**
Signature		
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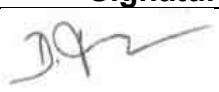
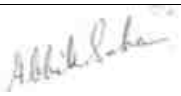
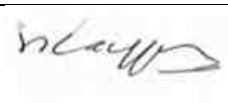
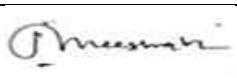
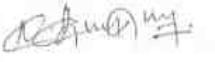
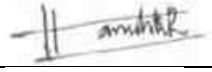
S. No	Functional Areas	Name of the Expert/s	Signature
1.	WP	Vaishnavi Dhinakaran	
2.	EB	Abhik Saha	
3.	SHW		
4.	AP	Muthiah Mariappan	
5.	AQ	Vinod Kumar Gautam	
6.	RH		
7.	HG	Dr.Veezhinathan Subramaniyam	
8.	LU	Dr. N Rama Krishnan	
9.	SE		
10.	NV	Haneesh	
11.	SC	Hemambika Balakrishnan	

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ToR compliance

In order to assess, the environmental impacts due to the ongoing project. Environmental Impact Assessment (EIA) & Environmental Management Plan (EMP) report has been prepared.

As a part of the process, the application (Form-1 & ToR) submitted for the ongoing project was considered in the 11th EAC (Thermal) meeting held on 27-28th June 2024 and issued the Terms of Reference (ToR). The Committee has suggested the specific and standard Terms of Reference (ToR) for preparation of the EIA report vide its File No. J-13012/19/2008-IA. II(T) and ToR identification no. TO24A0601TN5897590N dated 29.07.2024.

The ToR condition stipulated by MoEF&CC and its status of compliance are as follows;

S. No.	ToR Conditions	Compliance
Specific ToR		
1. [A] Environmental Management and Biodiversity Conservation		
1.1	PP is advised to implement the **'Ek Ped Maa Ke Naam'** Campaign which was launched on 5th June 2024 on the occasion of the World Environment Day to increase the forest cover across the Country. This plantation drive is other than green belt development. An action plan in this regard shall be submitted.	M/s. Tamil Nadu Power Generation Corporation Limited (TNPGCL) conducted the **'EK PED MAA KE NAAM'** tree plantation program at two schools, such as Sri R.K.C. Hr. Sec. School on 19.09.2024 and T.D.T.A. Hr. Sec. School on 26.09.2024. The plantation program engaged 200 school students, and 50 saplings were planted at each school. For more details refer **Annexure - I**
1.2	Detailed Impact assessment shall be carried out due to change in source of coal along with proper mitigation measure and EMP budget.	Detailed Impact assessment carried out and discussed in **Chapter 4 & 9** for Mitigation measures and EMP budget respectively. The revised ash generation in view of change in coal source is **Table.2.6.**
1.3	Impact of release of cooling tower water on marine life need to be studied by reputed govt. institute and measures implemented	The impact of release of cooling water on the marine ecology for the proposed plants has been studied by National Institute of Oceanography (NIO), GOA and it is recommended that there will not be any adverse impact on the marine ecology. The report enclosed as **Annexure - II**
1.4	Brine disposal and Management plan shall be studied and to be incorporated in EIA/EMP study.	The brine dispersion studies were carried out by NIO, GOA and the details are enclosed in **Chapter 4.** From the study, it is concluded that the peak salinity was observed during the summer season of 1.7

		PPT above ambient conditions during spring-ebb tide conditions. It takes 2.9 km in the NE direction for the discharged reject to attain near ambient conditions (Δ 0.5 PPT above baseline condition).
1.5	Radioactivity studies along with coal analysis to be provided (sulphur, ash percentage and heavy metals including Pb, Cr, As and Hg). Details of auxiliary fuel, if any including its quantity, quality, storage, etc should also be given.	The study on imported and indigenous coal was analysed and the results were within the stipulated norms. The results and details are given in **Table.3.42.** in **Chapter 3.** The auxiliary fuel oil details are given in **Table.2.3** in **Chapter 2**.
1.6	A comparative chart shall be prepared with changes observed from the previous baseline study and present baseline study.	The comparative studies have been carried out and discussed in **Chapter 3.**
1.7	Certified compliance report shall be submitted along with ATR and comments of RO on the existing EC.	Site inspection completed on 16.10.2024 and certification is in process.
1.8	PP should submit the detailed plan in tabular format (year-wise for the life of the project) for concurrent afforestation and green belt development in and around the project site. The PP should submit the number of saplings to be planted, names of native species, area to be covered under afforestation & green belt, location of plantation, target for survival rate and budget earmarked for the afforestation & green belt development. In addition to this, PP should show on a surface plan (5- year interval for life of project) of suitable scale the area to be covered under afforestation & green belt clearly mentioning the latitude and longitude of the area to be covered during each 5 years. The capital and recurring expenditure to be incurred needs to be submitted. Plantation plan should be prepared in such a way that 80% of the plantation to be carried out in first 5 years and for the remaining years the proposal for gap filling. The seedling of height not less than 2 meters to be selected and accordingly cost of plantation needs to be decided. In addition to this, plantation in the safety zone at project boundary the plantation	The greenbelt is planned around the plant as well as coal stock yards and fly ash ponds. About 167.058 Ha of land is earmarked for greenbelt, which is 44%. The species and plantation norms will be as per directives of CPCB guidelines in consultation with local forest department. The native species will be predominantly planted. The details are covered in **Chapter 2.**

	should be planned in such a way that it should be completed within 2 years only.	
1.9	Action plan for development of Three tier plantation programme (33% of total project cover area) along the periphery of the project boundary shall be provided. Plan shall be dully approved by the local forest department.	The greenbelt is planned around the plant as well as coal stock yards and fly ash ponds. About 167.058 Ha of land is earmarked for greenbelt, which is 44%. The species and plantation norms will be as per directives of CPCB guidelines in consultation with local forest department. The native species will be predominantly planted. The year wise plantation program is given in **Table.2.9.**
1.10	A detailed plan needs to be submitted for undertaking extensive green plantation within 10 km radius of the plant focusing on water reservoir, school, hospital and other institutional area and same need to be incorporated in EIA/EMP report.	Under **'EK PED MAA KE NAAM'** two schools have been covered. The nearest water bodies viz Avudayar kulam, Thangai kulam have been identified for plantation which will be along with yearly plantation given in **Table.2.9.**
1.11	Detailed action plan shall be prepared for maintenance of air pollution control equipment for proposed and existing units and shall be incorporated in EIA/EMP report	A robust air pollution control system is in place like 1. dry fog system 2. Dust suppression system 3. Hood collection system at Junction houses 4. ESP for main plant along with FGD. The details are covered in **Chapter 2 & 4.** The maintenance of the system is part of plant operation.
1.12	Details of Ash management of 5-year plan for 100 % ash utilization for proposed project shall be submitted. MoU signed for ash utilization with companies shall be submitted	The ash management of TNPGCL (TANGEDCO) for all plants is covered under E-auction. The same facilities will be extended to the proposed power plant. None of the plant is possessing ash in hand as their evacuated daily basis. The evidence to this enclosed as an **Annexure – III**.
1.13	Details of Dry Ash handling system along with the supplementary coal handling system shall be submitted.	For collecting fly ash in dry form, the system will be designed such that the fly ash and conveying air mixture from fly ash hoppers is passed through buffer hoppers, where ash will get separated and air will flow to the vacuum pumps through Bag

		filters. The bag filters will be pneumatic pulse jet type. The fly ash from the buffer hoppers will be transported to RCC silo by using air from conveying air compressors. Adequately sized vent filter will be mounted on top of the silos to filter the air and let it out to atmosphere. **Figure 2.4** depicts the Coal handling system.
1.14	Proper protection measures like HDPE lining, appropriate height of bund and adequate distance between the proposed Ash Pond and water body (minimum 60 meters) etc. shall be planned to reduce the possibility of mixing leachate with any freshwater body for under-construction ash pond. A high-density Slurry disposal plan shall be prepared.	Ash will be transported to ash pond in the land identified near the main plant. Ash slurry will be dumped into the ash pond would be contained in the ash pond by constructing bunds around the periphery of the ash pond. HDPE liner thickness of the ash pond will be established to limit permeability to the required level and as required to resist tears and punctures due to placement of the top soil on it. Recovery water system will be provided near the ash pond. The required area of the land will be about 48.562 Ha considering the bund height of 25m for both fly and bottom ash.
1.15	Pond and ground water quality (10 locations within 2 km radius of the plant boundary) shall be studied and report be submitted along with EIA/EMP. Action plan for Ground water monitoring stations on all hotspots like schools/hospitals within 2 km radius of the plant boundary be submitted. Baseline Study for Heavy metals in Groundwater, Surface water and soil to be carried out and incorporated in EIA/EMP report.	Pond and ground water quality (10 locations within 2 km radius of the plant boundary carried out and discussed in **Chapter 3** and refer **Table 3.17** for results. Baseline Studies for Heavy metals in Groundwater, Surface water and soil carried out and discussed in **Chapter 3** and refer **Table 3.16** to **3.18** for results. The 50 % of the 10 km radius falls in sea. The balance 50% covered by terrestrial land with hospitals and schools. The nearest schools Sri R.K.C. Hr. Sec. School & T.D.T.A. Hr. Sec. School have been identified for ground water monitoring. The nearest hospital is Sreedhar hospital & Kalangudieruppu Goverment Hospital have been identified for ground water monitoring.

1.16	Details pertaining to water source, treatment and discharge should be provided	About 3,13,512 KLD of sea water shall be required, with closed cycle cooling system with natural-draft cooling tower (NDCT). Water for construction purpose will be sourced from local water resource & Desalinated water will be used during operation stage. No extraction of ground water is envisaged. Water requirement for the operation phase will be met through captive desalination plant of 16 MLD capacity. Sequential batch reactors (SBR) based sewage treatment plant of 40 KLD capacities are planned for the project. Effluent generation from Transformer yard, TG hall, floor wash, fuel oil and coal handling area will be transferred/ collected/ treated in the Effluent Treatment plant of 720 KLD.
1.17	Liquid Discharge plan shall be submitted so as treated water can be use by the nearby people.	Sequential batch reactors (SBR) based sewage treatment plant of 40 KLD capacities are planned for the project. Effluent generation from Transformer yard, TG hall, floor wash, fuel oil and coal handling area will be transferred/ collected/ treated in the Effluent Treatment plant of 720 KLD. The process flow diagram of Effluent Treatment plant is enclosed as **Fig 2.10.**
1.18	PP shall submit action plan for using treated Sewage/Domestic wastewater for its operations	Sequential batch reactors (SBR) based sewage treatment plant of 40 KLD capacities are planned for the project and treated water used for toilet flushing and green belt. Effluent generation from Transformer yard, TG hall, floor wash, fuel oil and coal handling area will be transferred/ collected/ treated in the Effluent Treatment plant of 720 KLD and treated water used for green belt. The process flow diagram of Effluent Treatment plant is enclosed as **Fig 2.10.**

1.19	Project Proponent to conduct Environmental Cost Benefit Analysis for the project in EIA/EMP Report	Environmental Cost Benefit analysis is not applicable for this project. However, this chapter provides the information regarding the capital cost of the project and expenditure for the implementation of environmental mitigation measures. The cost of the EMP is provided in **Table 9.1.**
1.20	An action plan shall be prepared for Water shed development within 10 km radius of the plant boundary in consultation with reputed government institution and incorporated in EIA/EMP report	There are 2 minor watersheds are identified within the plant area based on the drainage map. The rainfalls within the plant area will be collected rain water harvesting sump. The other area of watershed left undisturbed. The details are incorporated in hydrology/ hydrogeology in **Chapter 3** under **Section 3.6.**
1.21	PP should clearly bring out that what is the specific diesel consumption ~ (Liters/Tonne of total material handled) and steps to be taken for reduction of the same. The year-wise target for reduction in the specific diesel consumption needs to be submitted. PP shall also explore the possibility of using e-vehicles/LNG/CNG-based machinery and trucks for the operation and transportation of Coal and ash	The proposed power plant is designed on coal based. Hence, diesel consumption is restricted to start-up. The SOP of the plant is drawn based on the minimum consumption of HSD during start-up. For e-vehicles /LNG /CNG-based trucks will be considered.
1.22	PP shall provide the details of transportation of fly ash from the plant, transportation route etc. Further, carry out a traffic study for at least one month and provide the impact of transportation along with the mitigation measures.	Fly ash transportation will be handled in dry / wet mode and systems are also designed for unloading in trucks to facilitate selling of fly ash for utilization of brick manufacturers, cement manufacturers, land filling, road making and other ash utilizing industries. The traffic study has been carried out and mentioned in the **Chapter 3** under **Section 3.16** for details.
1.23	PP shall submit the action plan to adhere to the Plastic Waste Management Rules 2016 and to adhere Ministry's OM dated 18/07/2022.	As the plastic waste recirculation is maximized and usage of plastic is reduced. The expected plastic waste is 13.08 kg/day. Recyclable materials will be sold to authorize dealers and remaining disposed through town panchayat.

1.24	Details on renewable energy (solar plant) proposed to be installed as energy conservation measures shall be submitted.	Total energy conservation from solar is about 3180.8 kWh per day. Initially, TNPGCL (TANGEDCO) 750 kW will be implemented. The remaining will come in the future.
1.25	PP shall provide the details of wastewater treatment facilities to be installed within its capacity	Sequential batch reactors (SBR) based sewage treatment plant of 40 KLD capacities are planned for the project. Effluent generation from Transformer yard, TG hall, floor wash, fuel oil and coal handling area will be transferred/ collected/ treated in the Effluent Treatment plant of 720 KLD. The process flow diagram of Effluent Treatment plant is enclosed as **Figure 2.10.**
1.26	A Cumulative Environmental Impact Assessment study of all the existing and proposed projects in the 10-km radius of the proposed project shall be conducted and the same shall be included the in EIA/EMP report. Details of industrial units present in 10 Km radius of the power plant shall be submitted	Complied. Environmental Impact Assessment study of all the existing and proposed projects in the 10-km radius of the proposed project conducted and attached in the EIA Report. No industrial units present in 10 Km radius of the power plant.
1.27	A Disaster Management Plan shall be prepared and incorporated in the EIA/EMP report	Complied. Attached in the EIA Report in **Chapter 7** under **section 7.2.**
2. (C)Socio economic study		
2.1	Public consultation (Written submission only) shall be conducted as per the provisions of EIA Notification, 2006 and as amended i.e PP shall obtain responses in writing from other concerned persons having a plausible stake in the environmental aspects of the project or activity by publicizing the draft EIA/EMP report/Summary on the SPCB website, following the provisions mentioned in the EIA Notification, 2006 and as amended.	Being submitted for public consultation.
2.2	As per the Ministry's OM dated 30.09.2020/20.10.2020, to address the concern submitted against the written submission, the Project Proponent is required to submit the detailed activities proposed with year-wise budgetary provision (Capital and recurring) for 10 years. Activities proposed shall be part of EMP	Complied

2.3	Further, incase no or few response is received, PP shall also do the need base assessment survey. Based on the survey, PP is required to take up physical activities in time bound manner with year-wise budgetary provision (Capital and recurring). Activities proposed shall be part of EMP.	Compiled.
2.4	A need based Social Impact Assessment Study shall also be carried out and an action plan on its recommendations may also be submitted with budgetary provisions.	Social Impact Assessment Study was carried out and discussed in **Chapter 7** under **Section 7.4.**
2.5	Demographic details in 10 km area shall be submitted	Demographic details are given in **Chapter 7** under **Section 7.4.**
2.6	The Public Health Delivery Plan including the provisions for drinking water supply for the local population shall be in the EIA/EMP Report. The status of the existing medical facilities in the project area shall be discussed. Possibilities of strengthening of existing medical facilities, construction of new medical infrastructure etc. will be explored after assessing the needs of the labour force and local populace.	Complied. TNPGCL (TANGEDCO) had developed medical facilities for catering to the needs of the project personnel. These facilities are extended to the local community in due course. It is proposed to realign the Ellappanaikan tank surplus course which will benefit the local people to store the water. The details are given in **Chapter 8**.
3. (D) Miscellaneous		
3.1	Plot the wind rose diagram using the typical meteorological year (TMY) data for the period considered for the study. The monitoring units shall be deployed in the field based on the coverage area ratio and direction of the wind. A mathematical model shall be developed for the local site rather than using the standard model available in software for both air & water quality modelling.	Compiled.
3.2	PP shall align its activities to one/few of the Sustainable Development Goals (SDG) and start working on the mission of net zero by 2050. PPs shall update the same to the EAC	Since the project is located on the sea shore the nearest mangrove has been identified at the distance of 8.08 km within the impact zone of the proposed plant. Hence, it is planned to identify the area and density in association with forest department for inter plantation for the mangroves are considered as carbon sink. This goal will be achieved after estimating the carbon foot print of the proposed plant. The inter plantation will be

		reducing the carbon print to the extent of two times of the source.
3.3	PP shall submit the EIA/EMP report after the plagiarism check using authenticated plagiarism software.	Complied
3.4	Detailed description of all the court cases including all directions given by the apex and currents status of them shall submit.	Not applicable
3.5	PP should provide in the EIA Report details of all the statutory clearances, permissions, no objection certificates, consents etc. required for this project under various Acts, Rules and regulations and their status or estimated timeline after grant of EC.	Complied. The details are given in **Chapter 1** under **section 1.6**.
3.6	The PP should submit the photograph of monitoring stations & sampling locations. The photograph should bear the date, time, latitude & longitude of the monitoring station/sampling location. In addition to this PP should submit the original test reports and certificates of the labs which will analyze the samples.	The photograph of monitoring stations & sampling locations enclosed in the **Chapter 3.** Test reports enclosed as **Annexure - IV.**
3.7	PP should clearly bring out the details of the manpower to be engaged for this project with their roles /responsibilities/designations. In addition to this PP should mention the number and designation of persons to be engaged for the implementation of environmental management plan (EMP). The capital and recurring expenditure to be incurred needs to be submitted.	The manpower engaged for this project with their roles /responsibilities/designations enclosed in the **Chapter 10** under **Table 10.1**.
3.8	PP should submit the year-wise, activity wise and time-bound budget earmarked for EMP, occupational health surveillance, and activities proposed to address the issues raised during Public Hearing. The capital and recurring expenditure to be incurred needs to be submitted.	Complied. The capital and recurring expenditure for EMP included in the **Chapter 9** under **Table.9.1**.
3.9	Activities shall be prepared based on the issues arise during previous public hearing conducted and fresh written submission with defined timeline and budgetary provisions.	Complied. The new public consultation & previous public hearing issues are addressed in additional studies with timeline and budgetary provisions in the EMP cost refer **Table 9.1**.

3.10	Aerial view video of project site and transportation route proposed for this project shall be recorded through drone and be submitted.	Complied.
3.11	The PP should ensure that only NABET-accredited consultants shall be engaged for the preparation of EIA/EMP Reports. PP shall ensure that the accreditation of the consultant is valid during the collection of baseline data, preparation of EIA/EMP report and the appraisal process. The PP and consultant should submit an undertaking the information and data provided in the EIA Report and submitted to the Ministry are factually correct and the PP and consultant are fully accountable for the same.	Complied. M/s. ABC Techno Labs India Private Limited, Chennai has been accredited for 25 sectors including Sector-4 (Thermal power plants) for Category 'A' by the National Accreditation Board for Education & Training (NABET), Quality Council of India (QCI) vide Certificate NABET / EIA / 2225 / RA0290 dated 11.06.2023 with a validity till 16.11.2025 (Sl. No. 4 of QCI /NABET List dated 26.04.2024).
3.12	PP should provide in the EIA Report details of the statutory clearances, permissions, no objection certificates, consents etc. required for this project under various Acts, Rules and regulations and their status or estimated timeline after the grant of EC.	Complied. The details are given in **Chapter 1** under **section 1.6**.
3.13	The budget to be earmarked for the various activities shall be decided after perusal of the Standard EC Conditions published by the Ministry.	Complied
3.14	All the certificates viz. Involvement of Forest land, distance from the protected area, and list of flora & fauna should be duly authenticated by the Forest Department. The Certificate should bear the name, designation, official seal of the person signing the certificate and dispatch number.	Complied.
Standard ToR		
1. Statutory compliance		
1.1	The proposed project shall be given a unique name in consonance with the name submitted to other Government Departments etc. for its better identification and reference.	Complied. Refer **Chapter 1** under **section 1.1** for details.
1.2	Vision document specifying prospective long-term plan of the project shall be formulated and submitted	Complied
1.3	Latest compliance report duly certified by the Regional Office of MoEF&CC for the conditions stipulated in the	Site inspection completed on 16.10.2024 and certification is in process.

	environmental and CRZ clearances of the previous phase(s) for the expansion projects shall be submitted.	
2. Details of the project and site		
2.1	The project proponent needs to identify minimum three potential sites based on environmental, ecological and economic considerations, and choose one appropriate site having minimum impacts on ecology and environment. A detailed comparison of the sites in this regard shall be submitted	Not applicable
2.2	Executive summary of the project indicating relevant details along with recent photographs of the proposed site (s) shall be provided. Response to the issues raised during Public Hearing and the written representations (if any), along with a time bound Action Plan and budgetary allocations to address the same, shall be provided in a tabular form, against each action proposed.	Complied.
2.3	Harnessing solar power within the premises of the plant particularly at available roof tops and other available areas shall be formulated and for expansion projects, status of implementation shall also be submitted.	Compiled. Total energy conservation from solar is about 3180.8 kWh per day. Initially, TNPGCL (TANGEDCO) 750 kW will be implemented. The remaining will come in the future. Refer **Chapter 10** under **section 10.2.12** for details.
2.4	The geographical coordinates (WGS 84) of the proposed site (plant boundary), including location of ash pond along with topo sheet (1:50,000 scale) and IRS satellite map of the area, shall be submitted. Elevation of plant site and ash pond with respect to HFL of water body/nallah/River and high tide level from the sea shall be specified, if the site is located in proximity to them.	Compiled. The ash pond is located 1.3 km away from the sea. There is no potential river/Nallah or water body is identified within the core zone. The HFL of the area is 3.77 km (Karumeni river). Refer chapter 1 under section 1.7 for details. Topo sheet (1:50,000 scale) and IRS satellite map given in **Figure 1.2** & **Figure. 3.10**.
2.5	Layout plan indicating break-up of plant area, ash pond, green belt, infrastructure, roads etc. shall be provided.	Complied. Enclosed as **Annexure V.**
2.6	Land requirement for the project shall be optimized and in any case not more than what has been specified by CEA from time to time. Item wise break up of land requirement shall be provided.	Compiled. Refer **Chapter 2** under **section 2.3** for details
2.7	Present land use (including land class/kism) as per the revenue records	Compiled. Refer **Chapter 2** under **section 2.3** for details

	and State Govt. records of the proposed site shall be furnished. Information on land to be acquired including coal transportation system, laying of pipeline, ROW, transmission lines etc. shall be specifically submitted. Status of land acquisition and litigation, if any, should be provided.	
2.8	If the project involves forest land, details of application, including date of application, area applied for, and application registration number, for diversion under FCA and its status should be provided along with copies of relevant documents.	Not applicable
2.9	The land acquisition and R&R scheme with a time bound Action Plan should be formulated and addressed in the EIA report.	Not applicable
2.10	Satellite imagery and authenticated topo sheet indicating drainage, cropping pattern, water bodies (wetland, river system, stream, nallahs, ponds etc.), location of nearest habitations (villages), creeks, mangroves, rivers, reservoirs etc. in the study area shall be provided.	Compiled. Refer **Figure 1.1** & **Figure 1.2** for Location map of the project & Topo map covering 10 km radius from the project site.
2.11	Topography of the study area supported by toposheet on 1:50,000 scale of Survey of India, along with a large scale map preferably of 1:25,000 scale and the specific information whether the site requires any filling shall be provided. In that case, details of filling, quantity of required fill material; its source, transportation etc. shall be submitted	Complied. Filling is not required. Toposheet 1:25000 & 1:50000 is given in **Chapter 1** under **Figure 1.2** & **Figure. 1.3**.
3. Ecology biodiversity and Environment		
3.1	A detailed study on land use pattern in the study area shall be carried out including identification of common property resources (such as grazing and community land, water resources etc.) available and Action Plan for its protection and management shall be formulated. If acquisition of grazing land is involved, it shall be ensured that an equal area of grazing land be acquired and developed and detailed plan submitted	Complied. Refer **Chapter 3** under **section 3.8** for details

3.2	Location of any National Park, Sanctuary, Elephant/Tiger Reserve (existing as well as proposed), migratory routes / wildlife corridor, if any, within 10 km of the project site shall be specified and marked on the map duly authenticated by the Chief Wildlife Warden of the State or an officer authorized by him.	Complied. 10 km of the project site no National Park, Sanctuary, Elephant/Tiger Reserve is identified.
3.3	A mineralogical map of the proposed site (including soil type) and information (if available) that the site is not located on potentially mineable mineral deposit shall be submitted.	Complied. Refer **Chapter 3** under **section 3.4 & 3.5** for details
3.4	The water requirement shall be optimized (by adopting measures such as dry fly ash and dry bottom ash disposal system, air cooled condenser, concept of zero discharge) and in any case not more than that stipulated by CEA from time to time, to be submitted along with details of source of water and water balance diagram. Details of water balance calculated shall take into account reuse and re- circulation of effluents.	Complied. Refer **Chapter 2** under **section 2.6.16** for details.
3.5	Water body/Nallah (if any) passing across the site should not be disturbed as far as possible. In case any Nallah / drain is proposed to be diverted, it shall be ensured that the diversion does not disturb the natural drainage pattern of the area. Details of proposed diversion shall be furnished duly approved by the concerned Department of the State.	Complied. It is proposed to realign the Ellappanaikan Tank surplus course.
3.6	It shall also be ensured that a minimum of 500 m distance of plant boundary is kept from the HFL of river system / streams etc. and the boundary of site should also be located 500 m away from railway track and National Highways.	Complied. No National highway or river / streams identified within 500 m.
3.7	Hydro-geological study of the area shall be carried out through an institute/ organization of repute to assess the impact on ground and surface water regimes. Specific mitigation measures shall be spelt out and time bound. Action Plan for its implementation shall be submitted	Compiled. Refer **Chapter 3** under **section 3.6** for details

3.8	Detailed Studies on the impacts of the ecology including fisheries of the River/Estuary/Sea due to the proposed withdrawal of water / discharge of treated wastewater into the River/Sea etc shall be carried out and submitted along with the EIA Report. In case of requirement of marine impact assessment study, the location of intake and outfall shall be clearly specified along with depth of water drawl and discharge into open sea	Compiled. Refer **Chapter 4** under **section 4.3.3** for details
3.9	Source of water and its sustainability even in lean season shall be provided along with details of ecological impacts arising out of withdrawal of water and taking into account inter-state shares (if any). Information on other competing sources downstream of the proposed project and commitment regarding availability of requisite quantity of water from the Competent Authority shall be provided along with letter / document stating firm allocation of water.	The estimated water requirement for the proposed power plant is about 3,13,512 m^3/day (13,063 m^3/h) Water drawn from the Bay of Bengal is subjected to Desalination and used for various systems.
3.10	Detailed plan for rainwater harvesting and its proposed utilization in the plant shall be furnished. In addition, wherever ground water is drawn, PP shall submit detailed plan of Water charging activity to be undertaken.	The rain (storm) water removed from the building roofs, non-process area and grade level surfaces will be directed through the open ditches and culverts to the storm drainage piping. The rain water is collected in the storm water drain running all around the project. Rain water harvesting pits - 30 nos. and pond capacity of 100 m^3 is proposed.
3.11	Feasibility of near zero discharge concept shall be critically examined and its details submitted	Not applicable
3.12	Optimization of Cycles of Concentration (COC) along with other water conservation measures in the project shall be specified.	Sea water is used for cooling purpose and 1.3 COC is maintained presently and in future all the technological effort will be taken to improve the COC.
3.13	Plan for recirculation of ash pond water and its implementation shall be submitted.	Compiled. Refer **Chapter 2** under **section 2.6.15** for details
3.14	Detailed plan for conducting monitoring of water quality regularly with proper maintenance of records shall be formulated. Detail of methodology and	Complied. For surface water, the existing Avudayar kulam, Thangai kulam will be collected regularly and surface water quality parameter will

	identification of monitoring points (between the plant and drainage in the direction of flow of surface / ground water) shall be submitted. It shall be ensured that parameter to be monitored also include heavy metals. A provision for long-term monitoring of ground water table using Piezometer shall be incorporated in EIA, particularly from the study area.	be tested. Regarding Ground water, the Piezometer likely to be install around the ash pond will be monitored once in fort night. In addition, the ground water quality near schools and village plan to be collected every six months and the report will be submitted to RO office. Refer **Chapter 3** under section 3.12 for details.
3.15	Hazards Characterization: Past incidents of hazard events within 10km radius of project area with detailed analysis of causes and probability of reoccurrence	Nil
4. Environmental baseline study and mitigation measures		
4.1	One complete season (critical season) site specific meteorological and AAQ data (except monsoon season) as per latest MoEF&CC Notification shall be collected along with past three year's meteorological data for that particular season for wind speed analysis and the dates of monitoring shall be recorded. The parameters to be covered for AAQ shall include PM10, PM2.5, SO2, NOx, CO and Hg. The location of the monitoring stations should be so decided so as to take into consideration the upwind direction, pre-dominant downwind direction, other dominant directions, habitation and sensitive receptors. There should be at least one monitoring station each in the upwind and in the pre - dominant downwind direction at a location where maximum ground level concentration is likely to occur.	AAQ data was carried out in the study period of March – May 2024. Refer **Chapter 3** under the **section of 3.9** for details.
4.2	In case of expansion project, air quality monitoring data of 104 observations a year for relevant parameters at air quality monitoring stations as identified/stipulated shall be submitted to assess for compliance of AAQ Standards (annual average as well as 24 hrs).	Not applicable.
4.3	A list of industries existing and proposed in the study area shall be furnished	Nil
4.4	Cumulative impacts of all sources of emissions including handling and	Complied. Refer **Chapter 4** under the **section of 4.3.1** for details.

	transportation of existing and proposed projects on the environment of the area shall be assessed in detail. Details of the Model used and the input data used for modelling shall also be provided. The air quality contours should be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any. The wind rose and isopleths should also be shown on the location map. The cumulative study should also include impacts on water, soil and socio economics.	
4.5	Radio activity and heavy metal contents of coal to be sourced shall be examined and submitted along with laboratory reports.	Complied. Refer **Chapter 3** under the **section of 3.17** for details. Coal analysis report enclosed as **Annexure VI.**
4.6	Fuel analysis shall be provided. Details of auxiliary fuel, if any, including its quantity, quality, storage etc should also be furnished.	Complied. Refer **Chapter 2** under the **section of 2.6.14** and **Table 2.3** for details.
4.7	Quantity of fuel required, its source and characteristics and documentary evidence to substantiate confirmed fuel linkage shall be furnished. The Ministry's Notification dated 02.01.2014 regarding ash content in coal shall be complied. For the expansion projects, the compliance of the existing units to the said Notification shall also be submitted	The total coal requirement for the Udangudi Super critical power project is 5.893 MTPA which will be sourced from Indonesia, South Africa, Australia, China, etc and Talcher coal fields of Mahanadi coal fields limited from Odisha. The linkage details enclosed as **Annexure VII.**
4.8	Details of transportation of fuel from the source (including port handling) to the proposed plant and its impact on ambient AAQ shall be suitably assessed and submitted. If transportation entails a long distance, it shall be ensured that rail transportation to the site shall be first assessed. Wagon loading at source shall preferably be through silo/conveyor belt.	The total coal requirement for the Udangudi Super critical power project is 5.893 MTPA. TANGEDCO has signed an agreement with M/s. MMTC for supply of the entire imported coal requirement. TANGEDCO is planning to use Imported Coal verses Indigenous Coal in the ratio of 50:50 based on efficiency which is amounting to 2.246 MTPA of imported coal and 3.647 MTPA of indigenous coal. Considering future expansion, the Jetty and Pipe Conveyors have been designed for the ultimate coal handling capacity of 15.33 MTPA through Panamax ships of 80,000 to 120,000 Tons capacity. Fuel oil will be transported through road.

4.9	For proposals based on imported coal, inland transportation and port handling and rail movement shall be examined and details furnished. The approval of the Port and Rail Authorities shall be submitted.	TANGEDCO is planning to use Imported Coal verses Indigenous Coal in the ratio of 50:50 based on efficiency which is amounting to 2.246 MTPA of imported coal and 3.647 MTPA of indigenous coal. the Jetty and Pipe Conveyors have been designed for the ultimate coal handling capacity of 15.33 MTPA through Panamax ships of 80,000 to 120,000 Tons capacity. Transportation of raw materials to the plant site will be transported from the captive jetty at Udangudi at the distance of 9.356 km. Port Approval enclosed as **Annexure VIII.**
4.10	Details regarding infrastructure facilities such as sanitation, fuel, restrooms, medical facilities, safety during construction phase etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase should be adequately catered for and details furnished.	Complied. Infrastructure facilities such as sanitation, fuel, restrooms, medical facilities, safety will be provided as per the industrial norms.
5. Environmental Management Plan		
5.1	EMP to mitigate the adverse impacts due to the project along with item - wise cost of its implementation in a time bound manner shall be specified.	Complied. Refer **Table 9.1** for details.
5.2	A Disaster Management Plan (DMP) along with risk assessment study including fire and explosion issues due to storage and use of fuel should be prepared. It should take into account the maximum inventory of storage at site at any point of time. The risk contours should be plotted on the plant layout map clearly showing which of the proposed activities would be affected in case of an accident taking place. Based on the same, proposed safeguard measures should be provided. Measures to guard against fire hazards should also be invariably provided. Provision for mock drills shall be suitably incorporated to check the efficiency of the plans drawn.	Individual risk from the thermal power plant is negligible, as it is below the tolerance criterion of individual risk not to exceed 1.0E-5 per year in populated areas, Individual risk contour for 1.0E-5 per year is also within the boundary limit of the Udangudi thermal power plant, The Individual Risk Potential for Loss of Life (Potential Loss of Life-PLL) due to Udangudi thermal power plant is 2.3527E-005 per avg. year. There will be no significant community impacts or environmental damage consequences; and the hazardous event scenarios and risks in general at plant adequately managed to acceptable levels by performing the

		recommended safety studies as part of detailed design, applying recommended control strategies and implementing a Safety Management System. Flash Fire, Pool Fire and Vapour cloud explosion have been conducted and safeguard measures enumerated in the **Chapter 7** under **Section 7.1.**
5.3	The DMP so formulated shall include measures against likely Fires/Tsunami/Cyclones/Storm Surges/ Earthquakes etc, as applicable. It shall be ensured that DMP consists of both On-site and Off-site plans, complete with details of containing likely disaster and shall specifically mention personnel identified for the task. Smaller version of the plan for different possible disasters shall be prepared both in English and local languages and circulated widely.	Complied. As per the ToR condition the Disaster management will be prepared in English and tamil widely circulated to the nearest villages. The copies will be made available in the panchayat office / Public assembly area. Refer **Chapter 7** under the **section of 7.2** for details.
5.4	Details of fly ash utilization plan as per the latest fly ash Utilization Notification of GOI along with firm agreements / MoU with contracting parties including other usages etc. shall be submitted. The plan shall also include disposal method / mechanism of bottom ash along with monitoring mechanism.	The ash management of TNPGCL (TANGEDCO) for all plants is covered under E-auction. The same facilities will be extended to the proposed power plant. None of the plant is possessing ash in hand as their evacuated daily basis. The evidence to this enclosed as an **Annexure – III**.
6. Green Belt Development		
6.1	Detailed scheme for raising green belt of native species of appropriate width (50 to 100 m) and consisting of at least 3 tiers around plant boundary not less than 2000 tree per ha with survival rate of more than 85%shall be submitted. Photographic evidence must be created and submitted periodically including NRSA reports in case of expansion projects. A shrub layer beneath tree layer would serve as an effective sieve for dust and sink for CO2 and other gaseous pollutants and hence a stratified green belt should be developed.	The detailed plan on green belt development given in **Chapter 2** under the section **2.9.** The list of details on greenbelt plant species are given in **Table 2.8** and the year wise plantation program is given in **Table 2.9**. The green belt layout is shown in the **Figure.2.12.** The capital and recurring expenditure given in **Table.9.1**.
6.2	Over and above the green belt, as carbon sink, plan for additional	Complied

	plantation shall be drawn by identifying blocks of degraded forests, in close consultation with the District Forests Department. In pursuance to this the project proponent shall formulate time bound Action Plans along with financial allocation and shall submit status of implementation to the Ministry every six months	
7. Socio economic activities		
7.1	Socio-economic study of the study area comprising of 10 km from the plant site shall be carried out through a reputed institute / agency which shall consist of detail assessment of the impact on livelihood of the local communities.	Socio-economic study of the study area comprising of 10 km from the plant site was carried out and discussed in **Chapter 7** under **section 7.4** for details.
7.2	Action Plan for identification of local employable youth for training in skills, relevant to the project, for eventual employment in the project itself shall be formulated and numbers specified during construction & operation phases of the Project.	During the construction phase the project requires direct employment of about 114 persons (permanent) and contractual workers of about 500 persons during construction period for supervision and execution. After construction of the project, the Plant will require about 545 persons for operation and maintenance of the plant.
7.3	If the area has tribal population, it shall be ensured that the rights of tribals are well protected. The project proponent shall accordingly identify tribal issues under various provisions of the law of the land.	Tribal population is not been identified with in 10 km radius.
7.4	A detailed CER plan along with activities wise break up of financial commitment shall be prepared in terms of the provisions OM No. 22-65/2017-IA.III dated 30.09.2020.CER component shall be identified considering need based assessment study and Public Hearing issues. Sustainable income generating measures which can help in upliftment of affected section of society, which is consistent with the traditional skills of the people shall be identified.	A detailed CER plan along with activities wise break up of financial commitment was prepared and discussed in **Chapter 8** under **Table 8.1**.
7.5	While formulating CER schemes it shall be ensured that an in-built monitoring mechanism for the schemes identified are in place and mechanism for conducting annual social audit from the nearest government institute of repute in	The CER scheme details are explained in **Table. 8.1**. The total amount for the ongoing project construction period planned to spend is Rs.32.694 Crore. Out of this during 2018 to 2020, Rs. 10.843

	the region shall be prepared. The project proponent shall also provide Action Plan for the status of implementation of the scheme from time to time and dovetail the same with any Govt. scheme(s). CER details done in the past should be clearly spelt out in case of expansion projects.	Crore was spent on equipment purchase/ repair/ alteration in government hospitals, construction of fish landing center and temporary protection of sea erosion, etc.
7.6	R&R plan, as applicable, shall be formulated wherein mechanism for protecting the rights and livelihood of the people in the region who are likely to be impacted, is taken into consideration. R&R plan shall be formulated after a detailed census of population based on socio economic surveys who were dependant on land falling in the project, as well as, population who were dependant on land not owned by them.	Not applicable
7.7	Assessment of occupational health and endemic diseases of environmental origin in the study area shall be carried out and Action Plan to mitigate the same shall be prepared	So for endemic disease origin is not reported from the study area. However, National Programme for Prevention and Control of communicable and Non-Communicable Diseases are adopted.
7.8	Occupational health and safety measures for the workers including identification of work-related health hazards shall be formulated. The company shall engage full time qualified doctors who are trained in occupational health. Health monitoring of the workers shall be conducted at periodic intervals and health records maintained. Awareness programme for workers due to likely adverse impact on their health due to working in non-conducive environment shall be carried out and precautionary measures like use of personal equipments etc. shall be provided. Review of impact of various health measures undertaken at intervals of two to three years shall be conducted with an excellent follow up plan of action wherever required.	Complied. Occupational health and safety measures for the workers discussed in **Chapter 10** under **section** of **10.2.7 to 10.2.9**.
8. Corporate Environment Policy		
8.1	Does the company has a well laid down Environment Policy approved by its	Yes. Approved by Board of Directors.

	Board of Directors? If so, it may be detailed in the EIA report.	
8.2	Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.	Yes. For all TNPGCL (TANGEDCO) operating plants.
8.3	What is the hierarchical system or administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions. Details of this system may be given.	An EMC is formulated and hierarchical system shown in **Figure 10.1.**
8.4	Does the company has compliance management system in place wherein compliance status along with compliances / violations of environmental norms are reported to the CMD and the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism should be detailed in the EIA report.	Yes Complied
9. Miscellaneous		
9.1	All the above details should be adequately brought out in the EIA report and in the presentation to the Committee	Complied.
9.2	Details of litigation pending or otherwise with respect to project in any Court, Tribunal etc. shall invariably be furnished.	Not applicable
9.3	In case any dismantling of old plants are envisaged, the planned land use & land reclamation of dismantled area to be furnished.	Not applicable
10. Additional ToR for coastal based Thermal Power Plants Projects (TPPs)		
10.1	Low lying areas fulfilling the definition wetland as per Ramsar Convention shall be identified and clearly demarcated w.r.t the proposed site.	There is no Ramsar site within 10 km radius.
10.2	If the site includes or is located close to marshy areas and backwaters, these areas must be excluded from the site and the project boundary should be away from the CRZ line. Authenticated CRZ map from any of the authorized agencies shall be submitted.	The ongoing power plant is located away from CRZ area. The infrastructure facilities like jetty and intake pipeline are falling CRZ area and the separate CRZ clearance had obtained vide MOEF letter no. EC22A004TN156490.

10.3	The soil levelling should be minimum with no or minimal disturbance to the natural drainage of the area. If the minor canals (if any) have to be diverted, the design for diversion should be such that the diverted canals not only drains the plant area but also collect the volume of flood water from the surrounding areas and discharge into marshy areas/major canals that enter into creek. Major canals should not be altered but their embankments should be strengthened and desilted.	Not applicable
10.4	Additional soil required for levelling of the sites should as far as possible be generated within the site itself in such a manner that the natural drainage system of the area is protected and improved.	Complied. Additional soil is not required.
10.5	Marshy areas which hold large quantities of flood water to be identified and shall not be disturbed	Not applicable
10.6	No waste should be discharged into Creek, Canal systems, Backwaters, Marshy areas and seas without appropriate treatment. Wherever feasible, the outfall should be first treated in a Guard Pond and then only discharged into deep sea (10 to 15 m depth). Similarly, the Intake should be from deep sea to avoid aggregation of fish and in no case shall be from the estuarine zone. The brine that comes out from Desalinization Plants (if any) should not be discharged into sea without adequate dilution.	Complied. The NIO, Goa, has finalized the location of the cooling water intake and outfall in sea by conducting the modelling studies. The total intake length is located at 2.68 km (onshore – 1 km & offshore – 1.68 km) and the total outfall length is located at 2.39 km (onshore – 1.51 km & offshore – 0.88 km).
10.7	Mangrove conservation and regeneration plan shall be formulated and Action Plan with details of time bound implementation shall be specified, if mangroves are present in Study Area.	The proposed project site is 8.08 km away from the mangroves. The details are enclosed in **Chapter 7** under **section 7.3**.
10.8	A common Green Endowment Fund should be created by the project proponents out of EMP budgets. The interest earned out of it should be used for the development and management of green cover of the area.	As on today there is no common Green Endowment Fund as the site is isolated and there are no other industries. However, TNPGCL (TANGEDCO) will spend the EMP budget as mentioned in **Table.9.1.** For green cover the local tanks,

		schools will be taken into account for plantation.
10.9	Impact on fisheries at various socio-economic level shall be assessed.	The fishermen communities' socio-economic level is detailed in the **Table.7.8 & 7.9**. Which will be monitored and supported by TNPGCL (TANGEDCO).
10.10	An endowment Fishermen Welfare Fund should be created out of CER grants not only to enhance their quality of life by creation of facilities for Fish Landing Platforms / Fishing Harbour / cold storage, but also to provide relief in case of emergency situations such as missing of fishermen on duty due to rough seas, tropical cyclones and storms etc.	Complied. about Rs. 3 Crore is identified for public hearing issues including Fishermen welfare fund.
10.11	Tsunami Emergency Management Plan shall be prepared wherever applicable and Plan submitted prior to the commencement of construction work.	Tsunami emergency management plan prepared and discussed in **Chapter 7** under the **section of 7.2.**
10.12	There should not be any contamination of soil, ground and surface waters (canals & village pond) with sea water in and around the project sites. In other words necessary preventive measures for spillage from pipelines, such as lining of Guard Pond used for the treatment of outfall before discharging into the sea and surface RCC channels along the pipelines of outfall and intake should be adopted. This is just because the areas around the projects boundaries could be fertile agricultural land used for paddy cultivation.	Complied.

Executive summary

Tamil Nadu Generation and Distribution Corporation (TANGEDCO) (A subsidiary of TNEB Ltd) is a state Government utility undertaking power Generation, Distribution and operation and maintenance of power plants. The power generation business of TANGEDCO under Tamil Nadu Electricity Board is unbundled into a separate company named as Tamil Nadu Power Generation Corporation Limited (TNPGCL) vide G.O (MS.) No. 6 Dated 24.01.2024 issued by Government of Tamil Nadu. Till such time TNPGCL is fully established TANGEDCO shall continue the business of Power Generation. To meet the increasing demand for power supply in the sectors of agriculture, domestic, industrial and commercial purposes in Tamil Nadu, TNPGCL (TANGEDCO) has proposed to install a 2 x 800 MW coal based Thermal Power Plant with supercritical technology at Udangudi village, Thiruchendur taluk, Thoothukudi district of Tamil Nadu, and obtained an Environmental Clearance for the same. Subsequently, TNPGCL (TANGEDCO) obtained amendment to the above-mentioned Environmental Clearance for reduction of unit sizes from 2 x 800 MW to 2 x 660 MW. Presently, the physical work progress for the Project is completed to the tune of 85% for which EC was granted. Since the validity of EC was extended for all the projects on account of Covid-19 pandemic, the validity of EC for Udangudi Supercritical Thermal Power Plant is valid upto 13.10.2024 As the validity of EC is completed, it is planned to obtain fresh EC for the project.

The ongoing power plant will be operated with coal as the main fuel to generate 1320 MW power (2×660 MW) and would be developed with super critical technology to obtain benefits under Clean Development Mechanism (CDM Project). It is proposed to use blended coal based on efficiency (50% imported Coal from Indonesia, South Africa, Australia, China, etc and 50%Indian coal from Talcher coal fields of Mahanadi coal fields limited from Odisha) as fuel. The annual consumption of coal for the ongoing power plant is estimated as 5.893 million tonnes for two units considering Plant Load Factor of 85%. The requirement of Indian coal from Talcher coal field will be about 3.647 million tonnes per annum and imported coal requirement will be 2.246 million tonnes per annum.

Land use area break up

S. No.	Purpose	Area in Ha
1	Main Plant, Transformer yard, Switch yard and FGD	26.305
2	Coal Yard	26.305
3	Cooling Water System	17.402
4	Fuel oil system	1.699
5	Water system including Chlorination system	7.782
6	Ash Dyke	48.562
7	Administration building and other non-plant buildings	4.719
8	Miscellaneous such as Corridor for CW piping, Ash piping, Intake & outfall, Silo & its utility building, Workshop, Stores, Roads etc.	80.168
9	Green Belt	167.058 (about 44% of total area)
Total		**380**

The project proposes to have its own captive coal jetty at Udangudi with transportation of coal through pipe conveyor system to the power plant to handle coal up to 15.33 million tonnes per annum. IITM, Chennai has studied the feasibility of the coal jetty. Based on the feasibility study NIO, Goa has finalized the location by model studies.

The Govt of Tamil Nadu has accorded approval for the development of coal jetty as Udangudi Minor Port by declaring the Port Limits for captive use of TANGEDCO. M/s. The coal jetty is located at about 7.5km from shore and possess a separate EC and CRZ clearance from MoEF&CC vide Lr. No. - EC22A004TN156490, 10-66/2020-IA.III dt. 03.08.2022.

The total water requirement for boiler and cooling water for the ongoing plant would be around 13,063 m^3/hr and the source is seawater. The NIO, Goa, has finalized the location of the cooling water intake and outfall in sea by conducting the modeling studies. The total intake length is located at 2.68 km (onshore – 1 km & offshore – 1.68 km) and the total outfall length is located at 2.39 km (onshore – 1.51 km & offshore – 0.88 km).

TANGEDCO has planned to install Supercritical pulverized fuel combustion technology for this ongoing 2x660 MW power plant, targeting higher efficiency (and hence minimum coal consumption) as well as conforming to best possible friendliness to environment at reduced emission.

Additionally, following pollution control equipment are attached to the once-through steam generator, for compliance to latest MoEF &CC guidelines.

- Selective Catalytic Reactor (SCR)
- Flue Gas Desulphurization (FGD
- Electrostatic Precipitator (ESP)
- Fly Ash Handling system and Storage Pond & Silos
- Sewage Treatment Plant
- Effluent treatment Plant

TANGEDCO is proposing 2x660 MW, in the district of Tuticorin, Tamil Nadu. The major components of (2x660 MW) Power Project are as follows:

- Steam Generator and its Auxiliaries;
- Steam Turbine and its Auxiliaries;
- Electrical Generators, Transformers and Switchyard
- Control and Instrumentation systems
- Air Pollution Control Systems like Dust Suppression and Extraction Systems, Electrostatic Precipitators, Flue Gas Desulphurization System and NOx Control (SCR) System;
- Water Intake and Treatment Systems;
- Condenser and Auxiliary Cooling System;
- Fuel Oil System;
- Coal Handling and Storage System;
- Ash Handling, Utilization and Disposal System;
- Site Drainage, Sewage Treatment Systems with facilities for Recycle and Reuse;
- Green belt, afforestation and landscaping systems.

Raw material requirement

Sl. No.	Raw Material	Quantity	Source	Calorific Value	Mode of Transport	Distance in kms.
1.	Imported Coal	2.246 (MTPA)	Indonesia	4350 kcal/kg (Blended coal)	captive jetty at Udangudi	9.356
2.	Indigenous coal	3.647 (MTPA)	Odisha			
Other Raw materials						
4.	Wet Lime stone	288 (T/day)	Indigenous	-	by road	-
5.	Fuel oil	41500m^3	Indigenous	-	By road	-

The Steam generator units will be of once through type with supercritical steam parameters. The steam generator will be of single pass (Tower type) or two pass type using spiral wall (inclined) or vertical plain / rifled type water wall tubing. The steam generator will be direct pulverised coal fired, top supported, single reheat, radiant, dry bottom, with balance draft furnace and suitable for outdoor installation. The evaporator of steam generator will be suitable for variable pressure operation from subcritical to supercritical pressure range.

During start-up and low load, the steam generator is operated in recirculation mode. In recirculation mode the boiling water is separated from the vapor in the steam water separators and the separated water dumped to condenser flash tank or recirculated via recirculation pump back to economizer and is mixed with feed water.

Coal bunkers are in-process storage silos used for storing crushed coal from the coal handling system. The coal feeders transport raw coal from the bunker to the inlet chute, leading to mill at required rate. The feeders will be of gravimetric type.

Mills pulveriser coal to the desired fineness to be fed to the furnace for combustion. The system consists of medium speed vertical spindle bowl mills. The no. of mills will be so selected to have N+ 2 standby mills available for 100% BMCR with design coal and N+1 standby mill available for 100% BMCR with worst coal.

The firing system will be designed for tangential corner firing/opposed wall firing.

Burners will be used for burning pulverised coal. Each unit has a set of burners located at different elevations of the furnace specially designed for low NOx emissions.

Seal air fans used for supplying seal air to the mills to prevent ingress of coal dust into gear box lubrication oil will be provided.

The primary function of the Air Pre-heaters is to cool down the flue gas to increase the efficiency of the unit by preheating the combustion air.

One (1) no. steam coil air pre-heater (SCAPH) will be provided at the outlet of each F.D. fan, and will be installed close to the regenerative air heater. The SCAPH will be designed to maintain the average metal temperature of regenerative air pre-heater cold elements 10°C above the acid dew point temperature by increasing the temperature of air to 100°C during start-up and very low load operation. The regenerative air pre-heater (RAPH) will

be of vertical type. The air heater will be leak proof and relatively maintenance free. These air pre-heaters will be designed passively to avoid the low temperature corrosion of the cold end section of the air heater parts.

When coal is fired in the boiler, ash will be liberated and about 80% of ash is carried along with the flue gas. If this ash is allowed to atmosphere, it will create an air pollution thereby resulting in health hazards. Hence it is necessary to precipitate the dust from the flue gas and in this process electrostatic precipitator will be envisaged to reduce particulates and remove fly ash from the flue gas. The ESP will have adequate number of ash hoppers provided with electric heaters. Each ESP will have separate collecting and emitting rapping system and each field have separate entry. Microprocessor based ESP controller will be provided. The ESP will be designed to control particulate matters in flue gas within the limits as prescribed in Ministry of Environment, Forest & Climate Change (MoEF&CC) norms.

SOx and NOx emission from the plant will be within the limits as prescribed in MoEF&CC norms. This is achieved using DeSOx and DeNOx equipment respectively.

Chimney is tall RCC structure with multiple flues. One (1) no of chimney of 275 m height is proposed for effective dispersion of the pollutants. One Chimney will be common for two (2) units housing two independent flues. The external platforms will be of RCC construction.

The Steam turbine units will be of condensing type with single reheat and supercritical steam inlet parameters.

The steam turbine will be of single reheat, condensing type with separate HP, IP and multiple LP cylinders. The steam turbine has eight (8) uncontrolled extractions for feed water and condensate preheating.

Flue Gas Desulphurisation (FGD) unit will be installed to reduce the concentration of SOx emission.

The FGD is classified into three types based on the following:

- Sea water-based flue gas desulphurisation system
- Dry Flue gas desulphurization system
- Wet Limestone based flue gas desulphurisation system

Among the three types, wet limestone based FGD system is selected.

At present, advanced Low NOx combustion technology is used in all steam generator combustion system with Low NOx burner and over fire air system. This will reduce the NOx emission to a large extent. However, cost effective post combustion NOx control technology such as SCR / SNCR will be required to limit the NOx level to 100 mg/Nm^3 as stipulated by 2015 amendment.

The coal requirement for 2x660 MW unit shall be about 5.893 MTPA based on gross calorific value of 4350 Kcal/ kg. Blended coal (Indian - coal and imported coal) will be used in the ongoing power project.

The I&C system will consist of a microprocessor based on Programmable Logic Control (PLC) system, hardwired Annunciation system, control desk cum- panel, local control panels, local instruments, instrumentation control cables and erection hardware.

For design basis of ash handling system, worst coal (blending option 50:50) will be considered. Ash content of the blended coal will be 19.5%. But for designing the ash handling system, 20% margin will be considered. This assumption is only for designing the ash handling system.

About 3,13,512 KLD of sea water shall be required, with closed cycle cooling system with natural-draft cooling tower (NDCT). Water for construction purpose will be sourced from local water resource & Desalinated water will be used during operation stage. No extraction of ground water is envisaged. Water requirement for the operation phase will be met through captive desalination plant of 16 MLD capacity.

Water requirement

Sr. No.	Description flow rate	m^3/hr
1.	Desalination Plant Feed Water	3632
2.	Cooling Water makeup	9431
3.	Total sea water requirement	13063

The RO reject (reject concentrate or Brine) from the desalination plant will be about 36840KLD. This reject will be diluted by discharging the same into the large quantity of blow down water let into the sea. Thereby the impact of RO reject over the marine ecology is negligible. The storm water drains will be segregated and channelized to water harvesting area.

STP Details: STP sludge generated will be used as manure for green belt development and maintenance. Quantity of sewage generated during operational phase will be 22.5KLD which will be treated through Two sequential batch reactors (SBR) based Sewage Treatment Plant of capacity 40 KLD.One STP at jetty (underground deck) and the other near shore within the port landward boundary is proposed. Treated wastewater from the Jetty STP will be reused for flushing while the landward STP treated water will be reused for gardening.

ETP Details: Effluent generation from Transformer yard, TG hall, floor wash, fuel oil and coal handling area of about 720 KLD will be transferred/ collected/ treated in the Effluent Treatment plant of capacity 720 KLD are planned for the project.

The expected power to be evacuated from the plant will be in the order of about 1228 MW after accounting 7% auxiliary power consumption for entire plant auxiliaries and desalination plant. Considering a plant load factor of 85% the available energy for evacuation per annum will be about 9140.7 million units from 2x660 MW power plant. The generators are connected to the 400 kV switchyard through step-up transformers. Gas insulated switchgear (GIS) is considered for the Switchyard; in view of the fact that project site is located in coastal area. GIS Switchyard will have 4 number line feeders. One double circuit (2 lines) 400 kV line will be routed to 400 kV Ottapidaram Substation, one double circuit (2 lines) 400 kV line will be routed to 400 kV Samugarengapuram

Substation and another double circuit (2 lines) 400 kV line will be routed to Viruthunagar Substation.

The rain (storm) water removed from the building roofs, non-process area and grade level surfaces will be directed through the open ditches and culverts to the storm drainage piping. The rain water is collected in the storm water drain running all around the project. Rain water harvesting pits 30 nos. and 100 m3 pond is proposed.

During the construction phase the project requires direct employment of about 114 persons (permanent) and contractual workers of about 500 persons during construction period for supervision and execution. After construction of the project, the Plant will require about 545 persons for operation and maintenance of the plant.

The project site has about 40.469 Ha of land adjacent to the power plant identified for residential development which is currently in the design phase and will be implement later.

The greenbelt is planned around the plant as well as coal stock yards and fly ash ponds. About 167.058 Ha of land is earmarked for greenbelt, which is 44%. The species and plantation norms will be as per directives of CPCB guidelines in consultation with local forest department. M/s. Tamil Nadu Power Generation Corporation Limited (TNPGCL) conducted the '**EK PED MAA KE NAAM**' tree plantation program at two schools, such as Sri R.K.C. Hr. Sec. School on 19.09.2024 and T.D.T.A. Hr. Sec. School on 26.09.2024. The plantation program engaged 200 school students, and 50 saplings were planted at each school.

The project cost is estimated to be Rs.13,076.705 crores.

The baseline environmental study has been carried out during pre-monsoon season i.e. March 2024 to May 2024 by ABC Techno Labs India Pvt Ltd., NABL Accredited Lab, in accordance with the guidelines of EIA issued by the Ministry of Environment Forests and Climate Change, Govt. of India and CPCB, New Delhi. Secondary data was collected from public domain as well as different Government sources. The scope of the study has been done as per approved ToR by 11th EAC MoEF&CC vide file no J-13012/19/2008-IA. II(T) dated 29.07.2024. Granted Terms of References for EIA/EMP Study of ongoing 2 x 660 MW Udangudi Supercritical Thermal Power plant of M/s. TANGEDCO, Tuticorin District, Tamil Nadu.

From the summary of the wind pattern for study period (March 2024- May 2024) season the predominant direction is ENE and followed by E with less calm of 5.71 percent. The average wind speed is 2.82 m/s. The nearby India Meteorological Department station that is generating meteorological data is 40 km from the site i.e. IMD, Tuticorin. Hence, secondary information on meteorological conditions has been collected from IMD station.

The monthly mean maximum temperature varied from 28.3°C to 30.1°C while annual mean monthly highest and lowest temperature in the region is about 39.1^0C and 18^0C respectively. The district is very hot and dry during the summer season from March to May. During winter season which was about 81% to 84% (at 08:30 Hours) and 76% to 77% (at 17:30 Hours). The annual average Relative humidity is 76% (at 08:30 Hours) and 69% (at 17:30 Hours).

The rainfall occurred maximum in the month of November (192.8 mm). The total rainfall received in the year is about 630.2 mm. Total rainy days observed was about 32.1 days. It is evident from the available IMD data that the area is not prone to any special weather phenomena like dust storm, hail, cloud burst etc.,

This height is determined by the observation of the atmospheric temperature profile. The inversion level during winter season ranges above 200 m at 8 A.M. and 1000m at 5 P.M.

Tuticorin district comprises of well-developed litho package of meta-sedimentary sequence inter banded with charnockite Group of rocks. The rock types exposed are of quartzite, calc-granulite, garnet-biotite-sillimanite gneiss, garnet quartzo -feldspathic gneiss and garnet-biotite-cordierite gneiss belonging to Khond alite group of rock. The economic minerals found in the district are gypsum, limestone, beach sand, kankar and shell limestone. Minor occurrences of quartzite were also observed in Thoothukudi District. Major deposits of garnet and ilmenite sand were present in the coastal part of Tiruchendur Taluk whereas proposed project site comprises of recent deposits (younger age of formation, which is called Quaternary comprises of alluvium and coastal sand).

The district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) unconsolidated & semi consolidated formations and ii) weathered and fractured crystalline rocks.

The porous formations in the district include sandstones and clays of Recent to subrecent and Tertiary age (Quaternary). The Recent formations comprising mainly sands, clays and gravels are confined to major drainage courses in the district. The maximum thickness of alluvium is 45m bgl, whereas the average thickness is about 25m. Ground water occurs under water table and semi-confined conditions in these formations and is being developed by means of dug wells and filter points. The productive zones are encountered in the depth range of 29.5 to 62 m bgl. Alluvium, which forms a good aquifer system along the Vaippar and Gundar river bed which is one of the major sources of water supply to the villages.

Landsat 8-9 & TIRS of 1:150000 scale is used for land use and landcover study. From the study it is observed that Barren land is covering 22% (90.48 Sq.km) of the total area followed by mixed plantation 21% (87.58 Sq.km).

Presentation of results

Air: The maximum and minimum concentrations for PM_{10} were recorded as 58 µg/m^3 and 33 µg/m^3 respectively. The maximum and minimum concentrations for $PM_{2.5}$ were recorded as 27 µg/m^3 and 16 µg/m^3 respectively. The maximum SO_2 concentrations were recorded as 8.9 µg/m^3 and minimum is found to be BDL(<5). The maximum and minimum NO_x concentrations were recorded as 17.7 µg/m^3 and 10.4 µg/m^3. it is observed that very marginal decrease in the revalidated baseline data.

Noise: The day time noise level at industrial zone was observed to be 51.7 dB(A) which is within the prescribed limit of 75 dB(A). The day time noise level at commercial zone was observed to be 53.7 dB(A) which is within the prescribed limit of 65 dB(A). The day time noise level at all residential zone was observed to be 47.5 to 53.7 dB(A) which is within the prescribed limit of 55 dB(A). The night time noise level at industrial zone was

observed to be 42.2 dB(A) which is within the prescribed limit of 70 dB(A). The night time noise levels at residential locations were found to be 40.8 to 44.5 dB(A) within the prescribed limit of 45 dB(A). From the revalidated data, it is observed that the noise level is decreasing when compared with existing baseline data.

Water: The pH value of the collected ground water in the study area varies from 7.41 to 8.02 and meets the acceptable limit for drinking water standards. The essential parameters of ground water are well within the permissible limits. The heavy metal parameters are also well within the IS10500 norms. The surface water analytical results are compared with best of use norms given by MoEF&CC and the observed values are well within the limit.

From the revalidated data of surface and groundwater samples, it is evident that there is no change in the chemical parameters and hence, it can be concluded the operation of plant does not have any impact on surface and ground water.

Soil: Eight numbers of soil samples have been collected from the study area and all the physical and chemical parameters are observed to be normal.

Ecology: The detailed study about 121 floral species observed. The most dominant tree species in the entire study area was dominated Cocos nucifera, Azadirachta indica, Musa paradisiaca, Acacia nilotica, Psidium guajava etc. Most dominant shrubs in the study area were, Prosopis juliflora, Lantana camara, Datura metel, Calotropis procera, Tecoma stans etc. Among the herb species observed are Boerhavia diffusa, Cynodon dactylon, Achyranthes aspera, Amaranthus spinosus, Ageratum conyzoides, Mimosa pudica, etc.

Livestock like cattle, buffalo, goat, poultry, and duck are reared for dairy products, meat, egg and for agriculture purpose. Majority of cattle and buffalo are of local variety. Backyard poultry farms are mostly common in this area; however, some commercial poultry farms are also recorded in the study area.

To assess the planktonic profile of Phytoplankton and Zooplankton, 3 water samples from estuary region, intertidal zone and coastal water were collected at sub surface level. The marine ecological study was conducted in different water bodies of the study area and the flora and fauna was recorded.

Traffic: The existing PCU per day volume of SH 176 (Thoothukudi - Tiruchendur - Kanyakumari Road) is about 21638.4 against the capacity of 36000 PCU per day.

Land: As the project site (total area 380 Ha) is under possession of TANGEDCO and preparatory activities like construction of access roads, temporary offices and godowns, piling, storage of construction materials etc. will be confined within the project area. Topography of the proposed site appears to be flat with level + 2.00 m AMSL and it may not require any major excavation. The filling material will be fly ash from Tuticorin Thermal Power station of TANGEDCO (TNEB). The filling material will be transported by closed trucks through all-weather metalled road. However, the above activities are already completed and suitable mitigation measures taken and hence does not warrant for further analysis.

Water: The study area is demarcated with dentritic drainage pattern as the area is completely covered by recent alluviam. The surface run-off water from the project site is

naturally diverted into surface water network system which is constructed one side of the road and all along the boundary wall and finally diverted to rainwater harvesting pits. The increase runoff will be directed to 100 m^3 rainwater storage pond. The excess runoff (i.e., pre-construction stage quantity) will be drained into rainwater harvesting pits 30 Ns. which is having 180 m^3 carrying capacity. The harvested water will be used for plant purposes.

Air: The construction and other associated activities will lead to emission of different pollutants, viz. particulate matter and gaseous pollutants (SO2 and NOx) from machineries and vehicles. The important air pollutants generated from thermal power plant are Particulate Matter (PM), Sulphur dioxide (SO_X) and Oxides of Nitrogen (NO_X) due to burning of coal.

The maximum GLCs for each grid point were predicted with respect to pollutants PM10, PM2.5, SO2 and NOx. In order to obtain the impact due to proposed project, Background concentration recorded in the study area are considered and the contribution due to proposed project is added to it. The predicted cumulative GLC values are as follows and the isopleths are enclosed in the report.

Resultant concentrations due to incremental GLC's at project site

Pollutant	Maximum AAQ Concentrations Recorded During the Study Period in Project site (µg/ m^3)	Incremental Concentration (µg/m^3) – Worst Case	Resultant Concentration (µg/m^3)	AAQ Standards (mg/Nm^3)
PM	31.849	1.17	33.01	100
NOx	51.374	1.89	53.264	80
SOx	28.78	1.06	29.84	80

Mitigation measures

It is proposed to install adequately sized electrostatic precipitator having an efficiency that limits the outlet emission to the applicable value of 30 mg/Nm3. The electrostatic precipitators will have adequate numbers of parallel gas streams, isolated from each other on the electrical as well as gas side and will be provided with gas tight dampers at inlets and outlets of each stream, to allow maintenance to be carried out safely on the faulty stream, while the unit is working. Electrostatic precipitator will be provided with transformer rectifier sets, microprocessor based programmable type rapper control system and ESP management system to ensure safe and optimum operation of ESP. The dust collection hoppers at all strategic locations will have a minimum storage capacity of eight (8) hours. The hoppers will have heating arrangements to prevent ash sticking to the sloping sides and down pipes. Level indicators to indicate ash levels in the hoppers and trip the ESP in case of high ash levels in the ash hoppers are also envisaged to ensure safety of ESP.

Wet Limestone based Flue Gas Desulphurization system

The wet limestone based FGD system adopts limestone slurry for the removal of the SOx present in the flue gas and the flue gas after treatment will be saturated. Gas to gas heat exchangers will be required to raise the temperature of the flue gas entering the chimney. The system will have efficiency of 95% or more. The arrangement of flue gas system will allow complete isolation of the absorber from gas side, with the unit in operation. For this purpose, Motorized/Pneumatic Guillotine type gates will be provided at hot gas inlet to gas-gas heater, cold gas outlet from gas-gas heater and the flue gas bypass duct.

NOX Control System

At present, advanced Low NOx combustion technology is used in all steam generator combustion system with Low NOx burner and over fire air system. This will reduce the NOx emission to a large extent. However, cost effective post combustion NOx control technology such as SCR / SNCR will be required to limit the NOx level to 100 mg/Nm3 as stipulated by 2015 amendment.

The proposed project related activities will lead to generation of noise that may have minor impact on the surrounding communities in terms of minor increase in noise levels. The machinery envisaged for the plant operation is a source of noise. Generally, this noise is generated due to continuous operation of machineries like coal mills, turbine, boilers, generators, pumps and cooling towers etc.

The propagation modeling Dhawani Pro considered for operation and the predicted noise level at source during operation is 85 dB(A). The results of the noise modelling reveal that the maximum noise level will be 23.4 dB(A) at 1.5km distance due to the proposed plant.

The effluent generated from the plant is treated in Sequential Batch Reactor (SBR) based ETP capacity of 720 KLD. The treated water will meet the requirement of TNPCB norms viz. BOD <30 mg/l, TSS <20 mg/l and pH 5.5-8.5. The SBR plant consists of clarifier, oil and grease removal, closed aeration followed by pressure sand filter and activated carbon filter.

The estimated Municipal solid waste is about 109 kg/day. Out of this, 40% that is about 43.6 kg/day is Bio-degradable waste. The non Bio-degradable waste 60% is estimated to be 65.4 kg/day. As the plastic waste recirculation is maximized and usage of plastic is reduced the expected plastic waste is about 20% of 65.4 kg/day that is 13.08 kg/day will be collected, segregated and disposed through Udangudi town panchayat as per Solid Waste Management Rules, 2016.

Hazardous Wastes are properly handled in containers and stored in hazardous waste storage areas as per rules and also bunding is provided to avoid overflow of spillage waters which can contaminate the surroundings. Recyclable waste is handed over to authorized recyclers and other hazardous waste will be disposed through approved TSDF facility.

TNPGCL (TANGEDCO) is located near to Udangudi village about 4.85 km in the West direction on SH-176 (Thoothukudi – Tiruchendur – Kanyakumari Road) - 0.12 km East which is leading to Udangudi. Since, the plant is located on the isolated path major traffic is not expected. The LOS study shows that the existing traffic scenario is “Excellent” and

the free flow of vehicles is observed during the study period February 2024. Out of the total traffic vehicles, 2 wheelers are very high followed by Trucks& Bus, 4-wheeler light and medium vehicles. Due to the proposed 2 x 660 MW supercritical thermal power plant, the traffic density will have negligible increase and traffic scenario is “High” and stable flow.

The ongoing plant is already in construction and about 85% of the work is completed and it is planned to obtain a fresh EC as the validity is expired in the month October, 2024. Hence, alternative site and technology consideration is not applicable for this project at this stage.

The key issues associated with the life cycle of a project are the monitoring of environmental parameters. Three types of environmental monitoring are ensured the compliance through separate EMC.

The preliminary risk assessment has been completed for the ongoing plant and associated facilities:

- Individual risk from the thermal power plant is negligible, as it is below the tolerance criterion of individual risk not to exceed 1.0E-5 per year in populated areas,
- Individual risk contour for 1.0E-5 per year is also within the boundary limit of the Udangudi thermal power plant,
- The Individual Risk Potential for Loss of Life (Potential Loss of Life- PLL) due to Udangudi thermal power plant is 2.3527E-005 per avg. year.

Socio-economic: The district population growth rate is 3% Which is used for projecting the population within the study area of 10 km radius. The projected population for 2024 study area is 140279 (13%).

The ongoing 2 X 660 MW Power plant will result in improvement of infrastructure as well as up-liftment of social infrastructure in the area. The people residing in the nearby areas will be benefited directly and indirectly through employment opportunities likely to arise due to the project. It will also help in sustainable development of this area including development of physical Infrastructural facilities such as road transport facilities, educational facilities and water supply and sanitation. It is anticipated that the ongoing power plant will provide benefits to the locals in two phases i.e. during construction phase as well as during the operational stage of the plant.

The capital cost of the project is estimated to be Rs. 13076.705 Crore. As the project is a greenfield project about 0.25% of the cost is to be spent towards CER activity as per OM F.No. 22-65/2017-IA. III dated. 1st May,2018. Accordingly, the ongoing project authority planned to spend Rs.32.694 Crore. This amount will be spent for the development of local people within the impact area of 10 km radius from the project site. During 2018 to 2020, Rs. 10.843 Crore was spent on equipment purchase/ repair/ alteration in government hospitals, construction of fish landing center and temporary protection of sea erosion, etc.

The CSR initiatives of TANGEDCO have been prioritized on local needs, which focus on Health, Education, Sustainable Livelihood, Social Mobilization, Infrastructure Development, Water Harvesting, Agriculture and Environment Conservation.

The EMC is headed by a Plant Head. In his day to day work, the plant head is assisted by chemists, laboratory assistants and other staff. Services of forest officials are also taken for effective implementation of plantation schemes. For development and maintenance of jobs like drainage, clearing settling pits etc. assistance from the plant's civil engineering department is taken. The officers of the department meet frequently to assess the progress and analyses the data collected during the preceding fortnight/month. Total manpower of EMC is about 41 numbers.

Anticipated adverse environmental impacts from the ongoing of TNPGCL (TANGEDCO) will be localized, short term and low/moderate in nature, and visible only during construction phase. Adverse environmental impacts identified in EIA study due to the ongoing project will be mitigated by implementation of mitigation measures/environmental management plan (EMP) described in EIA report and compliance of applicable environmental regulations. The ongoing project will have long term and regional beneficial/positive direct and indirect impacts on employment, socio economic conditions and development of the area and region. Hence, it is requested to grant Environmental Clearance for the project.

1 INTRODUCTION

1.1 Preamble

Tamil Nadu Generation and Distribution Corporation (TANGEDCO) (A subsidiary of TNEB Ltd) is a state Government utility undertaking power Generation, Distribution and operation and maintenance of power plants. TANGEDCO has improved the economy of the state of Tamil Nadu by extensive electrification of villages; large scale energization of agriculture pump sets and extension of electricity services to the poor/backward and downtrodden sections of the society, in addition to extension of power supply to large number of industries which has been well recognized. Tamil Nadu state is the most preferred State for IT and industrialization. The demand for power in the state is gradually increasing due to industrial growth, agriculture need as well as domestic consumption coupled with the improved standard of living.

The power generation business of TANGEDCO under Tamil Nadu Electricity Board is unbundled into a separate company named as Tamil Nadu Power Generation Corporation Limited (TNPGCL) vide G.O (MS.) No. 6 Dated 24.01.2024 issued by Government of Tamil Nadu. Till such time TNPGCL is fully established TANGEDCO shall continue the business of Power Generation. To meet the increasing demand for power supply in the sectors of agriculture, domestic, industrial and commercial purposes in Tamil Nadu, TNPGCL (TANGEDCO) has proposed to install a 2 x 800 MW coal based Thermal Power Plant with supercritical technology at Udangudi village, Thiruchendur taluk, Thoothukudi district of Tamil Nadu, and obtained an Environmental Clearance for the same. Subsequently, TNPGCL (TANGEDCO) obtained amendment to the above-mentioned Environmental Clearance for reduction of unit sizes from 2 x 800 MW to 2 x 660 MW. Presently, the physical work progress for the Project is completed to the tune of 85% for which EC was granted. Since the validity of EC was extended for all the projects on account of Covid-19 pandemic, the validity of EC for Udangudi Supercritical Thermal Power Plant is valid upto 13.10.2024 As the validity of EC is completed, it is planned to obtain fresh EC for the project.

1.2 Purpose of the report

This project falls under the category Thermal Power Plant and listed at Sl. No. 1(d) as per the EIA Notification Published on 14th September 2006 and falls under Category ‘A’ with MoEF&CC for obtaining Environmental Clearance.

In this connection, ToR has been issued by MoEF&CC vide File no: J-13012/19/2008-IA. II(T) dated 29.07.2024 with exemption of Public Hearing. The ToR as received from MoEF&CC is enclosed as **Annexure-IX.** The EIA report is prepared incompliance with ToR issued by MoEF&CC.

1.3 Identification of project and project proponent

Since the energy deficit is increasing day by day. Lack of availability of sufficient electric power has always been one of the greatest deterrents to the growth of industry in the state. In view of the above, Tamil Nadu Power Generation Corporation Ltd. (TNPGCL) (TANGEDCO a successor entity of TNEB) has proposed bridge the gap by installing 2 x 660 MW Udangudi Supercritical Thermal Power Project stage-1 at Thoothukudi District in Tamil Nadu.

The name of the project proponent and the contact details are as follows.

Name : Er.R. Sunil, B.E.,
Designation : Chief Engineer/Projects,
Address : Tamil Nadu Power Generation Corporation Limited (TNPGCL)
(erstwhile TANGEDCO a successor entity of TNEB),
Fifth Floor, West wing No.144, Anna Salai,
Chennai, Tamil Nadu 600002
E-mail : cepr@tnebnet.org
Contact : 9445994289

1.4 Need for the project and its importance

Tamil Nadu is one of the power generation forefront States in the country. However, TNPGCL (TANGEDCO) has proposed to set up the Udangudi Thermal Power Plant to address the rapid growth of energy demand considering the energy deficiency in the State. Thus, the proposal aims to address the following objectives.

- To meet the growing electricity demand for the development of the economy of Tamil Nadu and India.
- To increase access to affordable energy services and
- To improve energy sector governance.

The project will potentially pave way for rapid industrialization/development of SEZ like areas in the Thoothukudi District and nearby zones as large amount of vacant lands and other resources are available in addition to the energy that can be supplied from the project. This will eventually upgrade the economy of the State and Country.

1.5 Brief description and nature of the project

The ongoing project of 2x660 MW Udangudi Supercritical Thermal Power plant falls under 1(d) category as per the schedule of EIA notification of 2006. The ongoing power plant will be operated with coal as the main fuel to generate 1320 MW power (2×660 MW) and would be developed with super critical technology to obtain benefits under Clean Development Mechanism (CDM Project). It is proposed to use blended coal based on efficiency (50% imported Coal from Indonesia, South Africa, Australia, China, etc and 50%Indian coal from Talcher coal fields of Mahanadi coal fields limited from Odisha) as fuel. The annual consumption of coal for the ongoing power plant is estimated as 5.893 million tonnes for two units considering Plant Load Factor of 85%. The requirement of Indian coal from Talcher coal field will be about 3.647 million tonnes per annum and imported coal requirement will be 2.246 million tonnes per annum.

TNPGCL (TANGEDCO) is developing 2X660 Megawatt (MW) supercritical thermal power project stage-1 at Udangudi village, Thoothukudi District, Tamil Nadu. This project is the first supercritical power project with 660 MW capacity to be installed in Tamil Nadu by TNPGCL (TANGEDCO). TNPGCL (TANGEDCO) had obtained Environmental Clearance for the 2 x 800 MW (1600 MW) Udangudi Super critical with Imported Coal based Thermal Project at Udangudi Village, Tiruchendur Taluk, Tuticorin District of Tamil Nadu from MoEF&CC vide Lr. No. J 13012/19/2008—IA. II(T), dt. 14.10.2013.

Subsequently, TNPGCL (TANGEDCO) obtained amendment to the above-mentioned Environmental Clearance for reduction of unit sizes from 2 x 800 MW to 2 x 660 MW,

vide MOEF/GOI's Lr.No.13012/199/2008—IA II(T), dt 26.04.2017. Originally Validity of EC given for 5 years. i.e., upto 13.10.2018. Thereafter, the validity of EC was extended for further two more years, .ie., up to 13.10.2020 vide MOEF/GOI's Lr.No. J.13012/19/2008 – IA. II (T) dt. 10.09.2018. Then MOEF&CC/GOI has extended validity of EC for the Project by three years i.e., upto 13.10.2023 vide MOEF/GOI's Lr.No. J 13012/19/2008- 1A. II(T), dt.25.09.2020.

Presently, the physical work progress is completed to the tune of 85% for which EC was granted. Since the validity of EC was extended for all the projects on account of Covid-19 pandemic (vide MoEF&CC OM F.No.22-25/2020-IA.III dated: 18.1.2021), the validity of EC for Udangudi Supercritical Thermal Power Plant is valid upto 13.10.2024. The existing EC details are enclosed as **Annexure X**. As the validity is completed, it is planned to obtain fresh EC for the project. Further, TNPGCL (TANGEDCO) had planned to reduce the imported coal according to guidelines issued by MoEF&CC OM's issued vide circular. No. J-13012/8/2009-IA.II(T), dt.6.12.2023. TNPGCL (TANGEDCO) is planning to use Imported Coal verses Indigenous Coal in the ratio of 50:50 based on efficiency which is amounting to 2.246 MTPA of imported coal and 3.647 MTPA of indigenous coal (totaling 5.893 MTPA) which is also planned to be sought in this fresh EC. The project proposes to have its own captive coal jetty at Udangudi with transportation of coal through pipe conveyor system to the power plant to handle coal up to 15.33 million tonnes per annum. IITM, Chennai has studied the feasibility of the coal jetty. Based on the feasibility study by NIO, Goa has finalized the location by model studies.

The Govt of Tamil Nadu has accorded approval for the development of coal jetty as Udangudi Minor Port by declaring the Port Limits for captive use of TNPGCL (TANGEDCO). The coal jetty is located at about 7.5 km from shore and possess a separate EC and CRZ clearance from MoEF&CC vide Lr. No. - EC22A004TN156490, 10-66/2020-IA.III dt. 03.08.2022.

1.6 Statutory clearances

The list of statutory clearances as obtained are given in Table 1.1.

Table 1-1 List of statutory clearances obtained

Sl. No	Description	File/Letter No.	Issue Date	EC validity	Remarks
MoEF&CC – Environment Clearance, Amendment & ToR					
Thermal Power Plant					
1	EC for 2 x 800 MW Thermal Power Plant	Lr. No. J 13012/19/ 2008-IA.II (T)	14.10.2013	13.10.2018	Initially 2 x 800 MW planned as Phase I capacity.
2	EC Amendment for revision Thermal Power Plant capacity from 2 x 800 MW to 2 x 660 MW	Lr. No. J-13012/19/ 2008-IA.II (T)	26.04.2017	13.10.2018	Revised Phase I capacity to 2 x 660 MW.
3	EC extension for 2 x 660 MW Thermal Power Plant	Lr. No. J 13012/19/2008-IA.II (T)	10.09.2018	13.10.2020	As per Ministry's EIA Notification vide S.O. 2944(E) dated 14.09.2016 EC was extended to seven years.
4	EC extension for 2 x 660 MW Thermal Power Plant	Lr. No. J 13012/19/ 2008-1A.II (T)	25.09.2020	13.10.2023 (3 years)	EC extended
5	EC extension for Thermal Power Plant	MoEF&CC File No. 22-25/2020/IA.III	18.01.2021	13.10.2024	Validity extended for one year due to Covid -19 pandemic. The letter given by TANGEDCO. Lr.No. CE/Pr-2/SE/C/P&E/EE/EMC-I/AEE/C/ F.Udangudi STPP /D. 25 /23, t.15.02.2023
6	Fresh ToR	MoEF&CC File no: J-13012/19/2008-IA. II(T)	29.07.2024	29.07.2028	As the validity is completed, it is planned to obtain fresh EC for the project.
7	Certified compliance report	-	-	-	Site inspection completed on 16.10.2024 and certification is in process.
Captive Jetty and Associated Facilities (interlinked project of Udangudi Super critical TPP)					
1	EC and CRZ clearance for Coal Jetty, Pipe conveyor and associated facilities	F.No.11-48/2009-IA.III	06.06.2011	05.06.2018 (7 years)	EC + CRZ clearance was obtained

Sl. No	Description	File/Letter No.	Issue Date	EC validity	Remarks
2	EC and CRZ clearance extension for Coal Jetty, Pipe conveyor and associated facilities	F.No.11-48/2009-IA.III(pt-I)	15.05.2018	05.06.2021 (3 years)	MoEF&CC File No. 22-25/2020/IA.III Dated 18th January 2021, EC shall be valid till 04.06.2022.
3	Fresh EC and CRZ clearance extension for Coal Jetty, Pipe conveyor and associated facilities	File No. 10-66/2020-IA.III EC ID: EC22A004TN 156490	03.08.2022	10 years	For balance work.
TNPCB - Consent to Establish & Consent to Operate					
1	Consent order under Air & Water act from TNPCB	Consent order No. 2303250084899 for Air CONSENT ORDER NO. 2303150084899 for water	09.08.2023	13.10.2024	Consent for Establishment order was obtained. Attached as **Annexure XI.**
Additional clearances					
1	Chimney clearance from AAI	No. AAI/ 20012/ 1537/ 2008 -ARI NOC	25.08.2008	-	Enclosed as **Annexure XII.**
2	Tamil Nadu Maritime board	Lr No.3506/S1/2009	06.02.2024	-	Enclosed as **Annexure XIII.**
3	Electrical Inspectorate	Lr No. TIN 5217/CEIG/D3/SC/2024	08.08.2024	-	Enclosed as **Annexure XIV.**
4	Fire NOC	Applied.			Waiting for NOC.
5	Port approval	Letter No.3506/S1/09	8.06.2010	-	Enclosed as **Annexure VIII**.

1.7 Size and location of the project

The ongoing power plant will be operated with coal as the main fuel to generate power (2×660 MW) and would be developed with super critical technology to obtain benefits under clean development mechanism (CDM Project). The selection of a supercritical versus a sub-critical power cycle is dependent on many projects specific factors including fuel cost, emissions regulations, capital cost, load factor, duty and unit reliability and availability. It is proposed to use 50% imported coal and 50% domestic coal based on efficiency as fuel. The annual consumption of coal for the ongoing power plant is estimated as 5.893 million tonnes. The ash pond is located 1.3 km away from the sea. There is no potential river/Nallah or water body is identified within the core zone. The HFL of the area is 3.77 km (Karumeni river). The site coordinates are given in **Table 1.2.** The index map showing the site location, Topo Sheet and Eco sensitive map are given as **Figure 1.1**, **Figure 1.2, Figure 1.3 & Figure 1.3** respectively. The environmental setting in 10 km radius is given in **Table 1.3**.

Table 1-2 Site coordinates

Point No.	Latitude	Longitude
1.	8°25’ 20.50” N	78°03’ 05.85” E
2.	8°26’ 49.26” N	78°04’ 13.07” E
3.	8°26’04.94” N	78°03’ 51.40” E
4.	8°26’ 23.62” N	78°03’ 27.27” E

Table 1-3 Environmental setting of the proposed project site

S. No.	Particulars	Details
1.	Latitude	8°25’20.50” N to 8°26’23.62” N
2.	Longitude	78°03’05.85” E to 78°03’27.27” E
3.	Elevation above MSL	2 -10 m
4.	Topography	Flat Terrain
5.	Nearest Highway	SH-176 (Thoothukudi – Tiruchendur – Kanyakumari Road) - 0.12 km East
6.	Nearest Railway station	Tiruchendur Railway Station – 8.68 km, NE
7.	Nearest Airport	Tuticorin Airport - 31.91 km, NW
8.	Nearest Habitation	Udangudi – 4.85 km, W
9.	Nearest Town	Tiruchendur – 8 km
10	Reserve Forests	Kuthiraimozhi Theri R.F – 7.8 km (NW)
11.	Nearest Water body	Karumeni river – 3.75 km (S) Thangai kulam – 6.08 km (W) Ellappanayakan kulam – 4 km (N) Avudayarkulam – 7 km (NE)
12.	Ecologically Sensitive area	Mangroves – 8.08 km Sand dunes – 0.5 km
13.	Defense installation	Nil within 10 km radius
14.	Critically polluted area	Nil within 10 km radius
15.	Seismic Zones	Zone II (Low risk zone)

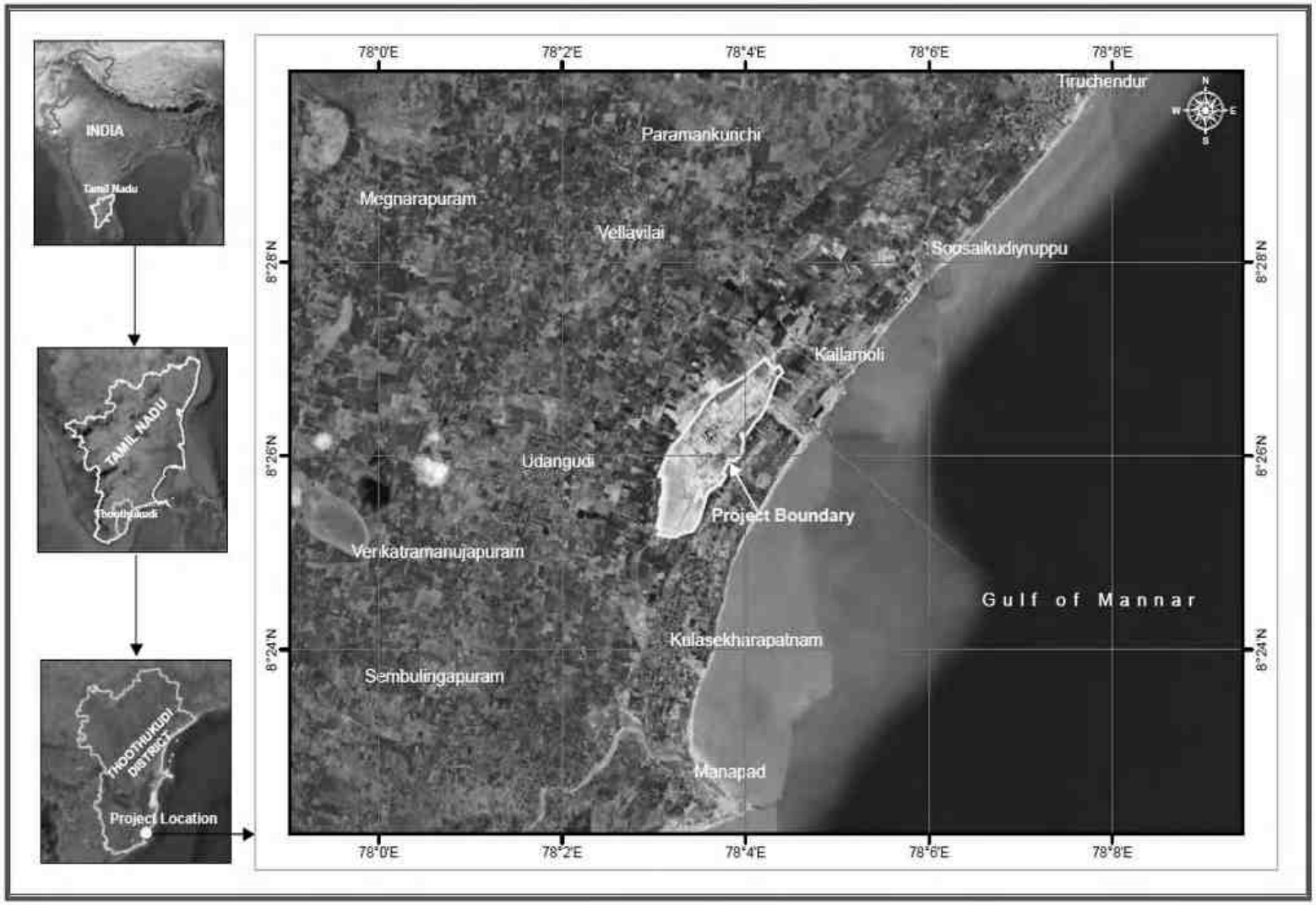


Figure 1-1 Location map of project site

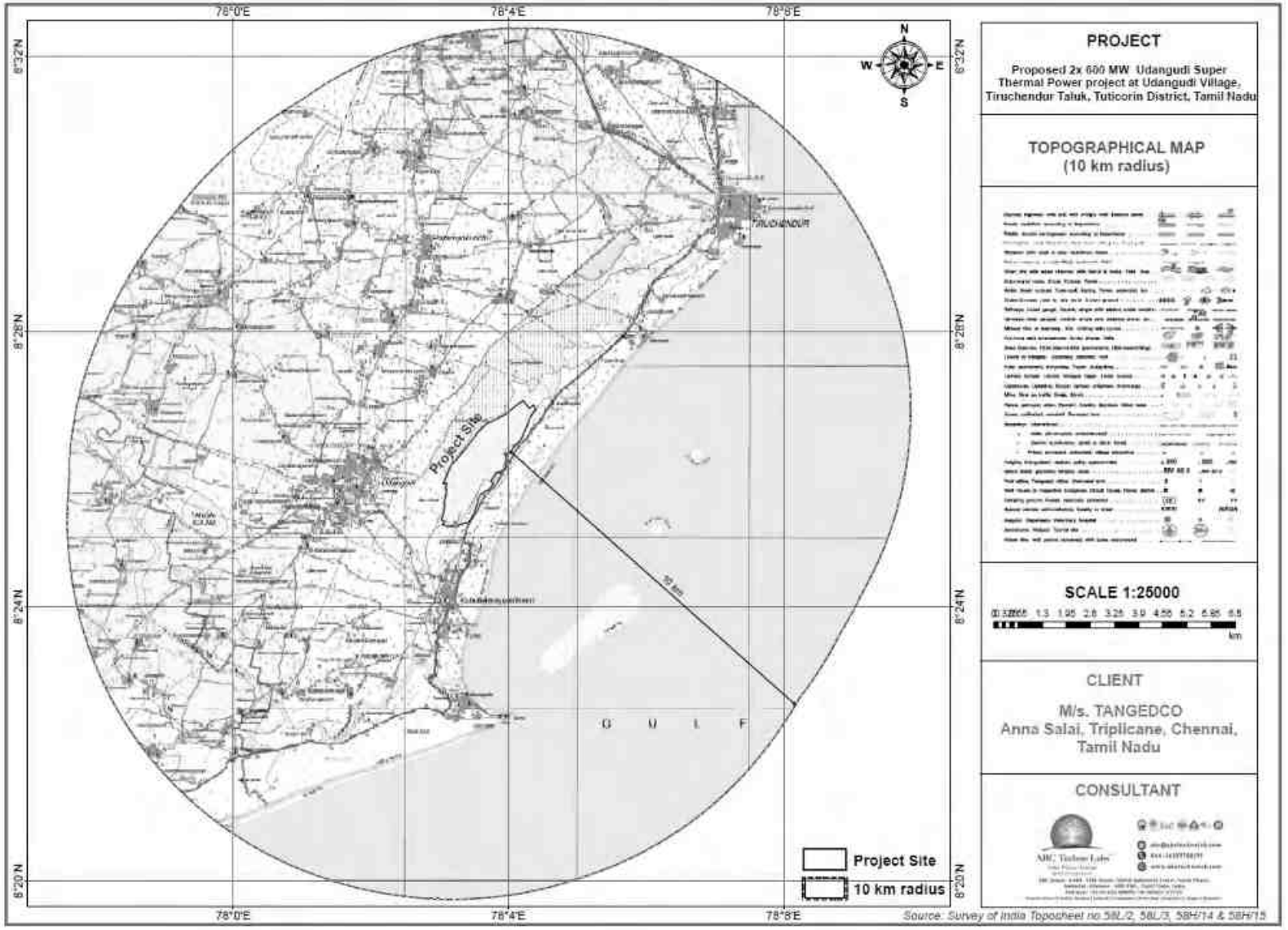


Figure 1-2 Topo map covering 10 km radius from the project site (1:25000 scale)

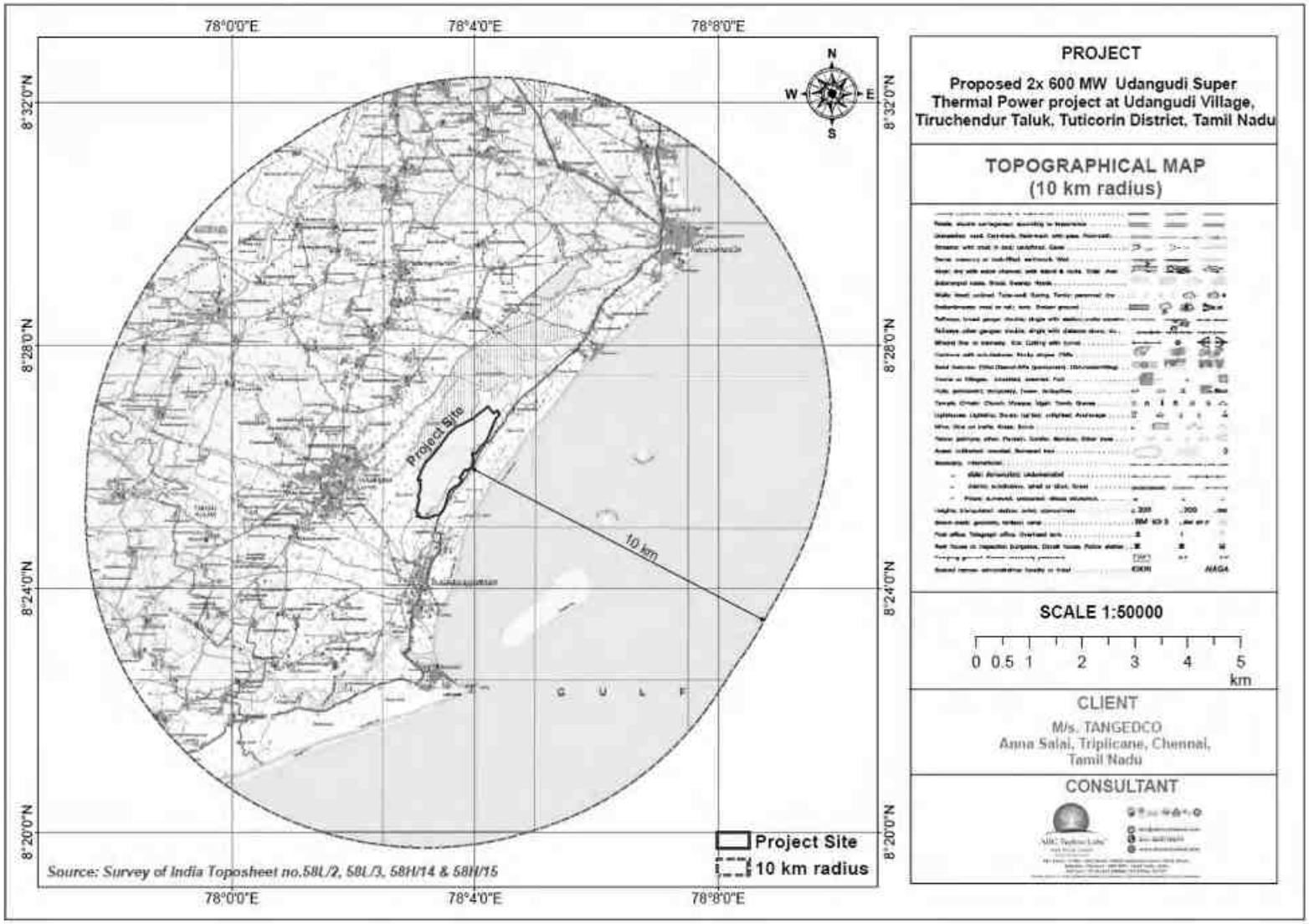


Figure 1-3 Topo map covering 10 km radius from the project site (1:50000 scale)

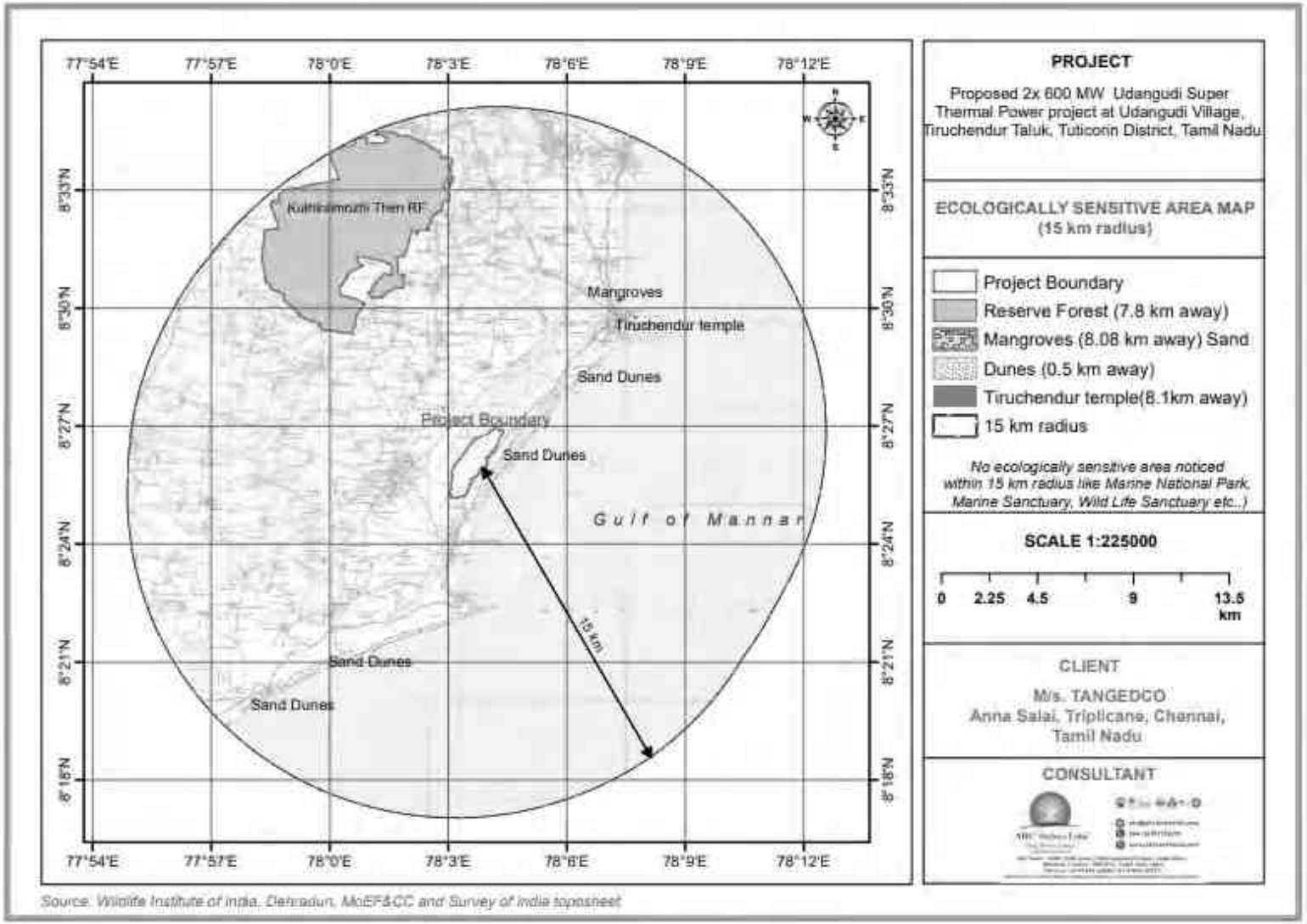


Figure 1-4 Eco sensitive map

1.8 Importance to the country and region

Since the energy deficit is increasing day by day. Lack of availability of sufficient electric power has always been one of the greatest deterrents to the growth of industry in the state. In view of the above, TNPGCL (TANGEDCO) has proposed bridge the gap by installing 2 x 660 MW Udangudi Supercritical Thermal Power Project stage-1 at Thoothukudi District in Tamil Nadu.

1.8.1 Domestic/export markets

Tamil Nadu is the most preferred state for industrialization, and hence the industrial demand for power will be ever increasing. Added to the industrial demand, the agriculture need as well as domestic consumption coupled with the improved standard of living of the population is on the rise. Taking all these into consideration, establishment of the ongoing power project of 2 x 660 MW is to meet the domestic demand only. Hence, there is no possibility for export.

1.9 Objective and scope of EIA

M/s. Tamil Nadu Power Generation Corporation Limited (TNPGCL) has engaged the services of M/s. ABC Techno Labs India Pvt. Ltd, Chennai to carry out EIA study and preparation of Environmental Impact Assessment (EIA) report to assess the anticipated impacts of the ongoing project on the environment and suggest suitable mitigation measures for likely adverse impacts due to the ongoing activities. The EIA/EMP report has been prepared for the ongoing project following the generic structure specified in the EIA Notification, 2006.

M/s. ABC Techno Labs India Private Limited, Chennai has been accredited for 25 sectors including Sector-4 (Thermal power plants) for Category 'A' by the National Accreditation Board for Education & Training (NABET), Quality Council of India (QCI) vide Certificate NABET/EIA/2225/RA0290 dated 11.06.2023 with a validity till 16.11.2025 (Sl. No. 4 of QCI/NABET List dated 26.04.2024). M/s. ABC Techno Labs India Private Limited Laboratory is accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) vide Certificate No. TC-5770 dated 03.04.2024 with validity till 02.04.2026. The Lab is also recognized by the Ministry of Environment, Forest and Climate Change (MoEF&CC) vide letter F. No. LB/99/7/2021-INST LAB-HO-CPCB-HO/Pvt./5877 dated 30.10.2024 with validity of 3 years.

An EIA study is useful to understand and mitigate the impact of the ongoing project on various parameters of environment. Therefore, the scope of the EIA study includes detailed characterization of the existing status of the land, water, air, biological and socio-economic environment in the project area. It also includes identification of the potential environmental impacts of the project and formulation of an effective Environmental Management Plan (EMP) and monitoring plan. The scope of EIA study includes,

- Literature review and collection of data relevant to the study area.
- Collection of baseline data related to the project activities.
- Establish the baseline environmental aspects in and around the proposed project.
- Collection of secondary data including socio-economic from published literature/government publications.
- Identify various existing pollution loads due to the proposed activities.

- Predict incremental levels of pollutants in the study area due to the ongoing project
- Evaluate the predicted impacts on various environmental attributes in the study area by using scientifically developed and widely accepted environmental impact assessment methodologies;
- Preparation of cost effective and appropriate Environmental Management Plan (EMP) encompassing strategies for minimization of potential adverse impacts on various environmental components along with budgetary provisions for implementation of pollution control measures and CER activities;
- To delineate measures for human health and safety during operational of ongoing project; and
- Delineation of post-study environmental quality monitoring programme.

The scope also includes all the conditions given in ToR prescribed by MoEF&CC for the Ongoing 2x660 MW Udangudi Supercritical Thermal Power Project of TANGEDCO. Terrestrial and Marine baseline studies were carried out for the period of three months from March 2024 to May 2024, representing summer season. Field studies have also been conducted to determine existing conditions of various environmental attributes for a month (February 2024) as outlined in **Table 1.4**.

Table 1-4 Environmental attributes and frequency of monitoring

Sl. No.	Environmental Component	Sampling Locations	Sampling Parameters	Sampling Period	Sampling Frequency
1	Meteorology	One location	Temperature, Relative Humidity, Wind Speed, Wind Direction & Rain fall	3 months + 1 Month	Hourly / Rainfall – Daily
2	Ambient Air Quality	8 Locations	PM_{10}, $PM_{2.5}$, SO_2, NO_2, CO, O_3, VOC, NMHC	Two days per week for 12 weeks	24 hourly
3	Water Quality	GW 8+ SW 3 Locations	As per IS:10500 – 2012 & Designated Best of Use Criteria by CPCB	Grab sampling	Once during study period
4	Noise	8 Locations	L_{eq} day & L_{eq} night	24 hourly	Once during study period
5	Soil	8 Locations	Soil profile & Chemical constituents	Composite sample	Once during study period

Sl. No.	Environmental Component	Sampling Locations	Sampling Parameters	Sampling Period	Sampling Frequency
6	Marine water Quality	5 Locations	Physical and Chemical parameters, Marine Water biological parameter- Primary productivity, Chlorophyll a, Phaeophytin, Phytoplanktons, Abundance, Density, Total Biomass, Zooplanktons- Abundance, Number and name of groups, present and Density	Grab sampling	Once during study period
7	Marine sediment Quality	5 Locations	samples analyzed for physical and chemical parameters, Benthic Organisms Meiobenthos and Macros-benthos- Abundance, Number and name of each group, present, Total number and name of species of each group present, Density (Total numbers of individuals of each species/m^2)	Grab sampling	Once during study period
8	Terrestrial Ecology	Study area	Flora and fauna	Field observations	Once in study period

Sl. No.	Environmental Component	Sampling Locations	Sampling Parameters	Sampling Period	Sampling Frequency
9	Marine Ecology	Study area	Marine Ecology- The water bodies shall be characterized for primary productivity, density and diversity of phytoplankton, zooplanktons, benthic macro invertebrates/fauna, Marine flora (sea grasses), Marine fauna (marine mammals, marine reptiles, fishes and macrophytes), Corals. Existing terrestrial flora and fauna within the study area	Field survey and Secondary sources	Once in study period
10	Land Use	Study area	Land use data based on recent satellite data	May 2024	Once in study period
11	Demography aspects	Study area	Demographic profile	Based on data collected from secondary sources	
12	Geology & Hydrogeology	Study area	Geological history, Drainage area and pattern, nature of streams, aquifer characteristics, recharge and discharge areas.	Based on data collected from secondary sources	
13	Traffic Studies	Project Area	Vehicle Counts IRC 106 -1990 Guideline capacity of urban roads	Once during monitoring period May 2024	
14	Risk analysis	Fuel oil storage area	As per risk analysis criteria with the help of Phast software	Once during the preparation of EIA/EMP report	

1.10 Methodology

Environment Impact Assessment report has been prepared with the following steps:

1.10.1 Establishment of baseline environmental status

A comprehensive database on the baseline environmental status of the study area has been established through review, compilation & analysis of

- Existing EIA/EMP and published secondary data/literature/information, and
- Primary data generated/collected through site surveys and field study

The field monitoring has been carried out as per the guidelines of CPCB and requirement of the MoEF&CC for one complete season. Field study/monitoring has been carried for:

- Ambient Air Quality.
- Ambient Noise Quality.
- Surface and ground Water Quality.
- Soil Quality.
- Marine water and Marine Sediment Quality.
- Ecological studies.
- Land Use Pattern and
- Socio- Economic status.

1.10.2 Environmental Impact Assessment

The project data/activities have been analyzed & linked with the existing baseline environmental conditions in order to list out the affected environmental parameters and assess the likely impacts on such parameters. Compliance of the project with national standards has been duly checked.

1.10.3 Preparation of Environmental Management Plan

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. The desired results from the environmental mitigation measures existing in the project may not be obtained without a management plan in order to assure its proper implementation & function. The EMP envisages the plans for the proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities. EMP has been prepared addressing issues such as:

- Details of management plan.
- Pollution control/mitigation measures for abatement of the undesirable impacts caused during operational activities.
- Optimization of water resources and water quality.
- Identification of Environmental cell for implementation of the EMP.
- Post project environmental monitoring programme.

1.11 Structure of Environmental Impact Assessment Report

Environment Impact Assessment report has been prepared as per format described in the EIA Notification, 2006. The report has been divided into 12 chapters; the structure & the contents of each chapter are given below:

Compliance of ToR conditions

Executive summary

Chapter 1: Introduction

This chapter provides background information, details of the existing environmental clearance, CTE, CTO & Certified Compliance, brief details and location of the project, geographical and environmental settings of the area and details of the consultant along with structure of the report.

Chapter 2: Description of the Project

This chapter deals with project location, project layout, list of equipments, detailed land use breakup, process description details like raw material balance/chemicals, utilities and services, power & water requirement, water balance and sources, drainage and sewage disposal system, storm water drainage system, horticulture and landscaping, energy conservation measures, brief pollution details like hazardous waste, emissions and effluent, implementation schedule, estimated cost of the project, etc.

Chapter 3: Description of the Environment

This chapter presents existing environmental status of the 10 km radius study area around the site including topography, geology, drainage pattern, water environment, climate & meteorology, ambient air quality with stack emissions, noise levels, flora & fauna, socio-economic conditions, traffic volume etc.

Chapter 4: Anticipated Environmental Impacts & Mitigation Measures

This chapter describes the anticipated impact on the environment and mitigation measures for project. It gives the details of the impact on the baseline parameters, both during the construction and operational phases and suggests the mitigation measures planned to be implemented.

Chapter 5: Analysis of Alternatives

This chapter involves description of existing plant site, summary of adverse impacts of each alternative, mitigation measures proposed for each alternative and selection of best alternative during the early stage of project before operation.

Chapter 6: Environmental Monitoring Programme

This chapter describes environmental monitoring programme (EMP) for the project during construction and operation phases.

Chapter 7: Additional Studies

This chapter spelt out hazard identification, risk analysis and disaster management plan for an unlikely event of emergency.

Chapter 8: Project benefits

This chapter includes the benefits in terms of improvement in physical infrastructure, social infrastructure, employment potential, etc.

Chapter 9: Cost Benefit Analysis

It involves Environmental Cost analysis. EMP cost included as Environmental cost analysis is not warranted in ToR.

Chapter 10: Environmental Management Plan (EMP)

This chapter describes Environmental Management Plan to mitigate adverse environmental impacts and to strengthen beneficial impacts.

Chapter 11: Summary & Conclusion

This chapter includes the entire summary and gives a clear conclusion of the EIA study report.

Chapter 12: Disclosure of the Consultant engaged

This chapter comprises the name of consultants engaged with their brief resume and nature of consultancy rendered.

1.12 Litigation/court cases

There is no litigation or court cases against the ongoing project as on date of preparation of report.

2 PROJECT DESCRIPTION

2.1 General

This chapter provides an overview of the ongoing project TNPGCL (TANGEDCO), indicating the plant operations and covering briefly the basic plant facilities. The description also highlights the quantum of waste generated from the operations and the schemes devised for their management. Engineering design details of the plant with respect to environmental protection measures are included in this chapter. General information like raw materials and material balance, utilities like water, power, manpower requirements and brief note on pollution load etc., are also covered in this chapter. The project information is mainly drawn from the Detailed Project Report (DPR) prepared by M/s. Fichtner Consulting Engineers (I) Pvt. Ltd., Chennai. The generic information as provided in the DPR are extracted and included in this chapter. The information pertaining to the environmental issues are given importance to cover all the information as required by MoEF&CC.

The ongoing power plant will be operated with coal as the main fuel to generate 1320 MW power (2×660 MW) and would be developed with super critical technology to obtain benefits under Clean Development Mechanism (CDM Project). It is proposed to use blended coal based on efficiency (50% imported Coal from Indonesia, South Africa, Australia, China, etc and 50%Indian coal from Talcher coal fields of Mahanadi coal fields limited from Odisha) as fuel. The annual consumption of coal for the ongoing power plant is estimated as 5.893 million tonnes for two units considering Plant Load Factor of 85%. The requirement of Indian coal from Talcher coal field will be about 3.647 million tonnes per annum and imported coal requirement will be 2.246 million tonnes per annum.

2.2 Project location

The project site identified by TNPGCL(TANGEDCO) is located at S.F. No. 594 -609, 611-620, 624-639, 640(1), 641(1), 642-655, 657-665, 666(1), 667-677, 678(1), 679(1), 680-689, 695-704, 709-711, 712(1), 712(3), 713-716, 721-726, 731-738, 740, 741, 748(1), 774(1), 610, 621(1), 621(2A), 621(2B), 622, 623(1), 623(2), 690-694, 705-708, 717-719 (1,2,3), 720, 727(1,2), 728(1,2), 729, 730, 739, 23(1,2,3), 24(1A,1B,1C,2A,2B,2C), 31(1A,1B1), 32 (2B, 3, 4), 768(2), 769(2), 770, 771(2A2,4B), 772(1A2,2B), 773(1,2), 774(2), 775(1-9), 776(1,2),777 (1-4), 466 (1A,1B,2A,2B,3A,4,5A,5B,6A,6B,7-10,12), 467(1A, 2A, 2B, 2C, 2D, 1A, 2D,1B,3), 468 A (1-3), 469(1-3), 470(1, 2A, 1A, 2A, 1B, 2A2, 2B,3B,6A,6B,9A,9B), 471(1B, 3-6, 7A, 7B, 8,9), 472A (1,2A,2B) Udangudi Village, Tiruchendur Taluk, Tuticorin District of Tamil Nadu. It is 650 km south of Chennai and 45 km from Thoothukudi. The climate of Udangudi area is arid, with an average ambient temperature of 30°C, annual rainfall of 718.2 mm and 65.5 % relative humidity. The village was once known for betel leaves (Vetrilai) and palm jaggery (Karupatti). Udangudi had a population of 19,347 according to the 2001 census. The area allocated for the project is about 380 Ha and is located close to the Gulf of Mannar. The nearest railway station is at Tiruchendur which is about 8.68 km from the project site. The nearest airport is at Tuticorin, which is about 31.91 km from the site. The nearest seaport is Tuticorin, which is about 45 km from the site.

2.3 Land use breakup

The project land area breakup of TNPGCL (TANGEDCO) is given in **Table 2.1**.

Table 2-1 Land use breakup

S. No.	Purpose	Area in Ha
1	Main Plant, Transformer yard, Switch yard and FGD	26.305
2	Coal Yard	26.305
3	Cooling Water System	17.402
4	Fuel oil system	1.699
5	Water system including Chlorination system	7.782
6	Ash Dyke	48.562
7	Administration building and other non-plant buildings	4.719
8	Miscellaneous such as Corridor for CW piping, Ash piping, Intake & outfall, Silo & its utility building, Workshop, Stores, Roads etc.	80.168
9	Green Belt	167.058 (about 44% of total area)
Total		**380**

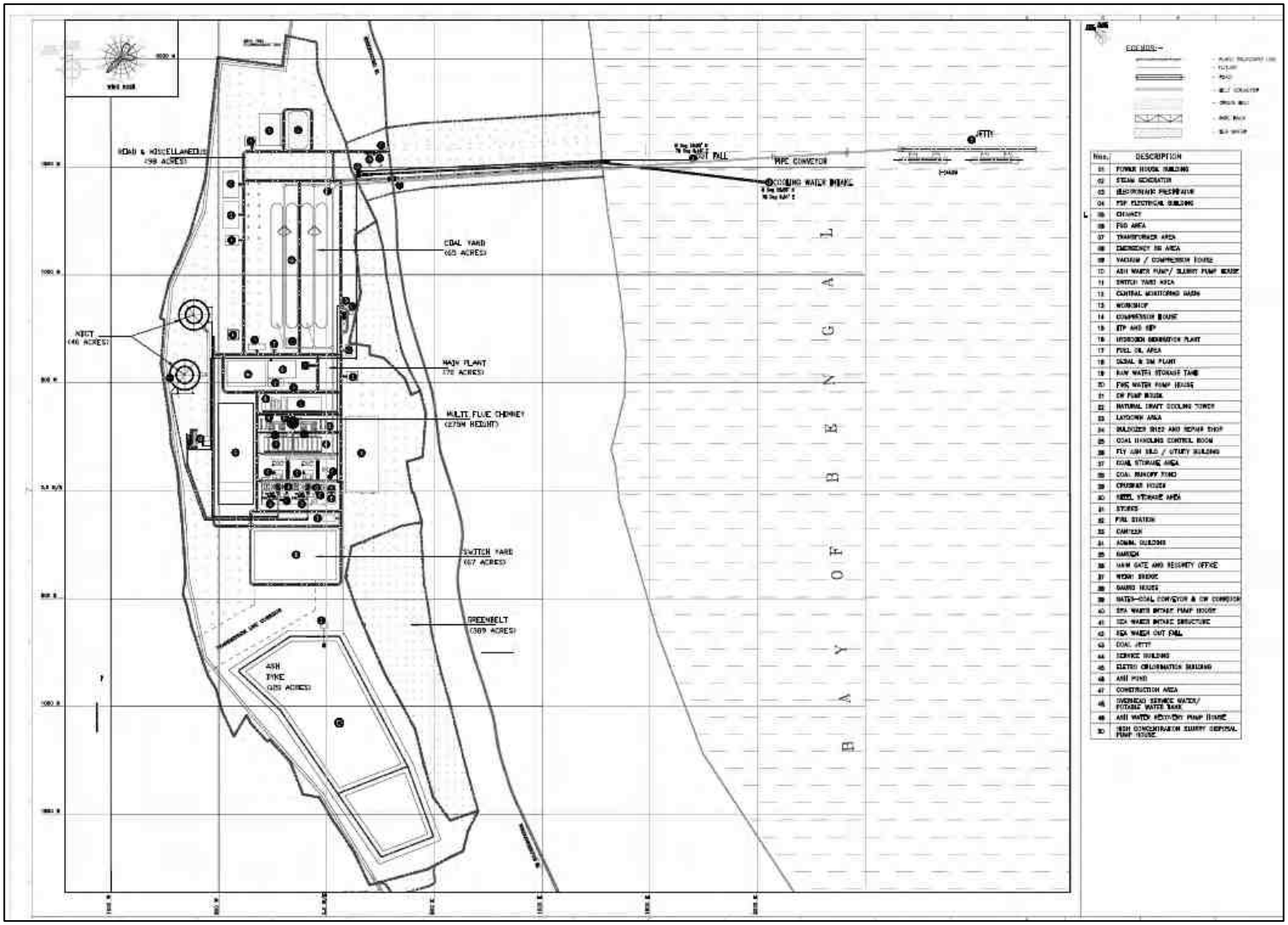


Figure 2-1 Project layout

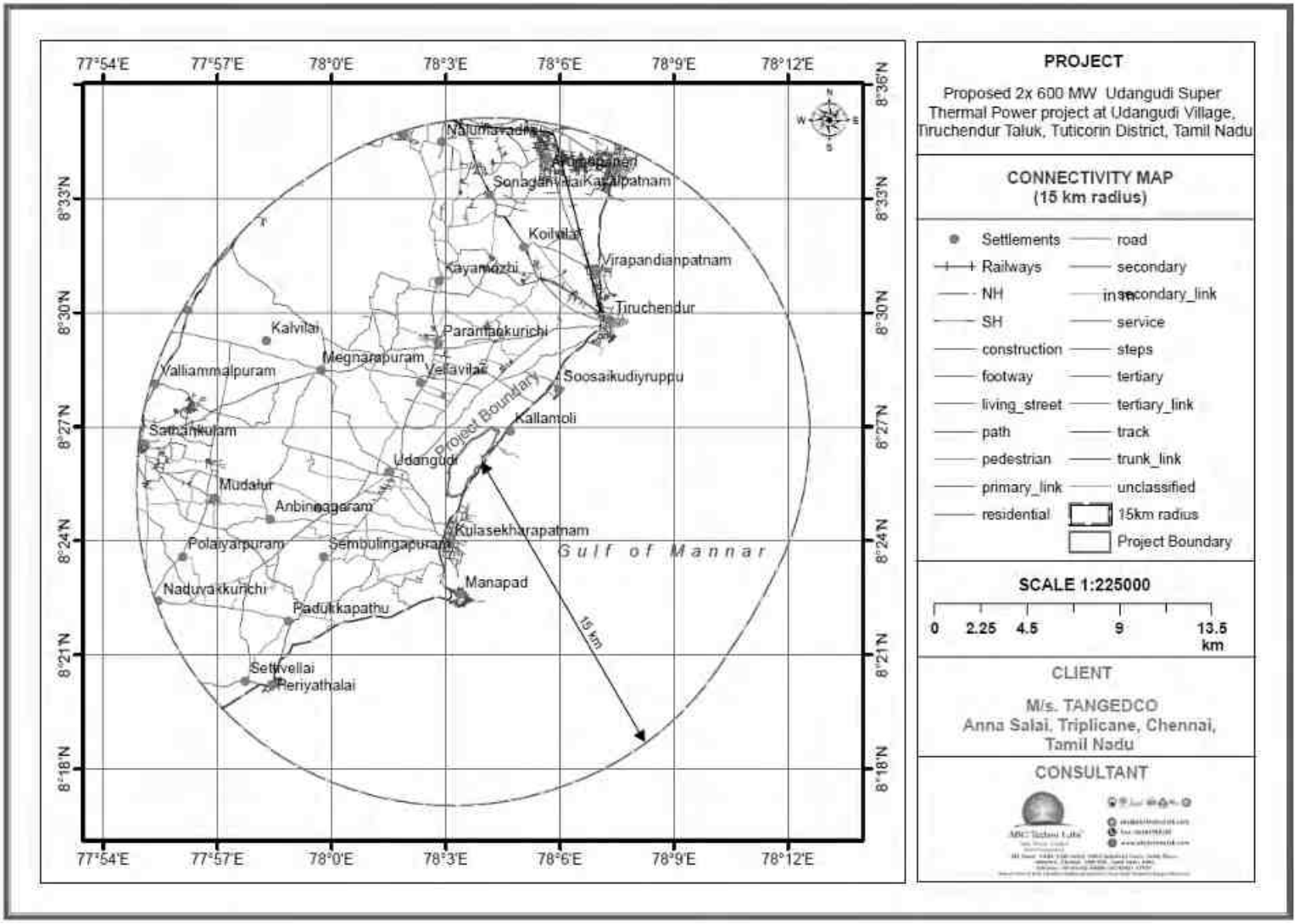


Figure 2-2 Site connectivity map covering 10 km radius

2.4 Size or magnitude of operation

The ongoing power plant will be operated with coal as the main fuel to generate power (2×660 MW) and would be developed with super critical technology to obtain benefits under clean development mechanism (CDM Project).

The selection of a supercritical versus a sub-critical power cycle is dependent on many projects specific factors including fuel cost, emissions regulations, capital cost, load factor, duty and unit reliability and availability. It is proposed to use 50% imported coal and 50% domestic coal based on efficiency as fuel. The annual consumption of coal for the ongoing power plant is estimated as 5.893 million tonnes.

The project proposes to have its own captive coal jetty at Udangudi with transportation of coal through pipe conveyor system to the power plant to handle coal up to 15.33 million tonnes per annum. IITM, Chennai has studied the feasibility of the coal jetty. Based on the feasibility study NIO, Goa has finalized the location by model studies.

The Govt of Tamil Nadu has accorded approval for the development of coal jetty as Udangudi Minor Port by declaring the Port Limits for captive use of TANGEDCO. M/s. The coal jetty is located at about 7.5km from shore and possess a separate EC and CRZ clearance from MoEF&CC vide Lr. No. - EC22A004TN156490, 10-66/2020-IA.III dt. 03.08.2022 enclosed as **Annexure XV**.

The total water requirement for boiler and cooling water for the ongoing plant would be around 13,063 m^3/hr and the source is seawater. The NIO, Goa, has finalized the location of the cooling water intake and outfall in sea by conducting the modeling studies. The total intake length is located at 2.68 km (onshore – 1 km & offshore – 1.68 km) and the total outfall length is located at 2.39 km (onshore – 1.51 km & offshore – 0.88 km). The project cost is estimated to be Rs.13,076.705 crores. Total land required for the project is 380 Ha.

2.5 Proposed schedule for approval and implementation

It has been envisaged that TANGEDCO shall attain its critical rated capacity of 2 x 660 MW during the year FY-2027-28. However, it is planned to commission unit wise and the second unit will be in full operation during the year 2027.

2.6 Technology and process description

In line with the observations of MoEF&CC and CEA guidelines, it is proposed to adopt Supercritical technology. It is worthwhile mentioning that the 2x660 MW Unit of Udangudi Power Plant is having higher cycle parameters (Main Steam pressure (MS) -281 ata, MS/Reheating (RH) temperature 603˚C/ 603˚C). The advantages of supercritical technology are listed below:

- Higher plant efficiency
- Less Fuel Consumption
- Less Infrastructure Investment for Fuel Transport / Storage and Ash Disposal
- Less Emission (CO2, SOx, NOx, Dust/Ash)
- Less Auxiliary Power Consumption of plant auxiliaries.
- Less Water Consumption (No need of continuous blow down in case of once through boiler.
- Lower operating costs
- Greater operating flexibility

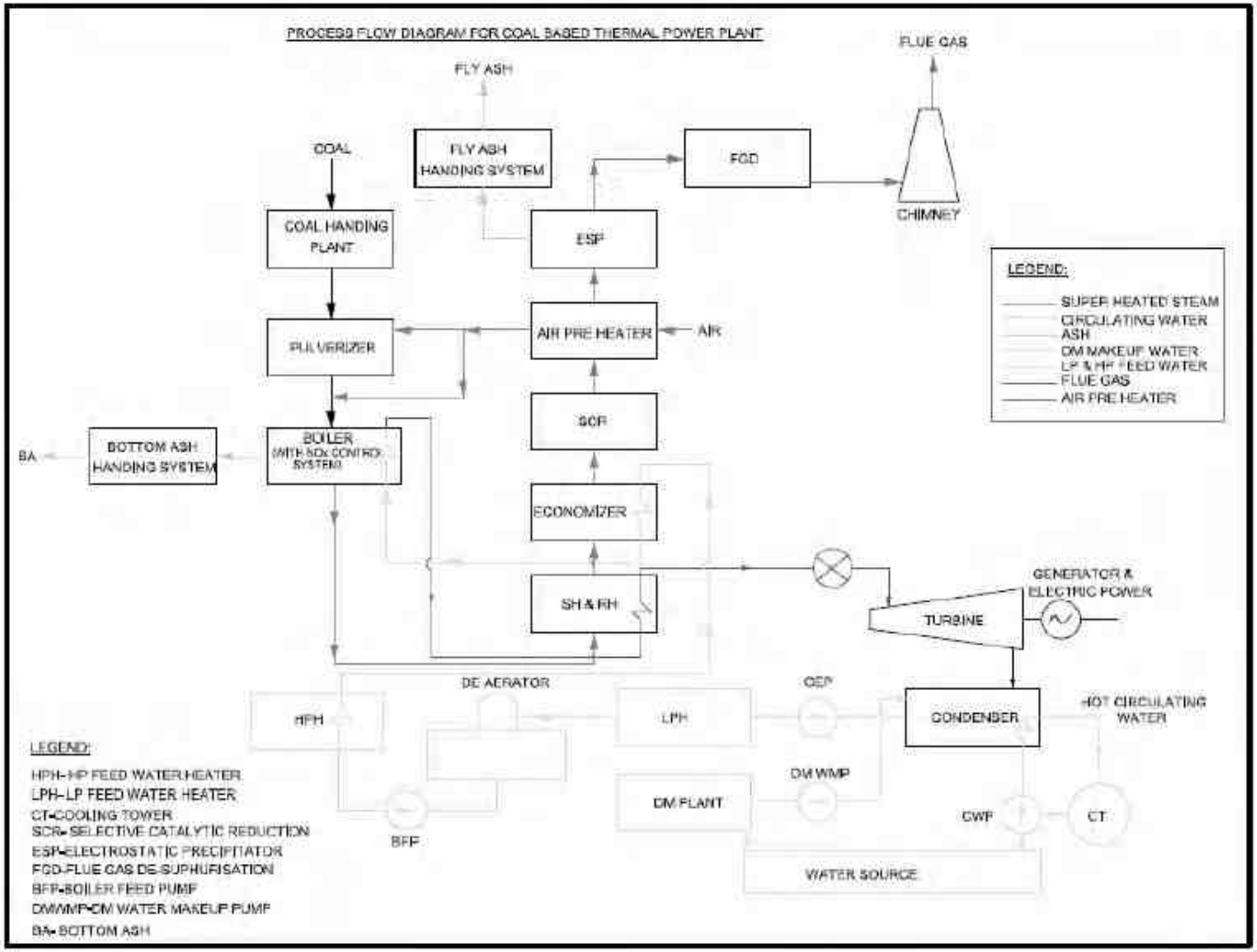


Figure 2-3 Process Flow Diagram for Coal Based Thermal Power Plant

In thermal Power generation, chemical energy of fuel is first converted into thermal energy (during combustion), which is then converted into mechanical energy (through a turbine) and finally into electrical energy (through a generator).

TANGEDCO has planned to install Supercritical pulverized fuel combustion technology for this ongoing 2x660 MW power plant, targeting higher efficiency (and hence minimum coal consumption) as well as conforming to best possible friendliness to environment at reduced emission.

Additionally, following pollution control equipment are attached to the once-through steam generator, for compliance to latest MoEF &CC guidelines.

- Selective Catalytic Reactor (SCR)
- Flue Gas Desulphurization (FGD
- Electrostatic Precipitator (ESP)
- Fly Ash Handling system and Storage Pond & Silos
- Sewage Treatment Plant
- Effluent treatment Plant

TANGEDCO is proposing 2x660 MW, in the district of Tuticorin, Tamil Nadu. The major components of (2x660 MW) Power Project are as follows:

- Steam Generator and its Auxiliaries;
- Steam Turbine and its Auxiliaries;
- Electrical Generators, Transformers and Switchyard
- Control and Instrumentation systems
- Air Pollution Control Systems like Dust Suppression and Extraction Systems, Electrostatic Precipitators, Flue Gas Desulphurization System and NOx Control (SCR) System;
- Water Intake and Treatment Systems;
- Condenser and Auxiliary Cooling System;
- Fuel Oil System;
- Coal Handling and Storage System;
- Ash Handling, Utilization and Disposal System;
- Site Drainage, Sewage Treatment Systems with facilities for Recycle and Reuse;
- Green belt, afforestation and landscaping systems.

2.6.1 Raw material requirement

The EC obtained during 2013 was planned with 100% imported coal. Based on MoEF&CC OM vide Circular. No. J-13012/8/2009-IA. II(T), dt.6.12.2023, TANGEDCO now proposes to use indigenous coal and imported coal for the ongoing power plant which is sought in this fresh EC. The total coal requirement for the Udangudi Super critical power project is 5.893 MTPA. TANGEDCO is planning to use Imported Coal verses Indigenous Coal in the ratio of 50:50 based on efficiency which is amounting to 2.246 MTPA of imported coal and 3.647 MTPA of indigenous coal. TANGEDCO has signed an agreement with M/s. MMTC for supply of the entire imported coal requirement. Considering future expansion, the Jetty and Pipe Conveyors have been designed for the ultimate coal handling capacity of 15.33 MTPA through Panamax ships of 80,000 to

120,000 Tons capacity. The other raw material required for the plant is Limestone. The total raw material requirement, source and mode of transportation with quantity are given below in **Table 2.2.**

Table 2-2 Raw material requirement

Sl. No.	Raw Material	Quantity	Source	Calorific Value	Mode of Transport	Distance in kms.
1.	Imported Coal	2.246 (MTPA)	Indonesia	4350 kcal/kg (Blended coal)	captive jetty at Udangudi	9.356
2.	Indigenous coal	3.647 (MTPA)	Odisha			
Other Raw materials						
4.	Wet Lime stone	288 (T/day)	Indigenous	-	by road	-
5.	Fuel oil	41500m^3	Indigenous	-	By road	-

2.6.1.1 Storage of raw materials and raw materials handling system

The production facilities would be adequately supported by necessary auxiliary facilities for raw materials handling such as raw materials unloading, conveying, stacking & storage and distribution etc. Transportation of raw materials to the plant site will be transported from the captive jetty at Udangudi at the distance of 9.356 km. the storage area is shown in the general layout.

2.6.2 Steam generator and auxiliaries

The Steam generator units will be of once through type with supercritical steam parameters. The steam generator will be of single pass (Tower type) or two pass type using spiral wall (inclined) or vertical plain / rifled type water wall tubing. The steam generator will be direct pulverised coal fired, top supported, single reheat, radiant, dry bottom, with balance draft furnace and suitable for outdoor installation.

The evaporator of steam generator will be suitable for variable pressure operation from subcritical to supercritical pressure range.

2.6.2.1 Fuel used

Coal- The fuel for the main steam generator(s) will be blended coal (Indian coal from Talcher coal field and imported coal).

Fuel Oil- Heavy fuel oil (HFO) will be used for start-up, coal flame stabilisation and low load operation of the main boiler(s). In addition, the Highspeed diesel (HSD) firing facilities will also be provided for cold start-ups of the steam generator(s).

Table 2-3 Fuel oil requirement

Sl. No.	Raw Material	Quantity	Source	Calorific Value	Mode of Transport	Distance in kms.
Other Raw materials						
4.	Heavy Fuel oil	35000 m^3	Indigenous	-	by road	-

5.	High speed diesel	6500 m^3	Indigenous	-	By road	-

The startup and low load flame stabilization with fuel oil are as follows:

Steam Generator	HFO	HSD
	% Boiler maximum continuous RATING (BMCR)	
Cold start-up & firing	NA	7.5
Start-up & firing	30%	NA
Coal low load flame stabilization	30%	NA

NA = Not applicable

The expected numbers of start-ups during 25 years of design life are as follows:

Type of starts	Number of starts
Hot starts (after 8 hours of unit shutdown)	4000
Warm starts (after 36 hours of unit shutdown)	1000
Cold starts (after 72 hours of unit shutdown)	150

2.6.2.2 Rating

The steaming capacity of the steam generator at Turbine maximum continuous rating (TMCR) conditions is indicated below:

Rated Steam parameters at TMCR condition.	Pressure bar(a)	Temperature °C	Flow tph
At super heater outlet	256	567	2340
At re-heater outlet	57	595	1967

The exact rating of the steam generator will be finalized by the BTG supplier depending on actual requirements of the turbine.

2.6.2.3 Control range

Steam temperatures at super heater and re-heater outlets will be maintained within ±5°C of the rated steam parameters between 60% TMCR to 100% BMCR.

- Boiler Steam Water components
- The boiler steam water system comprises the following:
- Feed water preheating and evaporation
- Recirculation and start-up drain system
- Super heater heating surfaces.
- Super heater spray water attemperator.
- Reheater heating surfaces
- Reheater spray water attemperator
- Super heater and reheater drains & vents
- Steam coil air heater–water/steam side.

The boiler high pressure part begins at the economizer inlet header and ends at the super heater outlet headers. The boiler medium-pressure part begins at the reheater inlet header and ends at the reheater outlet headers.

2.6.2.4 Recirculation mode

During start-up and low load, the steam generator is operated in recirculation mode. In recirculation mode the boiling water is separated from the vapor in the steam water separators and the separated water dumped to condenser flash tank or recirculated via recirculation pump back to economizer and is mixed with feed water.

2.6.2.5 Once through mode

In once-through operation, the feed water passes the evaporator section without recirculation. During once-through operation most components of the recirculation system are out of operation and not subject to hot fluid. Hot stand-by system is envisaged to prevent the cooling of these components during the once-through operation by intermittent extraction of a small amount of fluid from the lowest point in the recirculation system.

- The steam generators will be supplied with a complete set of equipment including;
- Coal Feeding & Firing System.
- Air & Flue Gas Components
- Draft Fans
- Air pre-heaters.
- Soot blowers
- Electro Static Precipitators (ESP).
- Chimney.

2.6.3 Coal feeding & firing system

Coal bunkers are in-process storage silos used for storing crushed coal from the coal handling system. The coal feeders transport raw coal from the bunker to the inlet chute, leading to mill at required rate. The feeders will be of gravimetric type.

Mills pulveriser coal to the desired fineness to be fed to the furnace for combustion. The system consists of medium speed vertical spindle bowl mills. The no. of mills will be so selected to have N+ 2 standby mills available for 100% BMCR with design coal and N+1 standby mill available for 100% BMCR with worst coal.

The firing system will be designed for tangential corner firing/opposed wall firing.

Burners will be used for burning pulverised coal. Each unit has a set of burners located at different elevations of the furnace specially designed for low NOx emissions.

Seal air fans used for supplying seal air to the mills to prevent ingress of coal dust into gear box lubrication oil will be provided.

2.6.4 Draft fans

The FD and ID fans will be capable of maintaining balanced draft condition in the furnace over the entire load range with any one or both ID fans and any one or both FD fans in operation while firing the specified range of fuels. The number of fans, capacity and type of control envisaged per unit will be as follows:

Description	No.& Capacity	Type
FD Fan	2 x 60%	Axial, variable pitch control
ID Fan	2 x 60%	Axial, variable pitch control

For each FD & ID fans forced oil lubrication system will be provided, consisting of 2 x 100% lube oil pumps, 2 x 100% oil cooler, oil reservoirs with heater, piping, valves, 2 x 100% lube oil duplex strainer etc. All necessary regulating and isolating dampers will be provided for each fan to ensure safe & efficient operation.

2.6.5 Air pre heaters

The primary function of the Air Pre-heaters is to cool down the flue gas to increase the efficiency of the unit by preheating the combustion air.

One (1) no. steam coil air pre-heater (SCAPH) will be provided at the outlet of each F.D. fan, and will be installed close to the regenerative air heater. The SCAPH will be designed to maintain the average metal temperature of regenerative air pre-heater cold elements 10°C above the acid dew point temperature by increasing the temperature of air to 100°C during start-up and very low load operation. The regenerative air pre-heater (RAPH) will be of vertical type. The air heater will be leak proof and relatively maintenance free. These air pre-heaters will be designed passively to avoid the low temperature corrosion of the cold end section of the air heater parts.

2.6.6 Soot blowers

The soot blowers will be envisaged for efficient on-load cleaning of furnace, super heaters, re heaters and air heaters. Steam will be tapped off from super heater outlet for the purpose of soot blowing.

2.6.7 Electro static precipitators

When coal is fired in the boiler, ash will be liberated and about 80% of ash is carried along with the flue gas. If this ash is allowed to atmosphere, it will create an air pollution thereby resulting in health hazards. Hence it is necessary to precipitate the dust from the flue gas and in this process electrostatic precipitator will be envisaged to reduce particulates and remove fly ash from the flue gas. The ESP will have adequate number of ash hoppers provided with electric heaters. Each ESP will have separate collecting and emitting rapping system and each field have separate entry. Microprocessor based ESP controller will be provided. The ESP will be designed to control particulate matters in flue gas within the limits as prescribed in Ministry of Environment, Forest & Climate Change (MoEF&CC) norms.

SOx and NOx emission from the plant will be within the limits as prescribed in MoEF&CC norms. This is achieved using DeSOx and DeNOx equipment respectively.

Chimney

Chimney is tall RCC structure with multiple flues. One (1) no of chimney of 275 m height is proposed for effective dispersion of the pollutants. One Chimney will be common for two (2) units housing two independent flues. The external platforms will be of RCC construction.

2.6.8 Steam turbine and its auxiliaries

The Steam turbine units will be of condensing type with single reheat and supercritical steam inlet parameters.

The steam turbine will be of single reheat, condensing type with separate HP, IP and multiple LP cylinders. The steam turbine has eight (8) uncontrolled extractions for feed water and condensate preheating.

Rating-Each steam turbine unit will conform to the following design and duty conditions:

Description	Value
Output under TMCR condition	660 MW
Turbine throttle steam pressure	252 bar (a)
Turbine throttle main steam temperature	565°C
Reheat steam temperature at turbine inlet	593°C
Variations in rated steam temperature & Pressure	As per IEC
Pressure drops in reheat circuit	10% of HPT Exhaust
Frequency variation range	(+) 3% to (–) 5%

Turbine will also be capable of operating continuously with valves wide open (V.W.O) to generate power of 105% TMCR at generator terminals with rated main steam and reheat steam parameters. The steam parameter will be finalized by BTG supplier during detailed engineering.

2.6.8.1 Turbine Casing

Turbine casings are pressure vessels which contain the steam so that it can perform work by causing rotation of the turbine shaft. The type and size of casing materials are determined primarily by the steam pressure and temperature conditions under which it must operate.

The turbine casing will be separate for HP, IP and LP designed for maximum pressure & temperature to be encountered during service including as specified under operational capabilities.

2.6.8.2 Rotor & Blading

The turbine rotor and its blading are the principal and the most highly stressed components in the conversion of steam energy into mechanical energy.

Turbine blades convert the thermal energy of heat, pressure and velocity into mechanical energy, which is then supplied to the generator via the rotor. Each stage consists of stationary and rotating blades. There are basically two types of blade designs in use today, impulse and reaction.

2.6.8.3 Gland Sealing System

Stationary and rotating turbine components must be sealed to

- Prevent steam leakages into the atmosphere
- Air leakages into the LP turbine
- Maintain the correct and efficient steam flow within the turbine.

Steam turbine will be self sealed during normal operation i.e the source of sealing steam will be from the turbine gland leakage.

During start-up and low loads, an external source of sealing steam will be provided from the main steam and/or cold reheat line and from the auxiliary steam header. The switchover from this external source to the self sealing will be automatically achieved above a certain set value of the load.

Gland Steam condenser to condense and return to cycle all gland leak off steam will be provided along with 2x100% capacity exhausters (AC motor drive) to remove air and non-condensable gases.

2.6.8.4 Bearings

Bearings mounted in the bearing pedestals support the rotating shaft and maintain its correct position in the radial and axial direction between the stationary and rotating components.

To minimize friction and dissipate the heat generated by shaft rotation, bearings are lubricated and cooled by the lube oil system.

Turning Gear

The primary function of the turning gear is to rotate the turbo-generator rotors slowly and continuously during start-up and shut down periods to ensure uniform heating and cooling of the rotor.

Turbine Steam valves

Steam inlet valves perform one of two functions, protection or control.

Steam inlet stop valves perform the protective function of stopping steam flow through the turbine unit. These valves are in either open or closed position.

Steam inlet control valves regulate the flow and/or the pressure of steam through the turbine. Their position, from closed to fully open, is determined by the turbine controller.

Turbine Drains System

The turbine and the steam lines are equipped with drain lines which allow condensate, formed in the turbine/steam lines during start-up, to escape. This ensures that no water remains in the turbine steam lines, casings or valves, which could otherwise cause extensive damage to the unit.

Rupture Diaphragm

The rupture diaphragm is normally placed on top of the LP casing. It is used on condensing type turbines to protect the exhaust casing and condenser against internal over-pressure if the primary safety devices fail. It is a planned weak point and breaks as soon as the diaphragm's design pressure is reached.

Thermal Stress

The allowable rates of temperature change during start-up, normal operation and shut-down will be observed. Observing these values will ensure long-term availability of the unit. Failure to observe them can result in additional thermal stress and a consequent reduction in component life.

Turbine Auxiliary Systems

Certain auxiliary systems such as the lubrication, jacking oil, turning gear, control fluid, LP hood spray, and vacuum breaking systems are required if the turbine components described above are to operate properly.

HP-LP Bypass system

The HP & LP turbine bypass system will be envisaged to assist in

- Unit house load operations
- Quick hot start, following a turbine trip.
- Reducing starting and loading time of boiler.

From the date of operating plant, it appears that a bypass capacity increase from 15% to 50% reduces the plant start- up time by about an hour, whereas a similar outcome for an increase in capacity from 50% to 100% is not foreseen. Hence an optimum capacity for the bypass system will be selected to balance the initial investment of equipments and plant start-up time. The factors considered below are for a typical large size thermal power plant. Safety valve on the boiler super heater has to be provided in any case as per IBR; cannot be eliminated by using 100% capacity bypass.

Because of large steam dumping in the condenser at higher specific volume, the same becomes very large and costly. In order to limit the condenser size, the pressure and temperature raise in the condenser, the steam can be dumped at full capacity for about only ten (10) minutes after which the boiler firing rate has to be reduced. Thus full utilization of 100% capacity is not possible if the unit cannot be brought back to grid within ten minutes after the trip. Apart from high investment in the bypass equipment itself, other heat cycle equipment needs to be oversized to handle additional flows during bypass. Main steam admission into turbine can be accomplished when the steam flow through the boiler is as low as 10% of BMCR. The selected steam temperature control range for the boiler is 60% to 100% MCR.

The boiler is designed to generate 30% of MCR without oil support. In practice this may not, however, be achieved at times particularly during load transients and oil support may become inevitable even at 50-55% load. Operation of boiler below 50% load may require tripping few pulverisers to maintain the operating pulverisers under stable load. Thus, for coping with load transients, the desirable minimum capacity of the bypass station will be 60% to permit continuous operation of the pulverisers and burners within a conservative turn-down range and to maintain main steam temperature. Based on the above it is preferred to install HP bypass system with 60% capacity at rated main steam parameters. The LP steam bypass will be compatible with HP Bypass system.

2.6.9 Condensing unit

The Condenser performs the following tasks:

- Condensation of LP turbine exhaust steam.
- Condensation of boiler feed pump drive turbine exhaust
- Condensation of steam turbine bypass steam.
- Transfer of waste heat (evaporation heat of exhaust steam) to the cooling water.
- Extraction of non-condensible gases;
- Collection of internal condensate drains.

Single pass surface condenser capable of maintaining the required vacuum while condensing maximum steam flow through LP turbine will be provided. The divided water

box arrangement will be such that it is possible to isolate one half of the condenser from cooling water inlet and outlet sides.

Tubes & tube sheets will be of titanium to maintain superior corrosion control against sea water. The water boxes will be of carbon steel with FRE lining. The condensers will have integrated air-cooling zone and it should be designed so as to accept full quantity of steam during turbine HP and LP bypass operation without any undue vibration, thermal stress etc. The condenser axis will be at right angle to the turbo-generator axis.

The condensate temperature under any circumstances will not be less than the saturation temperature corresponding to condenser back pressure. The maximum heat load of the condenser will correspond to turbine operating with valves wide open (VWO) condition or HP-LP Bypass in operation or all HP heaters out of operation conditions, whichever is higher, exhaust steam flow from BFP drive turbine, adequate make-up and cooling water inlet temperature of 33°C and temperature rise less than 10°C. Temperature rise of cooling water in condenser not exceeding 8.5 at TMCR condition. The design will satisfy the requirement of Heat Exchanger Institute (HEI), Standards.

At the CW Inlet to the Condenser, debris filter with suitable backwashing arrangement during continuous operation, complete with control and monitoring equipment will be provided.

Condenser online tube cleaning system will be provided for cleaning the condenser tube internals whilst on-load. The equipment will be initiated and sequentially controlled automatically.

Cathodic protection equipment for water boxes will be provided. Sacrificial anodes will be provided to include cathodic protection for water-side surfaces like water-box and water-side surfaces of tube sheet.

2.6.9.1 Condenser air evacuation system

The system fulfills the following tasks:

- Air evacuation of the steam turbine, condenser, flash box & bypass station during start-up of the plant.
- Venting of non-condensable gases during normal operation.

2 x 100% capacity vacuum pumps for each condenser will be provided to maintain the vacuum in the condenser by expelling the non-condensable gases. One (1) no. of vacuum pump will operate during normal plant operation and during start-up both two (2) pumps may be operated such that the desired vacuum can be pulled within a short time.

2.6.9.2 Condensate extraction pumps

The main condensate is extracted from the hot well tank by condensate extraction pumps. The extracted flow is routed via the main condensate line through condensate polishing unit, gland steam condenser and LP heaters to deaerator to feed water tank.

Main condensate is extracted from downstream from the condensate extraction pump, for:

- Steam conditioning in the LP steam bypass stations
- Turbine exhaust hood spray

- Gland sealing steam de superheating.
- Condensate supplies to the sealing water system

3 x 50% (2W+1S) capacity condensate extraction pumps will be provided. The condensate extraction pumps will be vertical, multi stage enclosed can-type with flanged connection driven by electric motor.

2.6.9.3 Closed feed water heaters

The feed water heaters will be envisaged to increase the overall efficiency of the regenerative cycle by heating the condensate/ feed water by the steam extracted from suitable stages of the turbine.

The feed water heaters will be of closed U-tube horizontal type. The feed water heaters will have both drain cooling and desuperheating zones in addition to the normal condensing zone as necessary.

High pressure heaters will be provided with group bypass and low pressure heaters will have individual bypass arrangement in order to allow isolation and maintenance. The recommendations of ASME standard TWDPS-I will be followed for prevention of water damage to the turbine.

2.6.9.4 De-aerating feed water heater

The purpose of the deaerator and feed water tank is:

- To remove the dissolved corrosive gases from the feed water in turn preventing internal corrosion of the boiler tubes. The oxygen is reduced to 0.005 cc / litre and carbon dioxide is reduced to untraceable limits.
- To serve as a feed water flow break tank between the condenser extraction pumps and the feed water pumps,
- To provide the required suction head to the feed water pumps.

The buffer volume is designed to prevent the plant trip due to failure of condensate extraction pump during operation. The buffer volume in the feed water storage tank allows the operator to restart these condensate pumps without tripping the feed water pumps.

The deaerator will be of spray type/spray-cum-tray type with a separate horizontal storage tank for feed water. The deaerator will be of variable pressure type with a feed water tank of six (6) minutes capacity.

Deaerator will normally operate by taking extraction steam from IP turbine casing. However, during low load operation and start-up, the deaerator will be pegged with steam drawn from auxiliary header. The deaerator will be placed at a suitable elevation to provide sufficient NPSHA for the boiler feed booster pumps and considering the head available for the drain of the preceding HP heater to flow to the deaerator.

Boiler Feed Pumps and Drives

The function of this system is to pump feed-water from feed water storage tank to boiler.

Boiler feed pumps will be horizontal, multistage, barrel casing, centrifugal type. There are two different drive types for the feed water pump for large thermal power plants:

- Steam turbine-driven
- Electrical-driven.

The decision for the drive types for boiler feed water depends on two main factors.

Firstly, the drive type influence on entire unit's heat efficiency. Secondly, the drive type selection influence on the initial power plant investment and O&M factors (flexibility, reliability, efficiency).

There are few configurations for feed water pump implementation for larger units:

- 2x50%, i.e. two turbine-driven feed water pumps operating in parallel and an electrical-driven 1x50% capacity pump for unit startup / shutdown and as standby. The advantage of this configuration is operating flexibility, and that breakdown or overhaul of a pump unit does not affect the unit's operation.
- 1x100%, i.e. one turbine-driven feed water pump and an electrical-driven pump of smaller capacity for unit startup and as standby. The advantage of this configuration is low initial investment, high reliability (its operating reliability and maintenance service schedule can be made the same as the main ST), and convenience for operation and maintenance.

Obviously, each of the above configurations has their own pros and cons.

The scheme adopted for each unit will be 2 x 50% turbine-driven for normal operation and 1 x 50% electric driven for start-up/shutdown and as standby. However, the final configuration for the boiler feed water pumps will be based on the standards and recommendations of the BTG supplier.

Each boiler feed pump will have one (1) matching capacity single stage booster pump. The booster pump will take suction from feed water storage tank and discharge into the suction of corresponding main feed pump which in turn, will supply feed water to boiler through the high-pressure heaters and feed control station. All the feed pumps will be provided with minimum flow automatic recirculation control arrangement to protect the pump under low load operation.

The recirculation will be discharged back to the deaerator. Motor driven Boiler feed pump will be provided with pressure control valve at the pump discharge for pressure regulation.

Each pump will be provided with mechanical seals with proper seal cooling arrangement, self-contained forced lubricating oil system for supplying oil to the bearings, couplings etc. the lubricating oil and also sealing arrangement of the feed pumps will be cooled by closed cooling water systems utilizing demineralized water as cooling medium. All necessary protective and supervisory system will be provided to ensure safe and trouble-free operation of the feed pumps.

The drive turbine of the feed pumps will receive steam from IP turbine exhaust during normal operation, during low load operation the steam will be supplied from main steam line and during start-up steam will be supplied from auxiliary steam header. The exhaust from the boiler feed pump drive turbine will be condensed in the main condenser itself.

2.6.10 Flue gas desulphurization

Flue Gas Desulphurisation (FGD) unit will be installed to reduce the concentration of SOx emission.

The FGD is classified into three types based on the following:

- Sea water-based flue gas desulphurisation system
- Dry Flue gas desulphurization system
- Wet Limestone based flue gas desulphurisation system

Among the three types, wet limestone based FGD system is selected.

Wet Limestone based flue gas desulphurisation system

The wet limestone based FGD system adopts limestone slurry for the removal of the SOx present in the flue gas and the flue gas after treatment will be saturated. Gas to gas heat exchangers will be required to raise the temperature of the flue gas entering the chimney. The system will have efficiency of 95% or more. The arrangement of flue gas system will allow complete isolation of the absorber from gas side, with the unit in operation. For this purpose, Motorized/Pneumatic Guillotine type gates will be provided at hot gas inlet to gas-gas heater, cold gas outlet from gas-gas heater and the flue gas bypass duct.

Considering that the limestone-based system is being adopted in the existing plant, sources & mode of transport already being identified and also considering the advantages of higher efficiency, wet limestone-based Flue gas desulphurisation system is proposed for 2 x 660 MW units.

2.6.11 NO_x reduction

At present, advanced Low NOx combustion technology is used in all steam generator combustion system with Low NOx burner and over fire air system. This will reduce the NOx emission to a large extent. However, cost effective post combustion NOx control technology such as SCR / SNCR will be required to limit the NOx level to 100 mg/Nm^3 as stipulated by 2015 amendment.

Selective Catalytic Reduction (SCR)

Selective Catalytic Reduction (SCR) uses a catalyst and requires a system to meter and inject ammonia into the flue gas such that it mixes before passing through the catalyst. NOx reduction is effective in a limited temperature range. For the majority of commercial catalysts, the optimum temperatures range from 250˚C to 425˚C, depending on gas composition and catalyst type.

- SCR System Features
- Easy operation
- Less moving equipment highly reliable
- No by-product
- High denox efficiency, 60 - 90%

In order to meet the NOx level of 100 mg/Nm^3, SCR is considered for this project.

2.6.12 Coal handling system

The coal requirement for 2x660 MW unit shall be about 5.893 MTPA based on gross calorific value of 4350 Kcal/ kg. Blended coal (Indian - coal and imported coal) will be used in the ongoing power project.

Design Criteria, Assumptions and System Capacity

The coal handling system of the ongoing plant will be designed considering the following design criteria:

Gross Calorific Value of Blended coal (50:50):		4350 kcal/ kg
Maximum lump size of coal as received	:	(-) 100 mm
Size of crushed coal	:	(-) 25 mm
Mode of receipt of coal in plant	:	From ship by Pipe Conveyors.
Coal transport to boiler bunkers	:	By belt conveyors (1W+ 1S)
Coal requirement of each 660 MW unit	:	337 T/h (worst Coal)
Coal requirement for two 660 MW units	:	674.3 T/h
Annual Coal requirement @ 85 % PLF	:	5.02 million tonnes / yr.
Stacker cum Reclaimers	:	4 Nos
Crushers and screens	:	100% stand by

Sizing of coal conveying system based on boiler requirement:

Sl. No.	Description	Units	Value
i	Calorific value of blended coal	kcal/ kg	4350
ii	MCR fuel consumption per 660 MW unit	T/h	337
iii	MCR Coal consumption for 2x660 MW units	T/h	674
iv	No. of hours of operation for CHS per day	H	14
v	Required rated capacity with margin	T/h	1282
vi	Required design Conveying system capacity	T/h	1410

As per DBR, rated and design capacity of the External coal handling system capacity (from port to plant) will be 3000 T/h and 3300 T/h respectively. In plant Coal handling system capacity will be matched with port conveyor capacity. The coal handling system in the power plant will be normally operational for two shifts a day with provision for third shift operation also. It is considered to have a fourteen (14) hrs. storage capacity in the bunkers.

Design capacity will be 10% margin over the rated capacity.

System Description

The Coal handling system comprises the following:

Incoming Conveying System

Coal will be received at the port in ships and unloaded on to the pipe conveyors which will feed into crushers. The rated capacity of these incoming conveyors is envisaged as 3000 T/h. Two streams of conveyors are envisaged from the jetty to plant.

Screening and Crushing System

The coal as received in the plant will be expected to be of (-) 100 mm size. Two stream of conveyors each with the capacity of 3000 T/h feeding to vibrating grizzly screens to separate (-) 25 mm before feeding to crushers. Over size (+) 25 mm coal will be fed to Ring granulator crushers for reducing to (-) 25mm size.

Blending

Blending of domestic coal and imported coal will be done by reclaiming coal from the respective stock piles at the required proportion and conveyed to the succeeding conveyor where they get mixed. The proposed blending ratio of imported and Indian coal will be as follows.

The coal will be blended in the following options,

Direct Feeding imported coal by 38 % and reclaiming domestic coal by 62 % For coal, blending option will be 50:50. Same options as stated above will be adopted.

Conveying system for Direct Feeding to SG Bunkers

SG bunkers will be filled by means of conveyors with traveling tripper. Bunker sealing arrangement is envisaged for covering the bunker opening when the feeding conveyor is away from the opening. The clearance between the bottom of the tripper floor and top of coal bunker has to be covered with steel plate to avoid dust formation.

Coal stockpiles, stacking and reclaiming

Coal received at the plant will be stored in four stockpiles. Rail mounted slewing type Stackers cum reclaimers are envisaged for stacking and reclaiming for the ongoing plant. Stockpile will be of trapezoidal cross section. The reclaiming will be through the bucket wheel mounted on the tip of the boom conveyor. The rated capacity of stacking will be 3000T/h. The rated capacity of reclaiming will be 3000T/h. The machine will be capable of stacking / reclaiming anywhere along the stockpile. The stockpile height will be 10m.

Whenever the reclaimer is not available, coal will be reclaimed by dozers into the emergency reclaim hopper (ERH). One set of emergency reclaim hoppers will be provided for reclaiming and further it feeds boiler.

Bypass chute will be provided to bypass screen and crusher.

Below each of the emergency reclaim hoppers, rod gate, rack & pinion gate and vibrating feeders will be provided for feeding coal to the belt conveyors. Vibrating feeders are driven by variable frequency drives thus adjusting the feed capacity.

During blending in some options combination of Stacker cum reclaimer and Emergency reclaimer will be operated to meet the required coal quantity.

Coal yards will be provided with plain water spray dust suppression system which would spray water on the stockpile wherever the Coal is being stacked and also dust control.

Fire water system will be provided along the rails for fire fighting purposes. The Coal yard would have a drainage system to drain out rain water.

Necessary entry points will be provided in the stock yard for bull dozer movement. Roads will be provided around the stockyard for the vehicle movement.

Necessary diversions/ interchanges by means of two-way chutes will be provided at strategic locations of the conveying system so as to render adequate flexibility in operation with minimum of complication. Refer flow diagram for no. of interchanging points in coal handling plant. Coal handling system is shown in **Figure 2.4**.

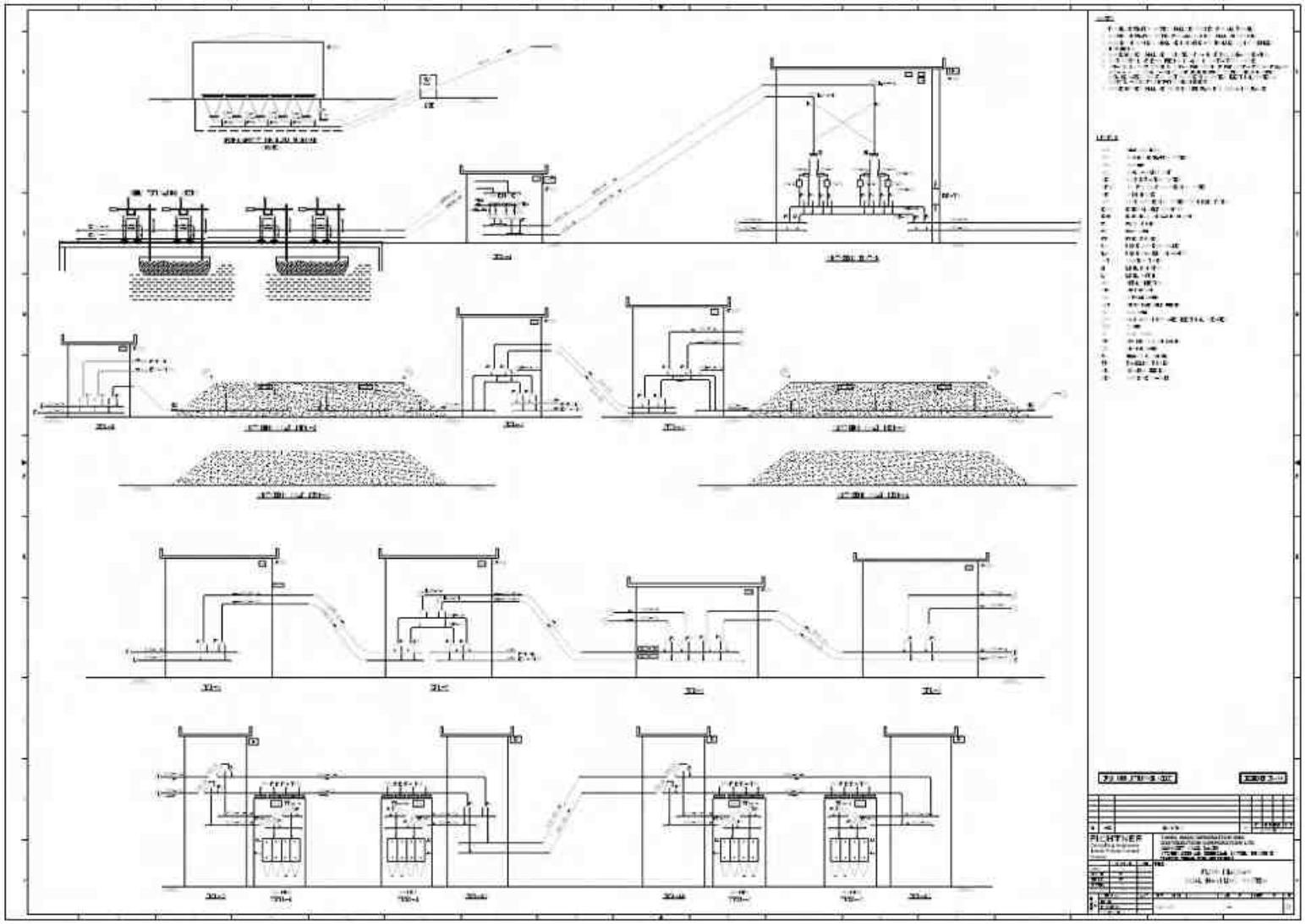


Figure 2-4 Coal handling system

2.6.13 Control system

The I&C system will consist of a microprocessor based on Programmable Logic Control (PLC) system, hardwired Annunciation system, control desk cum- panel, local control panels, local instruments, instrumentation control cables and erection hardware.

2.6.14 Fuel oil handling system

The steam generator will be designed for 100% coal firing. HFO will be used for hot start-up and for coal flame stabilisation at low loads up to 30% MCR. For cold start-up, warm-up purposes and for start-up / commissioning activities, HSD will be used up to 7.5% MCR.

Heavy Fuel Oil System

HFO will be received to the ongoing plant by means of road- tankers. HFO system consists of Unloading, storage, forwarding, heating & cooling skid.

Two (2) nos. of Heavy Fuel Oil (HFO) storage tank of 3000 m^3 each will be constructed. Heavy Fuel Oil will be transported to site by road tankers. The system will be equipped with dedicated facilities to unload and meter the deliveries by road tankers. Simplex strainer will be provided at each unloading pump suction. Flow meter will be provided after the unloading pump discharge header to measure the quantity of flow into the HFO storage tank.

Configuration of HFO pump is given as three (3) nos – (2W+1S) each with a capacity of 100 cum/hr.

The heavy fuel oil storage tanks will be provided with steam floor coil heaters at the bottom of the tank to raise the temperature of oil from minimum expected temperature of oil under minimum ambient temperature to the handling / tank maintenance temperature in order to ensure flow ability of oil.

The HFO tank suction heater will be provided to heat the required quantity of oil from the bulk temperature in the storage tanks to the temperature required at HFO forwarding pumps suction. The heater will heat only the quantity of oil that is being withdrawn from the tank.

The HFO forwarding skid consists of HFO forwarding pumps, duplex suction filters, HFO heaters and all necessary valves and instruments. The HFO from the storage tanks will be supplied to boiler units by means of the HFO forwarding system, comprising of 3 Nos. (2W + 1S) HFO Forwarding Pumps. System will be designed for a capacity sufficient for firing up each boiler for 30% load with recirculation. The excess oil will be returned to the storage tank. The HFO forwarding pumps will be designed to operate in parallel with each other with provisions for necessary relief valves. Duplex strainer will be provided at forwarding pump suction & discharge common headers.

HFO heater at HFO Forwarding pump outlet will maintain the outlet temperature of HFO as required at the burner header. Working Oil pressure will be as per requirement and design oil pressure will be 1.5 times the working pressure.

There will be return oil lines to return the unused HFO from the boilers back to the tank. Necessary flow measurement will be provided in the HFO return lines. HFO coolers will

be used to reduce the temperature of the heavy fuel oil by cooling it from the Boiler return temperature to HFO storage tank maintenance temperature.

The steam for the heaters will be supplied from auxiliary steam header. Steam tracing will be used for all HFO piping in the fuel oil unloading, storage and forwarding pump house area HFO piping (both supply and return lines) between pump house area and the boiler front will be electrically heat traced in order to maintain the oil temperature.

High Speed Diesel System

HSD system consists of unloading system, storage tank and forwarding skid.

One (1) no. of High-speed Diesel (HSD) storage tank of 1000 m^3 will be constructed. The HSD Road tanker unloading facility will be designed to enable to unload 5 road tankers simultaneously and discharge to onsite storage tanks within one hour period. Configuration will be Two (2) nos (1W+1S) each with a capacity of 100 Cum /hr. Simplex strainer will be provided at each unloading pump suction.

The HSD forwarding skid consists of HSD forwarding pumps, duplex suction filters, and all necessary valves and instruments. HSD forwarding pumps 3 Nos (2W+ 1S) will be designed to supply the HSD flow requirement for the start-up of each boiler simultaneously. Duplex strainer will be provided at forwarding pump suction and discharge common header. Necessary flow measurement will be provided in the HSD supply line. Necessary flow measurement will be provided in the HSD supply line.

2.6.14.1 Ash handling system

For design basis of ash handling system, worst coal (blending option 50:50) will be considered. Ash content of the blended coal will be 19.5%. But for designing the ash handling system, 20% margin will be considered. This assumption is only for designing the ash handling system.

A.	Hourly coal firing rate at MCR condition per unit.	:	337 T (maximum)
B.	Ash content in coal considered - for ash disposal area calculations	:	26%
C.	The maximum ash collection at various hoppers for design will be:		
	- Bottom ash hopper	:	25% (maximum)
	- Economiser ash hoppers	:	5% (maximum)
	- Fly ash in ESP hoppers	:	90% (maximum)
	- APH hoppers	:	5% (maximum)
	- Stack hoppers	:	0.5% (maximum)
	- Duct hoppers	:	2.5% (maximum)

The system adopted for bottom and economizer ash will be submerged scraper chain conveyor. Fly ash removal system will be done by vacuum-cum-pressure type pneumatic system. Fly ash also will be handled in dry / wet mode and systems are also designed for unloading in trucks to facilitate selling of fly ash for utilization of brick manufacturers, cement manufacturers, land filling, road making and other ash utilizing industries. Fly ash will be transported in pipe in to ash pond through lean concentration slurry disposal.

Capacity and Time Cycle

Sl.No.	Description	Unit	Value
1.	Maximum coal consumption at TMCR	TPH	337
2.	Percentage of ash	%	26
3.	Total Ash Generation Rate	TPH	88.4
4.	Percentage of Bottom Ash	%	25
5.	BA Ash Generation Rate	TPH	22.10
6.	Eco ash generation Rate	%	5
7.	ECO Ash Generation Rate	TPH	4.42
8.	Total BA & ECO Ash Generation Rate	TPH	26.52
9.	Ash Evacuation Time (per Shift)	Hrs	8
10.	Ash removal Rate	TPH	26.52
11.	No. of streams(working)	Nos	2
12.	No. of streams (Stand by)	Nos	2
13.	Margin	%	50
14.	Capacity Per Streams	TPH	19.89
15.	Clinker Grinder Capacity Selected	TPH	20
16.	Jet Pump Capacity Selected	TPH	20
17.	Percentage of Fly Ash	%	90
18.	FA Ash Generation Rate	TPH	79.56
19.	APH ash generation Rate	%	5
20.	APH Ash Generation Rate	TPH	4.42
21.	Duct ash generation Rate	%	2.5
22.	Duct Ash Generation Rate	TPH	2.21
23.	Stack ash generation Rate	%	0.5
24.	Duct Ash Generation Rate	TPH	0.442
25.	Total Fly Ash Generation Rate	TPH	86.63
26.	No. of streams(working)	Nos	4
27.	Ash Collection Time	Hrs	8
28.	Ash Disposal Time	Hrs	4
29.	Ash Disposal Rate	TPH	43.32
30.	Ash Disposal Rate Design	TPH	45

2.6.14.2Bottom ash handling

Ash source: Bottom ash and economizer ash

Bottom ash formed due to the combustion of coal in the SG will be collected in a refractory lined dry Bottom Ash Hopper (BAH). In this system, the bottom ash from the boiler furnace will be discharged into the submerged scraper chain conveyor provided below the dry type bottom ash hopper. The scraper chain conveyor in turn will feed bottom ash to clinker grinder where it gets crushed to (-) 25mm and feeds the buffer hopper (connecting the scarper chain conveyor outlet with jet pump). Bottom ash hopper refractory and bottom ash will be cooled by the sea water. Overflow from the Scraper chain conveyor will be collected in the overflow tank and recirculated by the overflow transfer pump to Clariflocculator. Common sea water tank will be provided for the bottom and fly ash disposal system.

From economiser hoppers, coarse ash will flow to the scraper chain conveyor (above the maintained water level) by means of an adequately sized sloping pipe (for transporting slurry by gravity) duly assisted by jets (nozzles) placed at strategic locations for easy slurry flow.

The individual slurry outlet pipes will combine to form a header in sloped gradient and the header will connect to each scarper chain conveyor. Each individual economiser hopper will be provided with manual isolation valve, water seal cum expansion trough, flushing apparatus having water supply from BAHP water pumps for slurry preparation.

Fly ash from Economizer hoppers are also conveyed to bottom ash hopper using flushing apparatus and same will be handled as a part of this system. Bottom ash handling system is shown in **Figure 2.5**.

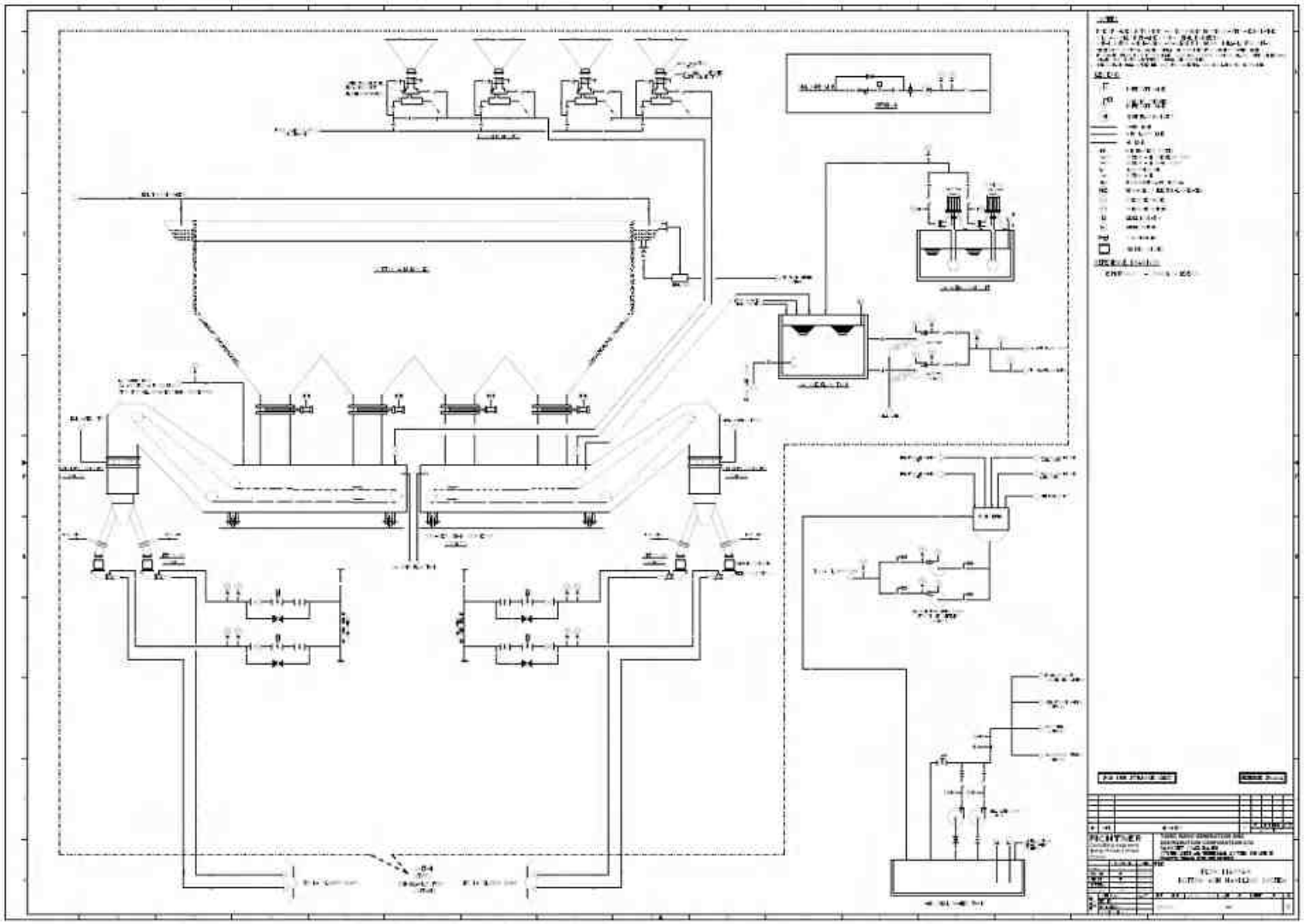


Figure 2-5 Bottom ash handling system

2.6.14.3 Fly ash handling

Ash Source: ESP ash, APH hoppers, duct hoppers (if applicable) and Stack hopper.

Vacuum-cum-pressure system: The fly ash handling system will be of vacuum-cum-pressure type. The fly ash collected in several sets of ESP hoppers located in the flue gas path will be evacuated pneumatically.

The fly ash is sequentially extracted from these hoppers by creating vacuum in extraction piping. In this system, the vacuum will be created using vacuum pumps. The total ash removal system will be divided into parallel paths (4 Nos). In each path, clearance of ash from hoppers connected to common fly ash header will be done one after another. Shifting of ash clearance cycle from one hopper to the next will be automatic and based on vacuum level. The evacuation will be done once in an eight (8) hours shift.

Fly ash will be conveyed in dry mode through bag filter to buffer hopper. There will be 4W Nos. of buffer hoppers for each unit.

Dry fly ash evacuation System:

The fly ash system will be designed to collect fly ash in dry form in RCC silos. Fly ash lines from Buffer Hoppers will be provided with pneumatically operated isolation valves for diverting fly ash to any of the silos.

For collecting fly ash in dry form, the system will be designed such that the fly ash and conveying air mixture from fly ash hoppers is passed through buffer hoppers, where ash will get separated and air will flow to the vacuum pumps through Bag filters. The bag filters will be pneumatic pulse jet type. The fly ash from the buffer hoppers will be transported to RCC silo by using air from conveying air compressors. Adequately sized vent filter will be mounted on top of the silos to filter the air and let it out to atmosphere.

Disposal of Fly Ash from Silo

Each storage silo will be provided with a dedicated aeration system. Each silo will have the following connections with rotary feeder to offer the unloading of ash in different form as below.

- no. opening common for Unloading of ash in dry form to closed tank carriers through Telescopic chute.
- no. opening for Wet disposal using jet pump.
- 1 Opening common for Unloading of ash through Dust conditioner into open truck.
- 1 One blind flange opening.

Silo area will be provided with compound wall and gate. Fly ash handling sytem is shown in **Figure.2.6.**

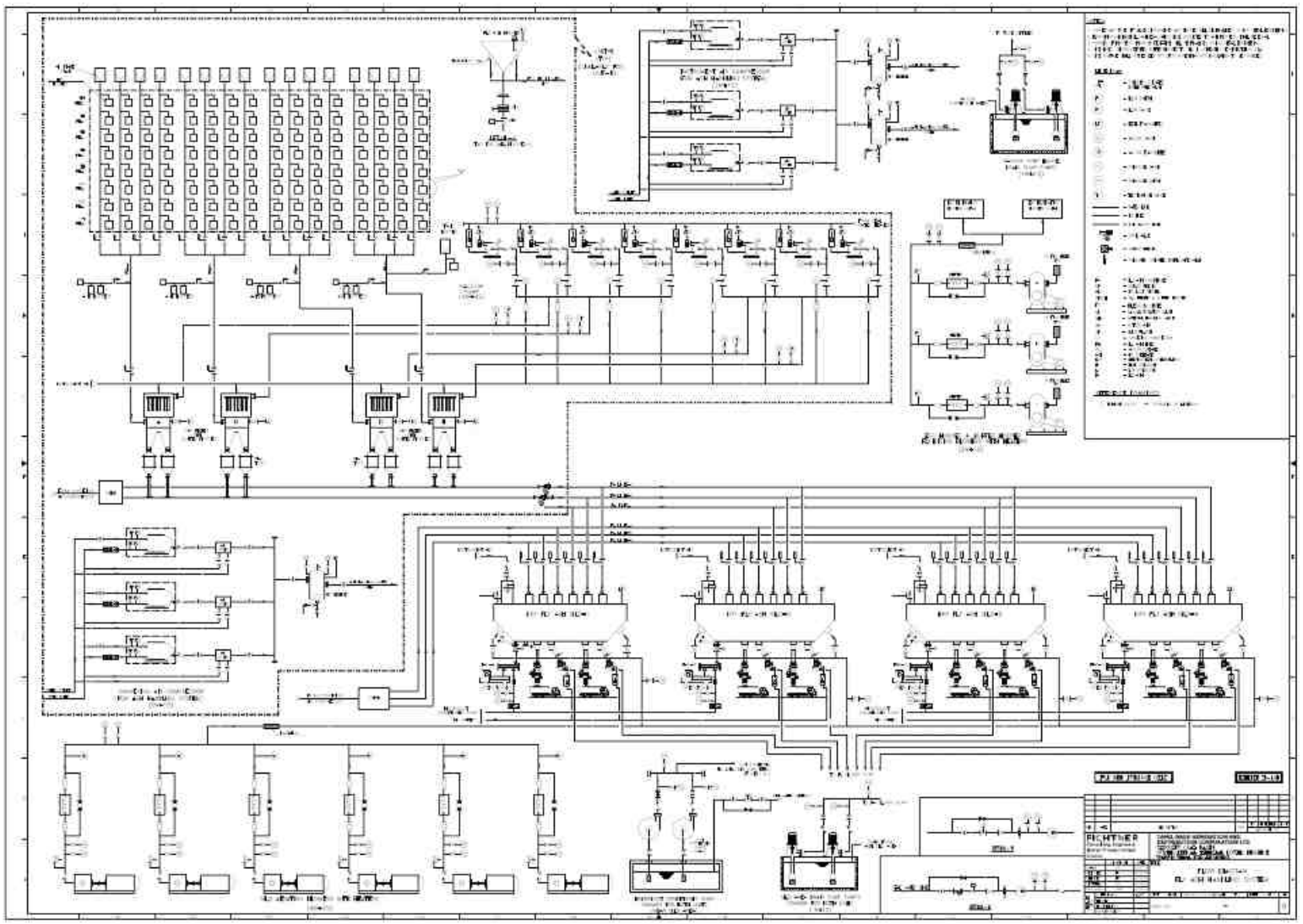


Figure 2-6 Fly ash handling system

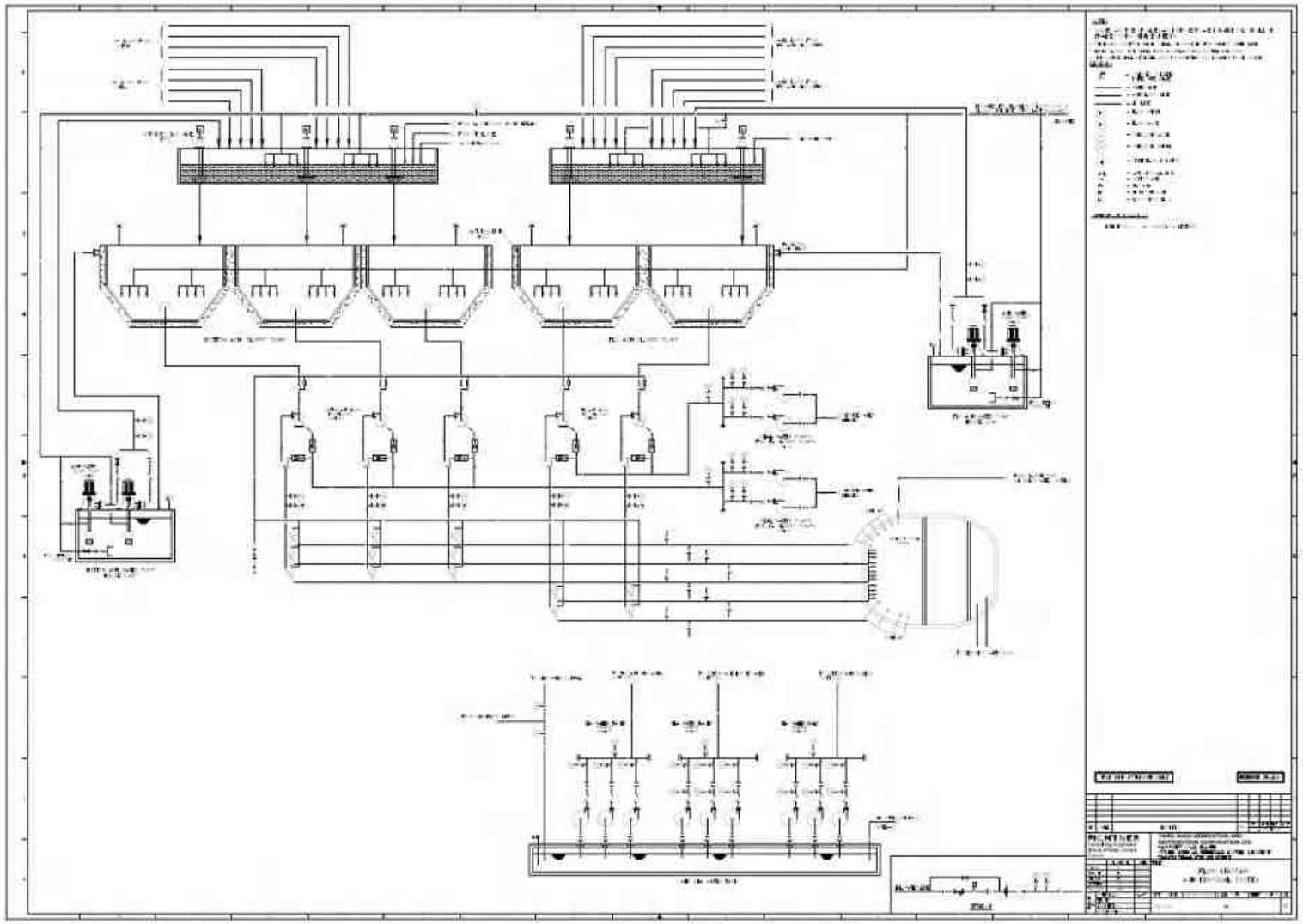


Figure 2-7 Ash disposal system

Ash Slurry Disposal

Common ash slurry pumps will be provided for bottom and eco ash of two units. (2W+1S) will be provided for two units. Ash slurry will be discharged into common channel of ash slurry sumps from where it will be disposed to Ash Pond by means of slurry pumps and associated piping. Number of slurry pumps in series will be selected based on the total disposal distance. One pipeline will be provided with each series of pumps. Slurry discharge line will be flushed with water in order to prevent settling of ash inside the slurry pipe lines at the end of each operation.

Common ash slurry pumps will be provided for fly ash of two units. (1W+1S) will be provided for two units. Ash slurry will be discharged into common channel of ash slurry sumps from where it will be disposed to Ash Pond by means of slurry pumps and associated piping. Number of slurry pumps in series will be selected based on the total disposal distance. One pipeline will be provided with each series of pumps. Slurry discharge line will be flushed with water in order to prevent settling of ash inside the slurry pipe lines at the end of each operation.

Ash Water Recovery System

Ash pond decanted water will be re-circulated back from ash pond to plant for treatment and reuse in ash handling system. The recovery water system will be designed considering the bottom & eco ash disposal, fly ash disposal and flushing requirement for each pipeline.

The water from the stilling pond will be let out through the collecting well. The effluent outflow from these collecting wells will be gravity led through a discharge pipe with an isolation valve to a recovery water sump (close to ash pond).

Water from collection sump will be pumped to clariflocculator by using recovery water pumps. Parshall flume flow measuring instrument will be provided for measuring the inflow to the clarifier. The clarifier will be located partially above ground. The dosing system (100% standby) will pump, measured quantity of coagulant solution into flash mixer of clariflocculator. The water from the clariflocculator will be led in to a clear water sump by gravity through open channel located above ground. The clear sump will be located partially below ground. The acceptable limit of suspended solids of the recovered clear water will be less than100 ppm. From the clear water tank, it will be pumped to AHS sea water tank/sea water outfall.

Whenever ashes are disposed in dry mode and excess water during rainfall, clear water will be taken to sea water outfall. Recovery water system will be sized considering excess rainfall.

Ash Pond

Ash will be transported to ash pond in the land identified near the main plant. Ash slurry will be dumped into the ash pond would be contained in the ash pond by constructing bunds around the periphery of the ash pond. HDPE liner thickness of the ash pond will be established to limit permeability to the required level and as required to resist tears and punctures due to placement of the top soil on it. Recovery water system will be

provided near the ash pond. The required area of the land will be about 48.562 Ha considering the bund height of 25m for both fly and bottom ash.

2.6.15 Resource Optimization/ Recycling and Reuse envisaged

- The water is mainly required for processing and cooling purposes in the plant.
- The water will be used in closed cooling circuit where 100% water will be recycled.
- 100% of wastewater will be recycled

2.6.16 Availability of water its source, energy/power requirement

2.6.16.1 Water requirement

About 3,13,512 KLD of sea water shall be required, with closed cycle cooling system with natural-draft cooling tower (NDCT). Water for construction purpose will be sourced from local water resource & Desalinated water will be used during operation stage. No extraction of ground water is envisaged. Water requirement for the operation phase will be met through captive desalination plant of 16 MLD capacity. Water requirement is given in **Table.2.4.**

Table 2-4 Water requirement

Sr. No.	Description flow rate	m^3/hr
1.	Desalination Plant Feed Water	3632
2.	Cooling Water makeup	9431
3.	Total sea water requirement	13063

The RO reject (reject concentrate or Brine) from the desalination plant will be about 36840KLD. This reject will be diluted by discharging the same into the large quantity of blow down water let into the sea. Thereby the impact of RO reject over the marine ecology is negligible. The storm water drains will be segregated and channelized to water harvesting area.

STP Details: STP sludge generated will be used as manure for green belt development and maintenance. Quantity of sewage generated during operational phase will be 22.5KLD which will be treated through Two sequential batch reactors (SBR) based Sewage Treatment Plant of capacity 40 KLD.One STP at jetty (underground deck) and the other near shore within the port landward boundary is proposed. Treated wastewater from the Jetty STP will be reused for flushing while the landward STP treated water will be reused for gardening.

ETP Details: Effluent generation from Transformer yard, TG hall, floor wash, fuel oil and coal handling area of about 720 KLD will be transferred/ collected/ treated in the Effluent Treatment plant of capacity 720 KLD are planned for the project.

Make-up Water & Raw Water System

The Make-up water for the project shall be drawn from sea. A water intake pump house will be constructed. Space provision is already provided in this Intake well cum pump house. Water requirement for the operation phase will be met through captive desalination plant of 16 MLD capacity.

Raw Water System

An open Raw Water Pump House shall be provided near reservoir in the plant to supply water to Water PT Plant and Ash handling system. Gantry crane of suitable capacity shall be provided in Raw Water pump house to meet the maintenance requirements of pumps and associated equipment.

Circulating Water System

For the re-circulating type CW system, it is proposed to supply clarified water as makeup. Clarified water shall be fed from the Water Pretreatment plant to the cold-water channel. Water from cold water channel will enter the CW pump house at low velocity through trash racks provided to filter out debris. Stop log gates shall be provided after the trash racks to facilitate maintenance.

A suitable CW chemical treatment program shall be adopted for CW system. The CW System shall be designed considering a design COC of about 5. The CW chemical treatment program will include Acid & Scale and/or corrosion inhibitors apart from chlorination. Hence required tanks and dosing equipment shall be provided near CW pump house. For carrying circulating water from CW pump house to TG area and from TG area to cooling tower, steel lined concrete duct would be provided. For interconnecting CW duct with CW pump, condenser and cooling towers, steel pipes would be used.

EOT crane of suitable capacity shall be provided in CW pump house to meet the maintenance requirements of CW pumps, associated equipment. Monorail hoists/cranes shall be handling of trash racks and stop log gates of CW pump house. The CW system shall be provided with required instrumentation, interlocks, controls, control panels to facilitate safe & reliable operation.

Equipment Cooling Water (ECW) System

Closed circuit cooling water system would be adopted for unit auxiliaries of steam generator and turbine generator. DM water would be used in primary cooling water circuit for cooling of various unit auxiliaries and plant & instrument air compressors which are station auxiliaries which in turn shall be cooled in a secondary circuit by circulating water through a set of plate type heat exchangers. The secondary circuit cooling water would be tapped from the CW pipe at the upstream of condenser and the return water from the circuit would be led to the CW discharge pipe after condenser. Re-cooled water after cooling tower will be led to the CW pump house through the cold-water channel by gravity. As the pressure required for coolers of SG auxiliaries and TG auxiliaries are different, it is proposed to provide two independent primary circuits i.e., one for SG auxiliaries of each unit and one for TG auxiliaries of each unit. However, a common secondary cooling water circuit shall be provided. Make up to the primary side closed loop would be from Unit DM make up system through overhead tanks.

Miscellaneous Water Systems

1. A pipe network for distribution of potable water for plant shall be provided from the overhead storage tanks. In addition, potable water requirement for the colony shall be supplied from the water treatment plant. Required number of potable water pumps for colony and plant area shall be provided.

2. A pipe network spread over the entire plant area would be provided for cleaning of main plant area and other buildings. Required number of service water pumps shall be provided which shall draw water from the service water tank which shall be supplied from PT plant.

3. In addition to the above, DM water make up system, boiler fill pumping system, Air Preheater wash water system, HVAC make up system and FGD make up water system shall also be provided as per requirement and required quantity of pumps for these services and their parameters shall be finalized as per final plant layout and requirements of the main plant equipment.

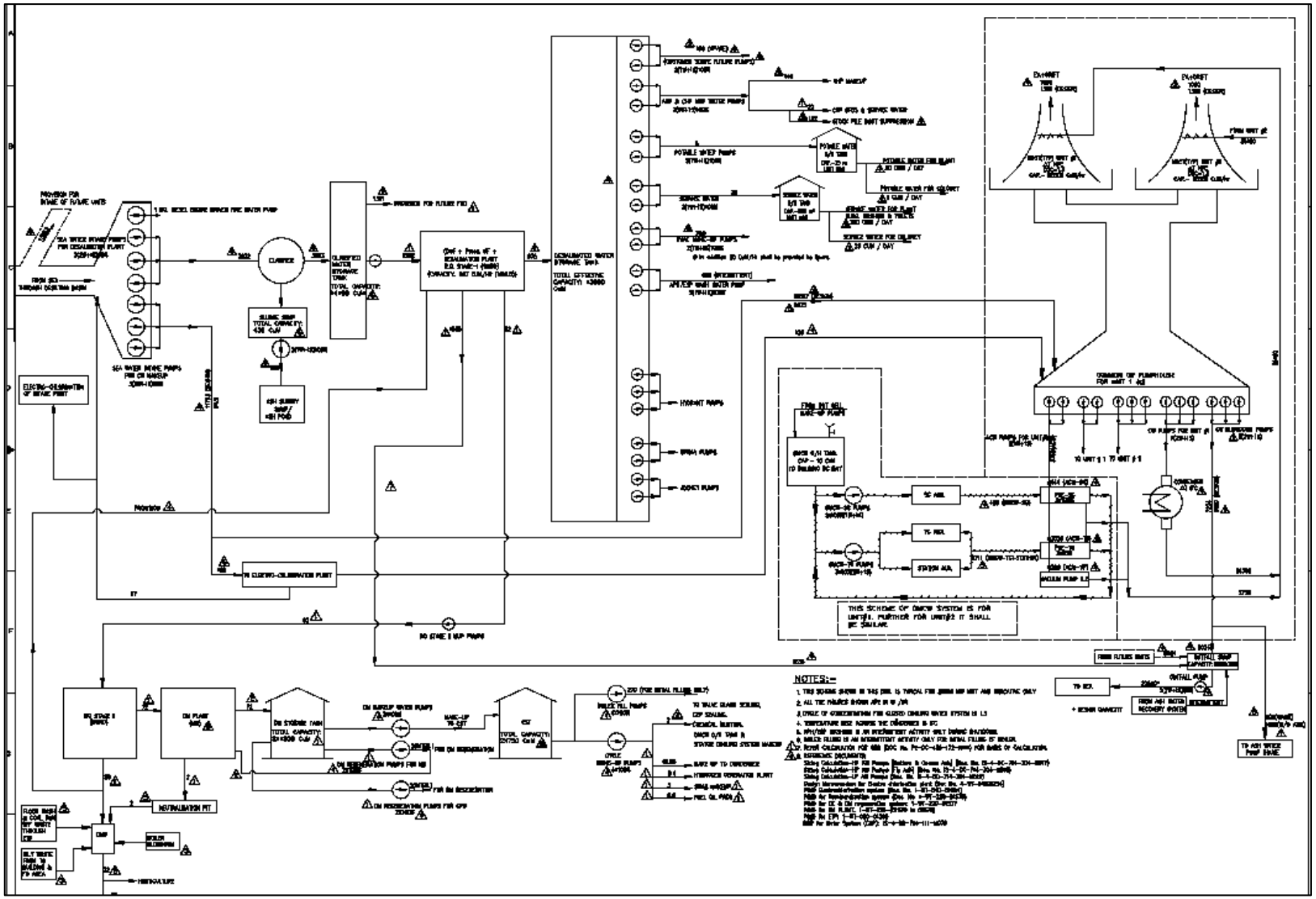


Figure 2-8 Water supply diagram

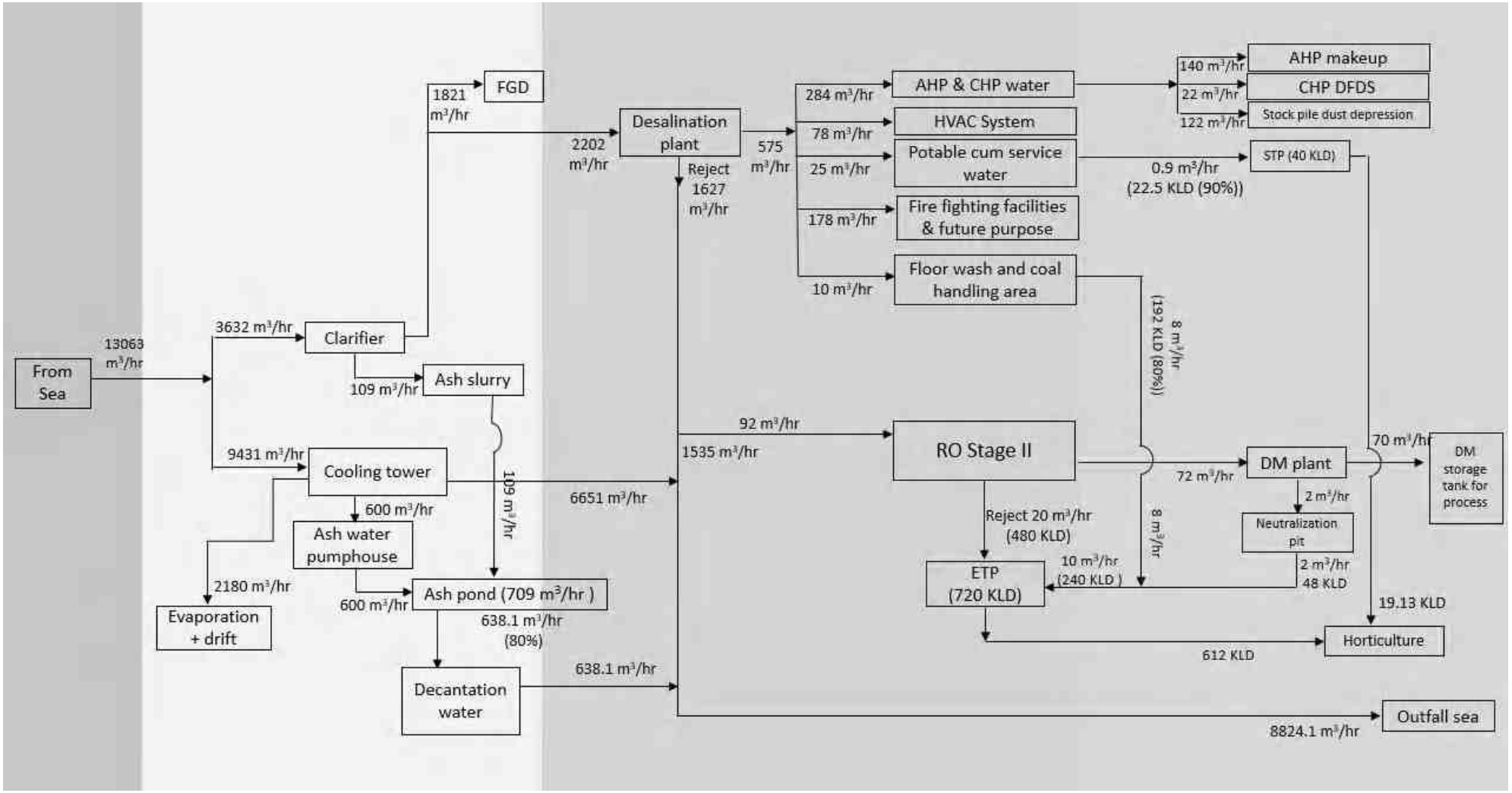


Figure 2-9 Water balance chart

2.6.16.2Power evacuation system

The expected power to be evacuated from the plant will be in the order of about 1228 MW after accounting 7% auxiliary power consumption for entire plant auxiliaries and desalination plant. Considering a plant load factor of 85% the available energy for evacuation per annum will be about 9140.7 million units from 2x660 MW power plant. The generators are connected to the 400 kV switchyard through step-up transformers. Gas insulated switchgear (GIS) is considered for the Switchyard; in view of the fact that project site is located in coastal area. GIS Switchyard will have 4 number line feeders. One double circuit (2 lines) 400 kV line will be routed to 400 kV Ottapidaram Substation, one double circuit (2 lines) 400 kV line will be routed to 400 kV Samugarengapuram Substation and another double circuit (2 lines) 400 kV line will be routed to Viruthunagar Substation.

For the ongoing 2 x 660 MW power project, the power to be exported will be in the order of about 1228 MW after accounting for plant auxiliaries power consumption. The export of power will be at the 400 kV level.

400 kV GIS switchyard will have one and half breaker arrangement (D type) with the following bays:

- Nos. Generator Transformer bays
- Nos. Line bays
- 1 No. Standby/maintenance Transformer Bay
- 2 Nos. Bus Reactor Bay
- 1 No. Spare Bay

Bus sectionaliser isolator for each bus

2 Nos. Bus VT

The transmission line measures approximately 170 km for which line reactor will not be required, the reactor considered in the bus will be adequate.

The system consists of two numbers STG of 660 MW rating, the generation voltage being 22 kV or Manufacturer's standard voltage. Generator Circuit Breaker (GCB) scheme will be adopted, in which the generator will be connected to the GCB which will feed the step-up Generator Transformer (GT), Station transformer (ST) and Unit auxiliary transformers (UAT). UAT will be connected to their respective 11 kV switchboards, ST will be connected to its corresponding 11kV switchboard and external CHP transformer, and this transformer will be in turn connected to 33kV switchboard. GT will be connected to 400 kV GIS switchyard. The power will be evacuated through the 400 kV lines emanate from the GIS switchyard. One (1) number common standby/maintenance transformer connected to 400 kV GIS switchyard will be considered for feeding the unit switchboards under eventual requirements.

It is intended to back charge the 400 kV line from one of the two 400 kV substations at the receiving end and obtaining the start-up power of the power plant. Plant start-up power will be drawn through GT, further the station and unit boards will be powered through their respective transformers.

Various voltage levels i.e. 11 kV, 33 kV, 6.6 kV and 415 V are adopted for feeding the plant auxiliaries.

2.6.17 Uninterruptible Power Supply System

The uninterruptible power supply (UPS) system furnishes a reliable and interruption free source of required voltage to equipment/instrument vital for plant control and emergency shutdown.

Two (2) UPS units (2x100 %) rated for 230V will be furnished for the power plant sized to feed essential AC loads like DCS and other C&I equipment. The DC supply for the UPS system will be with 2X100 % battery. The UPS system will be provided with two (2) nos. 100% capacity charger/ inverter.

An alternative 230V A.C. single phase source through by pass transformer and stabilizer are provided through a static transfer switch to feed the vital A.C. loads during the failure of both the inverters.

2.6.18 Emergency DG set

One number emergency DG set with a capacity of 2000 kVA will be provided for each unit to cater the loads during emergency conditions. The DG set will be sized considering the essential loads like emergency oil pumps, seal oil systems, air pre-heaters, turning gear motor, jacking oil pumps, lifts, battery chargers, UPS, emergency AC lighting, etc. during emergency condition. The DG Set will be started automatically in case of failure of AC Power. Manual starting facility from central control room will also be provided in addition to automatic starting.

2.6.19 Electrical Monitoring System (EMS)

An integrated EMS will be provided to monitor the various parameters of the electrical system captured from relays, meters, IEDs through data concentrators provided at each switchboard/panel over IEC-61850 protocol. The EMS will be SCADA based provided with Human Machine Interface system which display all the electrical system in graphical form. It will be able to generate various trends/historical data/sequence of events through this EMS.

An integrated energy management system will be provided to monitor auxiliary power consumption of various equipment / systems.

2.6.20 Quantity of wastes to be generated (Solid & Liquid) and scheme for their management / disposal

2.6.20.1 Air pollution control system

The steam generator shall be suitable to comply with applicable emission norms. The emission control shall be achieved through steam generator design features and through external control equipment.

Electrostatic Precipitator

It is proposed to install adequately sized electrostatic precipitator having an efficiency that limits the outlet emission to the applicable value of 30 mg/Nm^3. The electrostatic precipitators will have adequate numbers of parallel gas streams, isolated from each other on the electrical as well as gas side and will be provided with gas tight dampers at inlets and outlets of each stream, to allow maintenance to be carried out safely on the

faulty stream, while the unit is working. Electrostatic precipitator will be provided with transformer rectifier sets, microprocessor based programmable type rapper control system and ESP management system to ensure safe and optimum operation of ESP. The dust collection hoppers at all strategic locations will have a minimum storage capacity of eight (8) hours. The hoppers will have heating arrangements to prevent ash sticking to the sloping sides and down pipes. Level indicators to indicate ash levels in the hoppers and trip the ESP in case of high ash levels in the ash hoppers are also envisaged to ensure safety of ESP.

In order to meet the environment norms and maintain the sustained efficiency of ESP, it shall be adequately designed with sufficient margins for all operating conditions. The Electrostatic Precipitator Management System (EPMS) in conjunction with opacity monitor shall continuously monitor and maintain the optimum energy level to achieve higher efficiency of ESP. One (1) no. twin-flue chimney of 275 m height has been envisaged. The chimney would be provided with personal access for regular monitoring of stack emissions.

For the control of fugitive dust emission within and around the Coal handling plant, dust extraction and suppression systems will be provided. Dust suppression system will be installed at all the transfer points in Coal Handling Plant and at Coal stockyard. Dust extraction system would be provided in crusher house, and at Coal stockyard. Further in order to arrest the coal dust generation, all conveyers will be provided with enclosed galleries. The bottom portion of all the conveyors will be provided with seal plates within the power plant area and above roads.

Flue Gas Desulphurization (FGD)

Wet Limestone based Flue Gas Desulphurization system
The wet limestone based FGD system adopts limestone slurry for the removal of the SOx present in the flue gas and the flue gas after treatment will be saturated. Gas to gas heat exchangers will be required to raise the temperature of the flue gas entering the chimney. The system will have efficiency of 95% or more. The arrangement of flue gas system will allow complete isolation of the absorber from gas side, with the unit in operation. For this purpose, Motorized/Pneumatic Guillotine type gates will be provided at hot gas inlet to gas-gas heater, cold gas outlet from gas-gas heater and the flue gas bypass duct.

Considering that the limestone-based system is being adopted in the existing plant, sources & mode of transport already being identified and also considering the advantages of higher efficiency, wet limestone-based Flue gas desulphurization system is proposed for 2 x 660 MW units.

NOX Control System

At present, advanced Low NOx combustion technology is used in all steam generator combustion system with Low NOx burner and over fire air system. This will reduce the NOx emission to a large extent. However, cost effective post combustion NOx control technology such as SCR / SNCR will be required to limit the NOx level to 100 mg/Nm^3 as stipulated by 2015 amendment.

Emission source	APC measure proposed	Stack height, m	Top Dia. (m)	Exit vel. (m/s)	Temp. °C	Proposed No. of. stacks	Type of Pollutants	Concentration of pollutant designed (mg/Nm^3)		
								PM	SOx	NOx
Multi Flue Gas Chimney	Adequate stack height as per TNPCB Norms	275 AGL	7.1	22.88	393.15	-	PM, SO_x, NO_x	100	80	80

2.6.20.2 Water pollution control system

It is proposed to utilize the power plant waste water for plant reuse to achieve minimum discharge concept. It is envisaged to utilize cooling water blow down for ash handling purposes and treated waste water from various sources for gardening. Rest of the waste water treated and the treated will be used for Plantation activities. Streams of waste water emanating from the power station sources during operational phase will be treated individually based on the waste water quality. The treated waste water will be recycled for plant use and for green belt development. Therefore, there will be no impact on the ground water resources.

Effluents	Sources	Method of treatment	Disposal/Reuse
Oil wastes	Transformer yard, TG hall, floor wash, fuel oil handling area.	Tilted Plate interceptor, oil skimmer to bring down the treated water oil level to less than 10 ppm. 720 KLD ETP.	Treated effluents are reused for Greenbelt development and removed oil is taken offsite for disposal.
Chemical	DM regeneration waste	Neutralisation in a neutralising pit to bring the pH to acceptable levels. 720 KLD ETP	Neutralized effluent is utilised for Horticulture
Contaminated waste	Desalination Plant reject water (Brine)	No treatment is necessary as the TDS is of brine is higher than 45,000 mg/l	Disposed to sea
Sewage	Canteen, toilets	40 KLD SBR based STP	Treated sewage is reused for Greenbelt development.
Cooling tower blow down	Cooling tower	Reducing NDCT to reduce the temperature	Disposed to sea with the help of diffuser at 1.6 km from the plant

The rain (storm) water removed from the building roofs, non-process area and grade level surfaces will be directed through the open ditches and culverts to the storm drainage

piping. The rain water is collected in the storm water drain running all around the project. Rain water harvesting pits 30 nos. and 100 m^3 pond is proposed.

Excess rain water will flow to common collection pit from where water can be pumped for use in the ash handling system. All ditches will be concrete lined and located along the roads. All drainage ditches will be located to provide the shortest practical drainage path while providing efficient drainage for the yard. Grade level will be contoured such that storm water run-off is directed on the ground by sheet flow, to well defined drainage paths leading to the ditches.

Rainfall runoff from the coal pipe will contain mainly suspended solids. This runoff will be routed to the settling basin for retention and settling of suspended solids, and the clear water from there may be used for dust suppression system.

Liquid Effluent Treatment Plant

Sequential batch reactors (SBR) based sewage treatment plant of 40 KLD capacities are planned for the project. STP sludge generated will be used as manure for green belt development and maintenance.

Effluent generation from Transformer yard, TG hall, floor wash, fuel oil and coal handling area will be transferred/ collected/ treated in the Effluent Treatment plant of 720 KLD. The process flow diagram of Effluent Treatment plant is enclosed as **Figure 2.10**.

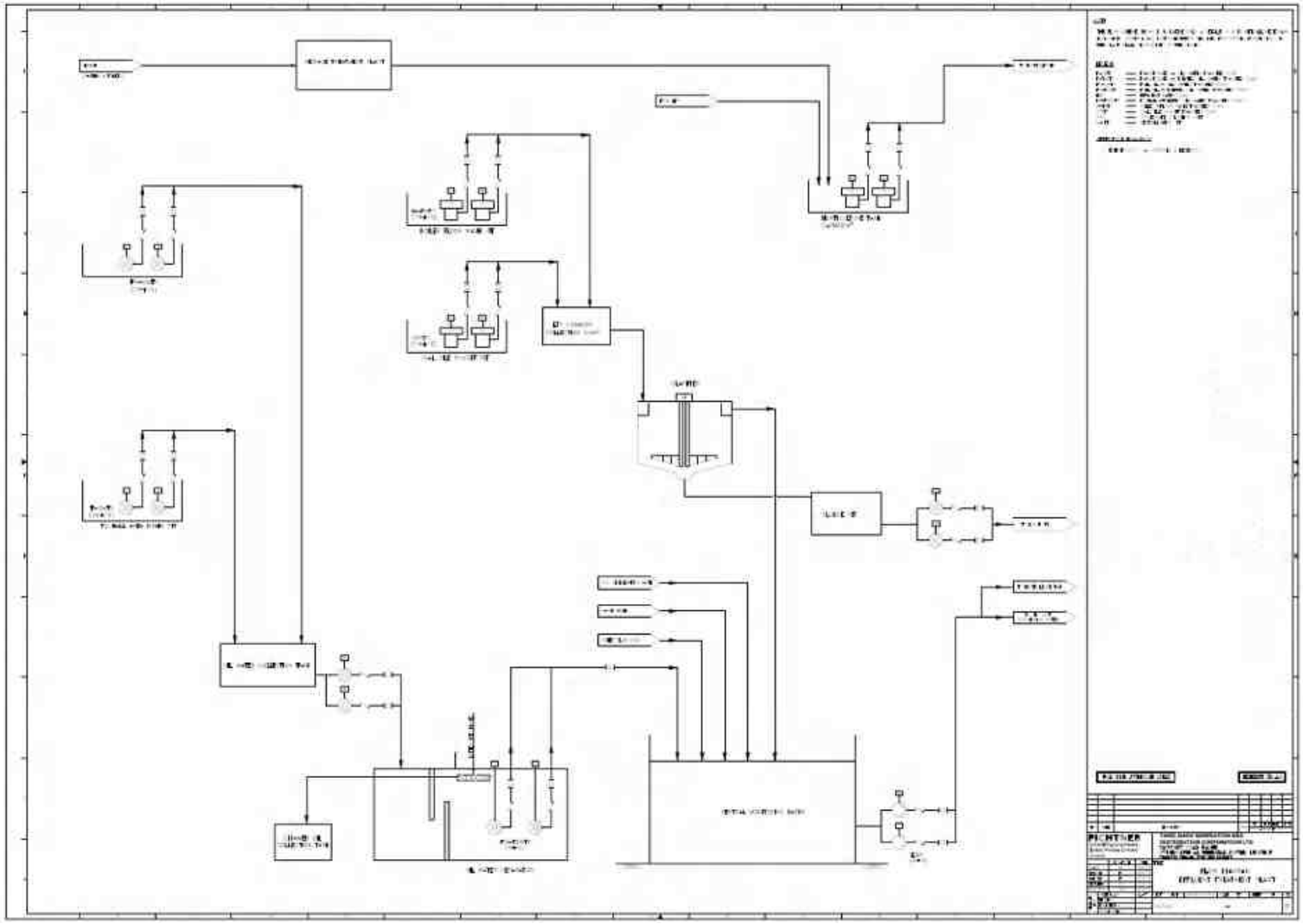


Figure 2-10 Process flow diagram of effluent treatment plan

Table 2-5 Summary of effluent generation

Outlet No.	Description of outlet	Max discharge (KLD)	Point of disposal
Effluent Type: Sewage			
1.	Sewage Treatment Plant	40	On land for gardening
Effluent Type: Trade Effluent			
2.	Cooling tower blowdown	159624	Marine Coastal area
3.	Desalination Plant rejects	36840	Marine Coastal area
4.	Ash water recovery	15314.4	Marine Coastal area
4.	Transformer yard, TG hall, floor wash, fuel oil handling area, Wash water from Coal handling area etc.	720	On land for gardening

2.6.20.3 Condensate polishing unit

For maintaining the feed water purity condensate polishing plant will be provided in the feed water cycle at the downstream of condensate extraction pumps as per the existing practice. The condensate polishing plant will be of full flow, deep mixed resin bed type. The resins to be used would be strongly acidic cation and strongly basic anion type, appropriate for condensate polishing system. A common external regeneration facility will be provided along with one additional Mixed Resin Storage vessel. The exhausted charge of resins from the service vessel will be hydraulically transferred to the resin separation/ cation regeneration vessel for regeneration and reuse. One additional charge of resin will be procured for use during start-up of both the units. Acid, Alkali & DM Water Storage for regeneration, and Wastewater Neutralization facilities with one additional mixed resin storage vessel will be provided separately for the external regeneration facility.

2.6.20.4 CW treatment system

The power station will have to depend upon seawater to meet the cooling water requirement due to non-availability of sweet water either from surface water sources or underground sources on a sustained basis. The hourly sea water requirement break-up for the 2 x 660 MW Power Plant with closed cycle cooling water system and 16 MLD desalination plant is as follows:

Sea water intake requirement

Description	Unit	Sea water with 1.3 COC for CW system
Desalination plant Feed water	m^3/hr	3632
Cooling water makeup for cooling	m^3/hr	9431
Total sea water requirement	**m^3/hr**	**13063**

Sea water outfall

Description	Unit	Sea water outfall with 1.3 COC
Blow down from CW system	m^3/hr	6651
SWRO reject+PSF&UF reject	m^3/hr	1535
Ash water recovery	m^3/hr	638.1
Total sea water outfall	**m^3/hr**	**8824.1**

2.6.20.5 Solid waste

Ash will be the major solid waste generated from the power project. An ash management scheme will be implemented consisting of dry collection of ash, supply of ash to entrepreneurs for utilization and promoting ash utilization to maximum extent and safe disposal of unused ash. Unlike other process industries, power project does not handle and generate any major flammable materials (Class A and Class B Flammable material) except small quantities of furnace oil for boiler start up conditions. Other hazardous materials that will be handled at the power plant will be small quantities of Chlorine used as biocide in the cooling tower. In general, about 2 to 5ppm of Chlorine is doped in the cooling water circulation line for this purpose. Both Hydrochloric acid and Sodium Hydroxide will be used for regeneration of the De-Mineralization Plant resin beds. The solid waste (effluent) generated in DM & PT plant shall be disposed of in ash disposal area.

Table 2-6 Solid waste generation

Description	Ash Generation
Total Ash generation for two units	175.2 T/h
Annual ash generated for two units	1.31 million TPA
Annual Bottom ash generated for two units	0.26 million TPA
Annual Fly ash generated for two units	1.054 million TPA

Municipal Solid waste

The estimated Municipal solid waste for the given man power mentioned in section 2.7 is about 109 kg/day. Out of this, 40% that is about 43.6 kg/day is Bio-degradable waste. The Non-Bio-degradable waste 60% is estimated to be 65.4 kg/day. As the plastic waste recirculation is maximized and usage of plastic is reduced. The expected plastic waste is about 20% of 65.4 kg/day that is 13.08 kg/day.

Storage of Hazardous Materials

Hazardous material to be stored at site during construction include petrol, diesel welding gas, weld inspection material, radiographic material, paints, chemicals, DM plant chemicals etc. These materials will be stored in accordance with prescribed safety norms in ventilated enclosures. Safety instructions and signage will prominently be displayed at appropriate points/locations.

Table 2-7 Hazardous waste generation

Name of the waste	Source	Qty (TPA)	Mode of disposal	Mode of transport
Resin	DM Plant	2	TSDF site	Road
Glass Wool	Overhauling	1.3	TSDF site	Road
Waste oil	Maintenance	1.6	TSDF site	Road

2.7 Man power requirement

During the construction phase the project requires direct employment of about 114 persons (permanent) and contractual workers of about 500 persons during construction period for supervision and execution. After construction of the project, the Plant will require about 545 persons for operation and maintenance of the plant.

2.8 Residential area

The project site has about 40.469 Ha of land adjacent to the power plant identified for residential development which is currently in the design phase and will be implement later.

2.9 Green belt development

The greenbelt is planned around the plant as well as coal stock yards and fly ash ponds. About 167.058 Ha of land is earmarked for greenbelt, which is 44%. The species and plantation norms will be as per directives of CPCB guidelines in consultation with local forest department. The native species will be predominantly planted. Existing green belt photographs are shown in **Fig.2.11**.

The main objective of the green belt is to provide a buffer between the sources of pollution and the surrounding areas. The green belt helps to capture the fugitive emissions and attenuate the noise apart from improving the aesthetics quality of the region. A 35 – 50 m wide greenbelt will be developed along the periphery of the plant and in all open areas. Avenue plantation will also be developed as per the standard norms.

2000 trees per Ha will be planted in consultation with the local Forest Department. The plant species suggested for the greenbelt development are presented in **Table 2.8**.

M/s. Tamil Nadu Power Generation Corporation Limited (TNPGCL) conducted the '**EK PED MAA KE NAAM**' tree plantation program at two schools, such as Sri R.K.C. Hr. Sec. School on 19.09.2024 and T.D.T.A. Hr. Sec. School on 26.09.2024. The plantation program engaged 200 school students, and 50 saplings were planted at each school.

Figure 2-11 Green belt photographs

Table 2-8 Plants species of green belt

S. No.	Botanical name of the plant	Local name	Size of the tree	Type and suitable site
1.	*Acacia auriculaeformis*	karuvel	Medium	Semi-evergreen fragrant white flowers suitable in green belts and on road sides
2.	*Adina corodifolia*	Kadami	Large	Deciduous, a light demander, suitable on open areas and near flares
3.	*Anogeissus latifolia*	axlewood	Medium	Deciduous, Suitable for green belts
4.	*Azadirachta indica*	neem	Large	Evergreen, Medicinal
5.	*Bauhinia variegata*	Kachnar	Medium	Deciduous, good in green belts in garden and as a second row avenue tree
6.	*Borassus flabellifer*	Palmyra Palm	Large	A tall deciduous palm can be used as wind break when of different age.
7.	*Boswellia serrata*	Indian olibanum	Medium	Deciduous suitable on green belt on shallow soils
8.	*Caesalpinia pulcherrima*	Peacock Flower	Small	A large shrub, suitable for gardens outside offices and along channels
9.	*Callistemon lanceolatus*	bottle brush	Medium	Deciduous for some time, ornamental plant in garden
10.	*Carrisa Carandas*	Karaunda	Small	Semi evergreen large bushy shrub good as a hedge to protect against noise.
11.	*Cassia fistula*	golden shower	Medium	Deciduous, good ornamental tree in green belts.
12.	*Cassia siamea*	Kassod Tree	Large	Evergreen, good as an avenue tree.
13.	*Casuarina equisetifolia*	Casuarina	Medium	Evergreen suitable for covering low lying area and in green belts and along ponds.
14.	*Cedrela toona*	redcedar	Large	Deciduous, good in open spaces, in green belts and along ponds.
15.	*Peltophorum inerme*	Fabaceae	Medium	Semi evergreen, suitable on road sides, in gardens and outside office buildings.

The following plant species have been suggested for Road Side Plantation.

Sr. No	Scientific Name	Vernacular name
1.	*Bauhinia purpurea*	Kachnar
2.	*Leucaena leucocephala*	Subabool
3.	*Delonix regia*	Gulmohar
4.	*Cassia fistula*	Amaltas
5.	*Pongamia pinnata*	Karanj
6.	*Azadirachta indica*	Margosa

The general guidelines for development of greenbelt are:

- Trees growing up to 5 m or more will be planted along the plant premises and along the road sides
- Planting of trees will be undertaken in rows.
- Open areas inside the plant boundary will be covered with grass lawns.
- The spacing between the trees will be maintained slightly less than the normal spaces, so that the trees may grow vertically and slightly increase the effective height of the green belt.
- Planting of trees in each row will be in staggered orientation.
- Since the trunks of the tall trees are generally devoid of foliage, it will be useful to have shrubs in front of the trees so as to give coverage to this portion.
- In the 2nd & 3rd rows, shrubs consisting of Margosa, Kachnar, Amaltas, etc. will be grown.
- Shrubs and trees will be planted in encircling rows around the project site.
- The short trees (<5 m height) will be planted in the first two rows (towards plant side) of the green belt. The tall trees (>5 m height) will be planted in the outer three rows (away from plant side).
- For adsorption of dust and gaseous pollutants the following types of plants have been considered:
- Fast growing
- Thick canopy cover
- Longer duration of foliage.
- Adequate height and spread of crown
- Small leaves (Lanceolate) trees which can sustain the sea breeze.
- Preference to perennial and evergreen trees

The choice of plants includes shrubs that grow 1 to 2 m high and trees of 3 to 5m heights. It will be ensured that the foliage area density in vertical is almost uniform by intermixing the trees and shrubs. Since safety during transport is a major consideration, shrubs in traffic islands and along road dividers will be short enough to be below the eye-level of motorists. The species identified for greenbelt development will be planted using pitting technique. The pit size will be either 45 cm X 45 cm X 45 cm or 60 cm X 60 cm X 60 cm . Bigger pit size will be preferred. Soil used for filling the pit will be mixed well with decomposed farm yard manure

or sewage sludge at the rate of 2.5 kg (on dry weight basis) and 3.6 kg (on dry weight basis) for 45 cm X 45 cm X 45 cm and 60 cm X 60 cm X 60 cm respectively. The filling of soil will be completed at least 5-10 days before actual plantation.

Out of 939 Acres (380 Ha) of land, green belt will be developed in 413.16 Acres (167.2 Ha). It is proposed to cover an area of 20 - 50 m all-round the proposed unit. Apart from the bulk plantation around the boundaries, Roadside Avenue plantations will also be taken up. The green belt layout is shown in the **Figure.2.12.** The nearest water bodies viz Avudayar kulam, Thangai kulam have been identified for plantation which will be along with yearly plantation given in **Table.2.9**.

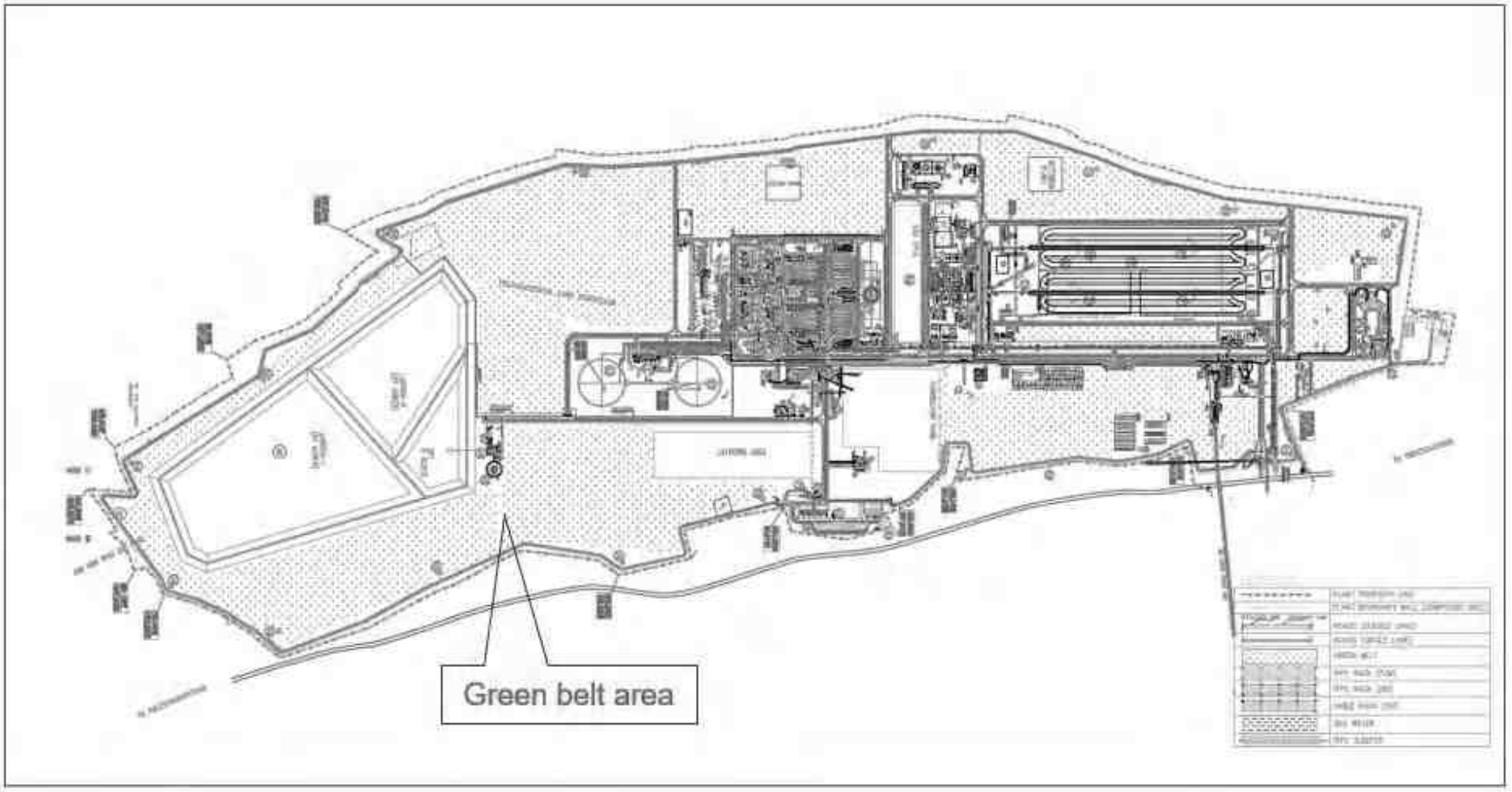


Figure 2-12 Green belt layout

Table 2-9 Year wise plantation program

Year	Location	Area (in ha.)	No. of Tress	Remarks
1st	Along project area as green belt	21.0	42,000	20 to 50m width
2nd	Along Proposed Unit	23.0	46,000	35 to 50m width
3rd	Along Proposed Road	33.5	67,000	15m width
4th	Within un worked area	67.558	1,35,116	15m width
5th	Along Ash Pond	22	44,000	15m width
Total		167.058	3,34,116	

2.10 Project cost and schedule

The estimated project cost is Rs.13076.705 Crore. It has been envisaged that TANGEDCO shall attain its critical rated capacity of 2 x 660 MW during the year FY-2027-28. However, it is planned to commission unit wise and the second unit will be in full operation during the year 2027.

3 DESCRIPTION OF THE ENVIRONMENT

3.1 General

Environmental Impact Assessment Study includes an assessment of the various environmental impacts likely to be caused on the surrounding nature in and around the ongoing project. It will also incorporate the appropriate control measures required to be adopted or implemented in order to minimize the adverse effects thereof. In order to carry out such assessment study, it is first necessary to delineate and define the existing environmental factors in the vicinity of the ongoing project on the existing environmental scenario which will include various environment matrix like ecology, flora-fauna, socio economic profiles, environmental quality with respect to air, water, noise & soil etc.

3.2 Study area, study period and validation of baseline data

This section incorporates the description of the existing environmental settings within the area encompassed in 10 km radius around the project site. The baseline environmental study has been carried out during pre-monsoon season i.e. March 2024 to May 2024 by ABC Techno Labs India Pvt Ltd., NABL Accredited Lab, in accordance with the guidelines of EIA issued by the Ministry of Environment Forests and Climate Change, Govt. of India and CPCB, New Delhi. Secondary data was collected from public domain as well as different Government sources. The scope of the study has been done as per approved ToR by 11th EAC MoEF&CC vide file no J-13012/19/2008-IA. II(T) dated 29.07.2024. Granted Terms of References for EIA/EMP Study of ongoing 2 x 660 MW Udangudi Supercritical Thermal Power plant of M/s. TNPGCL (TANGEDCO), Tuticorin District, Tamil Nadu.

3.3 Meteorology

The meteorological data recorded during the study period is very useful for proper interpretation of the baseline information as well as for input to prediction models for air quality dispersion. On site monitoring was undertaken for various meteorological parameters in order to generate the site-specific data. The Automatic Weather Station (AWS), equipped with continuous monitoring equipment to record wind speed, wind direction, temperature, humidity and rainfall was set up at the top of the office building at a height of ~ 4.0 m above the ground level. The methodology adopted for monitoring surface observations was as per the standard norms laid down by the Bureau of Indian Standards (IS: 8829) and IMD. Baseline data for a month i.e. March 2024 to May 2024 was generated by M/s. ABC Techno Labs India Pvt. Ltd. in-house facilities.

3.3.1 Meteorological data recorded at site

The meteorological parameters were recorded at site on hourly basis during the study period and consists of parameters like wind speed, wind direction, humidity and temperature. The total rainfall was recorded daily once at 08:30 hrs. The maximum and minimum values for all the parameters except wind speed and wind direction are presented in **Table 3.1**.

Table 3-1 Summary of the meteorological data generated at site

Month	Temperature ^{0}C			Relative Humidity (%)			Wind Speed (km/h)			Rainfall (mm)
	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	
Baseline data during March 2024 – May 2024										
March	95.3	74.6	83	88.69	42.1	70.69	21.9	0	10.52	0.051
April	101.9	82.8	86.2	85.71	41.12	72.49	48.3	0	9.91	0.077
May	100.7	77.2	85.78	94.25	46.94	73.84	31.8	0	10.13	0

The summary of the wind pattern for study period (March 2024- May 2024) is given in **Table-3.2**. The wind rose of the same is shown in **Figure 3.1**.

Table 3-2 Summary of the wind pattern in the study area

Existing baseline data during March - May 2024				
Month/season	**First predominant wind direction**	**Second predominant wind direction**	**Average wind speed (m/s)**	**Calm (%)**
March to May	**ENE**	**E**	**2.82**	**5.71**

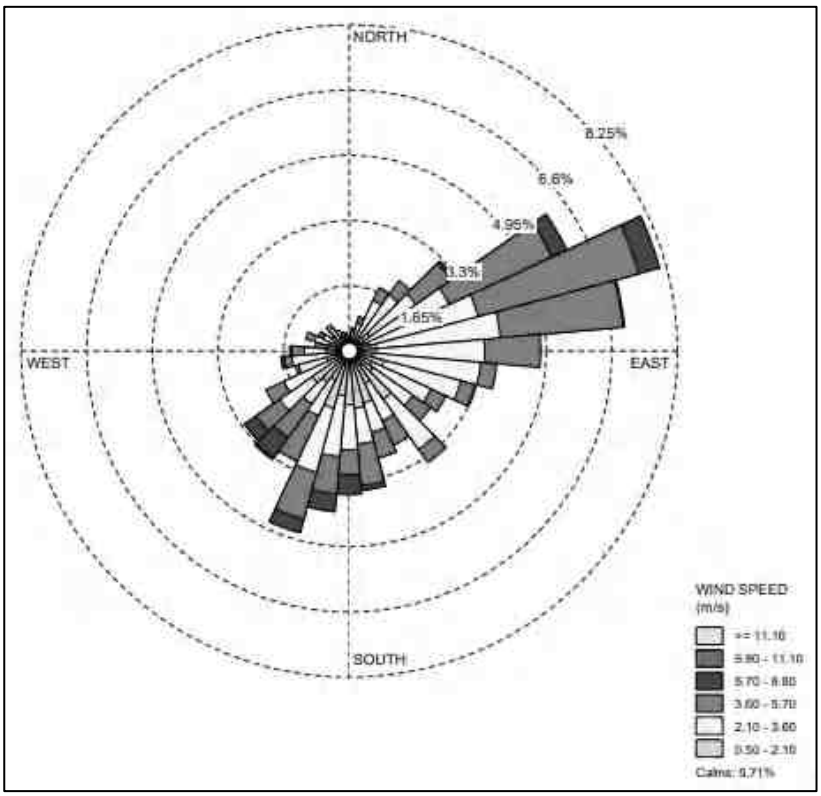


Figure 3-1 Wind rose (March to May 2024)

3.3.2 Secondary data from Indian Meteorological Department Station: (IMD) Tuticorin

The nearby IMD station is Tuticorin which is located at 40 km from the site. Hence, secondary information on meteorological conditions have been collected from IMD station. Indian Meteorological Department regularly monitors wind direction, wind speed, relative humidity, temperature, rainfall, evaporation and pressure at 08.30 hours and 17.30 hours every day. Wind rose diagrams are collected from IMD for the period 1981 – 2010 and are shown in **Figure 3.2**. From the figure it is evident that the predominant direction is during the Month of March to May is observed to be from south direction. The reason could be the data is observed for two times and 30 years average and located on the sea shore of Tuticorin.

3.3.2.1 Temperature

As per the climatologically data published by Indian Metrological Department (IMD) for 1981- 2010, the annual mean daily maximum and minimum temperature in the Thoothukudi District is about 32.90C and 24.30C respectively. The annual mean monthly highest and lowest temperature in the region is about 39.10C and 180C respectively. The district is very hot and dry during the summer season from March to May. From 1981 to 2010, extreme highest temperature recorded was 41.1°C (May) and the extreme lowest temperature was 15.3°C (January).

3.3.2.2 Relative humidity

According to the Climatology table published by India Meteorological Department (IMD) for an averaged data of 30 years between 1981 and 2010, the relative humidity was comparatively higher during winter season which was about 81% to 84% (at 08:30 Hours) and 76% to 77% (at 17:30 Hours). The lowest relative humidity of 63% occurs in the months of June and July (at 17:30 Hours).

3.3.2.3 Rainfall

Rainfall of Thoothukudi District is contributed by both southwest and northeast monsoon. Invariably, Northeast monsoon is the significant contributor with an average contribution of higher than 60% of the rainfall. Southwest monsoon barely has any influence on the overall rainfall received in the district. The rainfall occurred maximum in the month of November (192.8 mm). The total rainfall received in the year is about 630.2 mm. Total rainy days observed was about 32.1 days.

3.3.2.4 Wind speed/Direction

The maximum wind speed observed during the month of June & July is 15.4 kmph and minimum wind speed observed during the month of November is 10.5 kmph. The annual average wind speed calculated is 13.1 kmph. The predominant winds are mostly from W followed by NE direction.

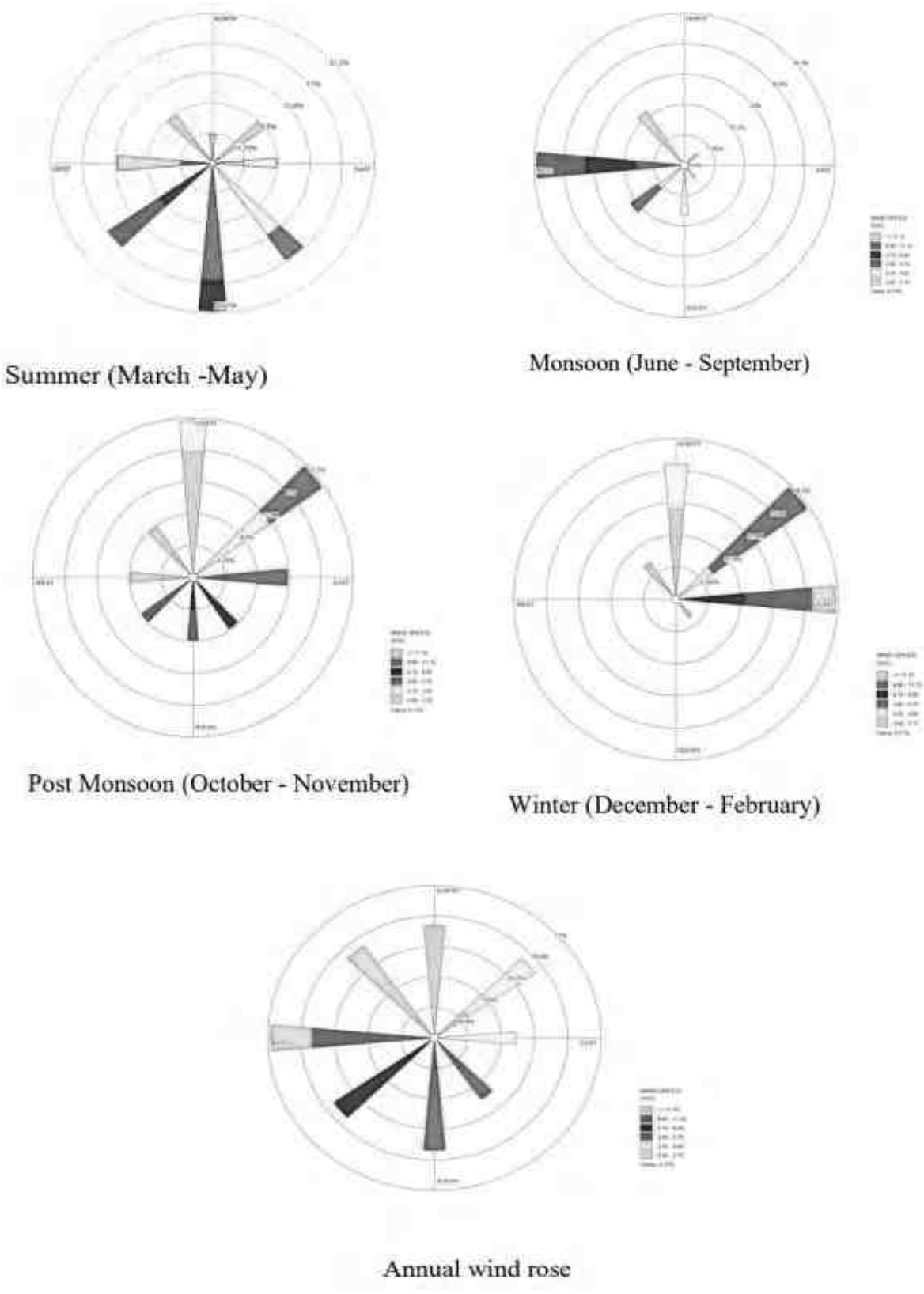


Figure 3-2 Wind rose (IMD-Tuticorin 1981-2010)

Table 3-3 Historical meteorological data at IMD Tuticorin (1981-2010)

Month	Mean Temp. (°C)		Relative Humidity (%)		Rainfall (mm)		Mean Wind Speed (KMPH)
	Max	Min	08:30	17:30	Monthly Total	No. of Rainy days	
January	30.9	18.7	84	76	28.4	1.6	13.8
February	31.9	19.3	83	76	39.6	1.8	12.8
March	34	21.1	81	75	24.8	1.9	12.3
April	35.8	22.5	77	77	56.2	2.7	11.9
May	38.6	23.2	73	73	18.3	1.2	13
June	38.6	23.5	71	63	3.7	0.4	15.4
July	38.4	23.1	70	63	4.7	0.4	15.4
August	38.3	23.3	70	65	6.2	0.5	15.1
September	38.1	22.9	72	71	14.3	1.1	13.7
October	36.3	20.9	78	76	141.8	6.5	11.2
November	32.8	20.5	83	79	192.8	9.2	10.5
December	31.3	19.5	83	77	99.4	4.8	12.7
Annual or Mean	**39.1**	**18**	**77**	**73**	**630.2**	**32.1**	**13.1**

3.3.2.5 Special phenomenon

Special weather phenomena are given in **Table 3.4** for the area. Thunder occurs on an average 3.6 day in a year. Fog, Hail, dust storm and squalls are rare in the region. More than 0.3 mm precipitation occurs on 50.6 days in a year.

Table 3-4 Special weather phenomena in the area

Months	PPT 0.3 mm or more	Hail	Thunder	Fog	Dust Storm	Squall
January	3.2	0.0	0.1	0.0	0.0	0.0
February	2.4	0.0	0	0.0	0.0	0.0
March	3.4	0.0	0.2	0.0	0.0	0.1
April	3.9	0.0	0.6	0.0	0.0	0.3
May	2.2	0.0	0.4	0.0	0.0	0.4
June	1.7	0.0	0.0	0.0	0.0	0.1
July	1.5	0.0	0.0	0.0	0.0	0.1
August	1.0	0.0	0.1	0.0	0.0	0.0
September	2.0	0.0	0.0	0.0	0.0	0.1
October	9.2	0.0	1.0	0.0	0.0	0.3
November	12.2	0.0	1.1	0.0	0.0	0.1
December	8.0	0.0	0.2	0.0	0.0	0.2
Annual	**50.6**	**0.0**	**3.6**	**0.0**	**0.0**	**1.8**

From the above table, it is evident that the area is not prone to any special weather phenomena like dust storm, hail, cloud burst etc.,

3.3.2.6 Atmospheric inversion level

Inversions are a result of the vertical temperature profile of atmosphere. Temperature normally decreases as altitude increases in the troposphere. However, an increase of temperature may occur after certain altitude. This zone is termed as inversion which plays a major role in dispersion. Thus, the colder air layer which is below the warmer air results in a stable temperature profile that restricts vertical mixing. Because of the restricted mixing volumes of air due to the inversion, pollution becomes stagnant and does not dissipate. The mixing height is the height of vertical mixing of air and suspended particles above the ground.

This height is determined by the observation of the atmospheric temperature profile. A parcel of air rising from the surface of the earth will rise at a given rate (called the dry-adiabatic lapse rate). As long as the parcel of air is warmer than the ambient temperature, it will continue to rise. However, once it becomes colder than the temperature of the environment, it will slow down and eventually stops. It is at this junction, where the temperature of the parcel crosses the curve denoting the vertical environmental temperature profile determines the mixing height. The spatial distribution of mixing height during winter, pre-monsoon and post monsoon season for 0800 and 1700 IST is shown in **Figure 3.3, 3.4 and 3.5** respectively. From the figure the Tuticorin witnesses mixing height of above 200 m during winter season. The same is recorded more and extended spatially covering the entire Tamil Nadu.

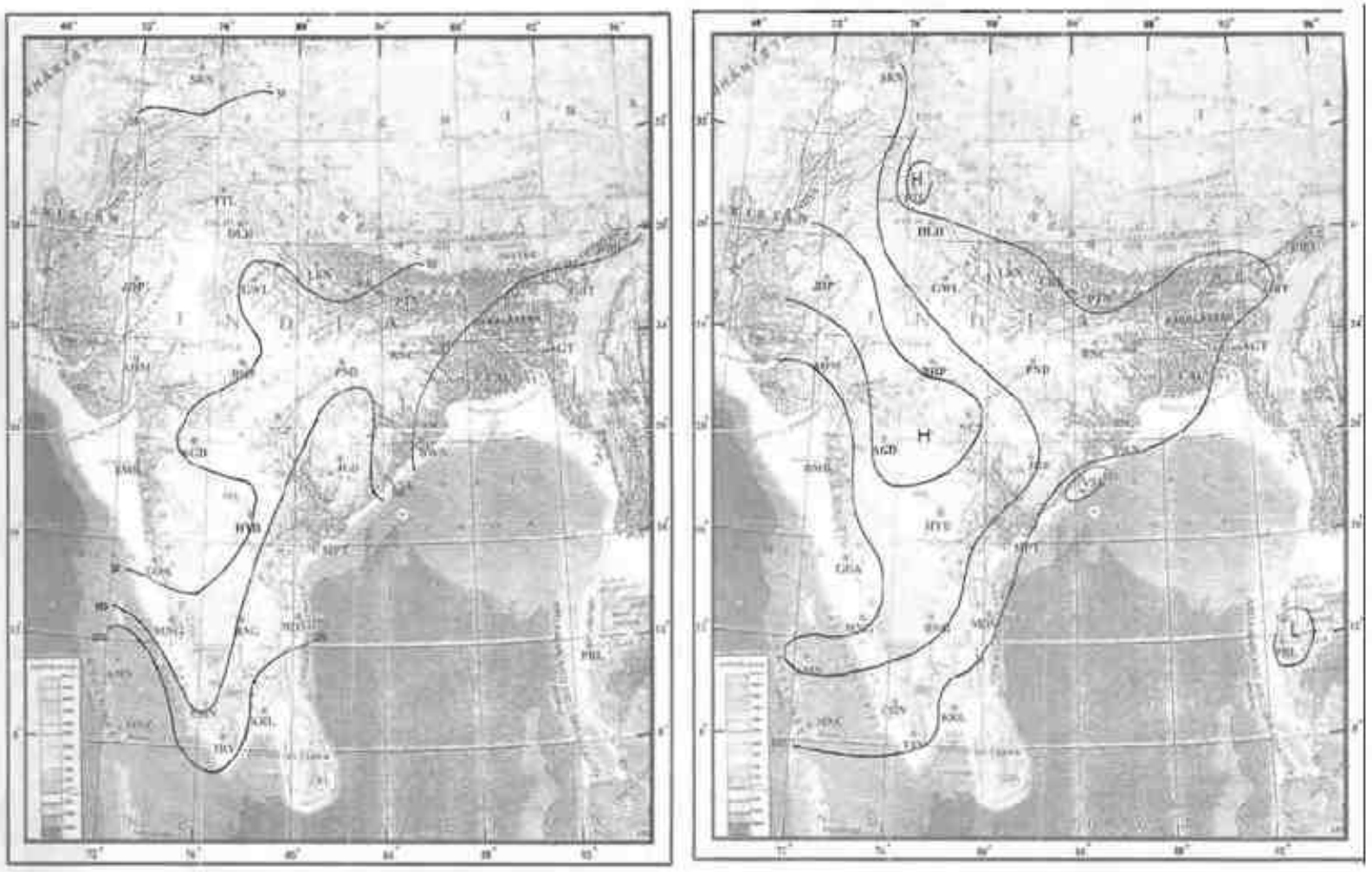


Figure 3-3 Spatial distribution of mixing height in winter season – 0800 IST and 1700 IST

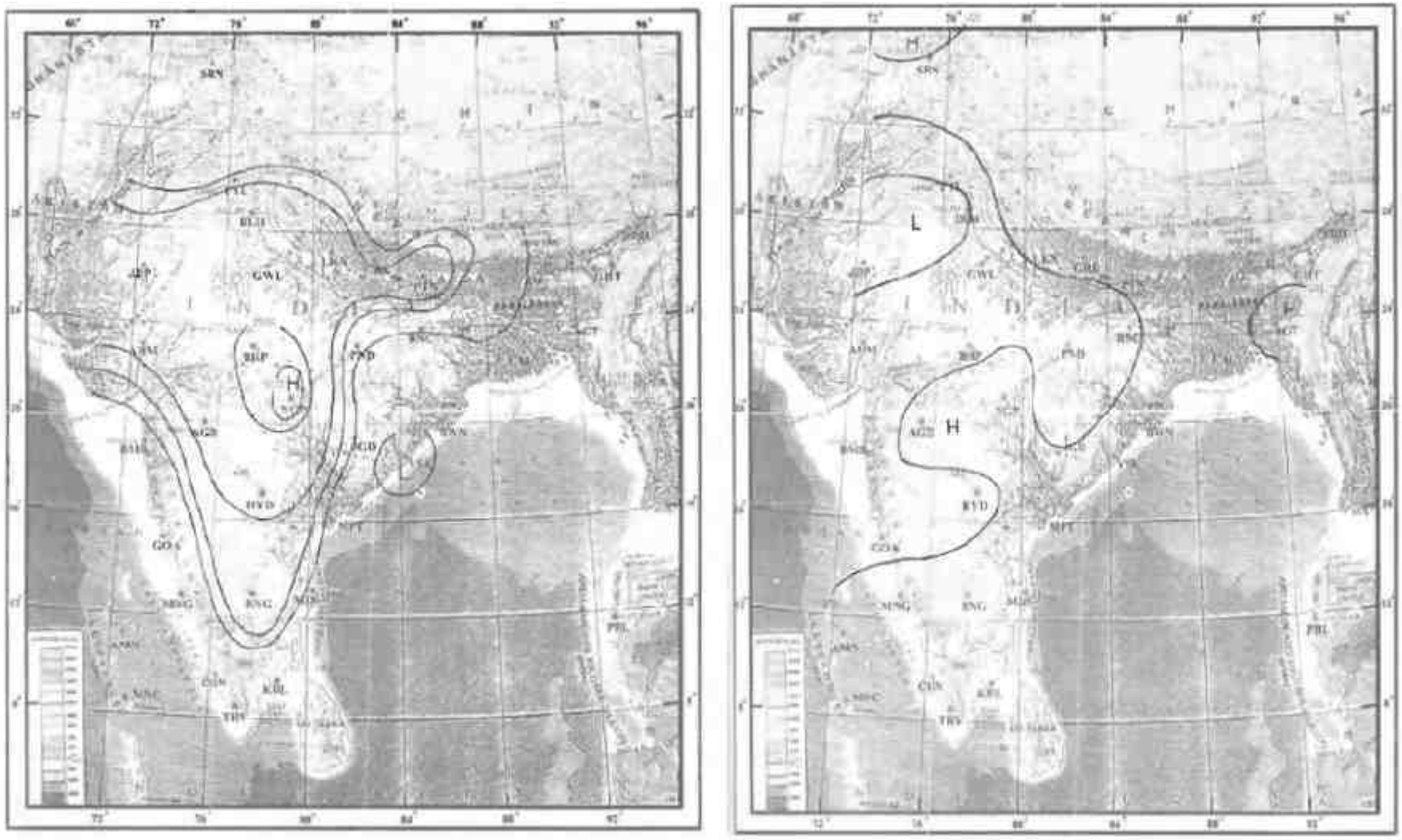


Figure 3-4 Spatial distribution of mixing height in Pre-Monsoon season – 0800 IST and 1700 IST

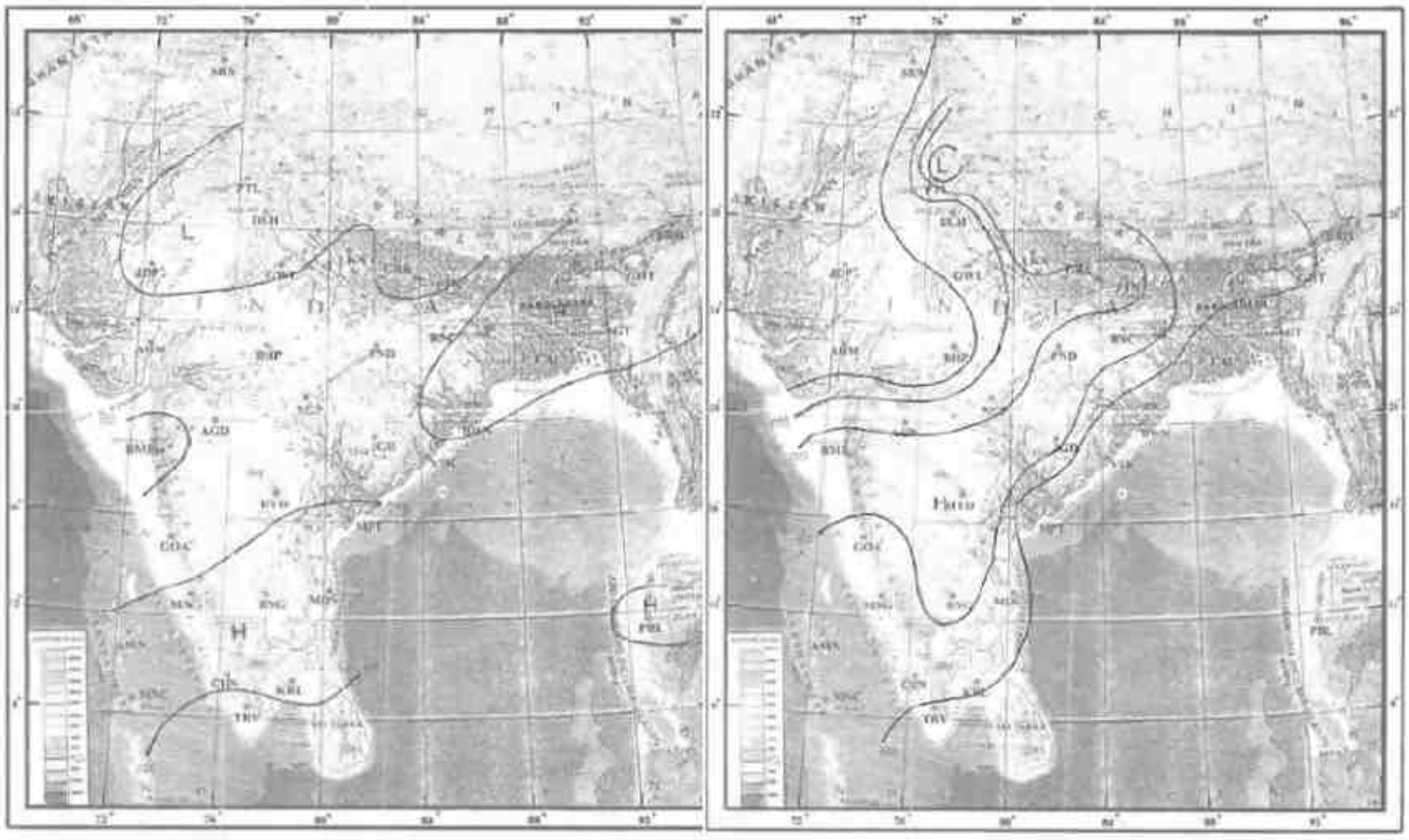
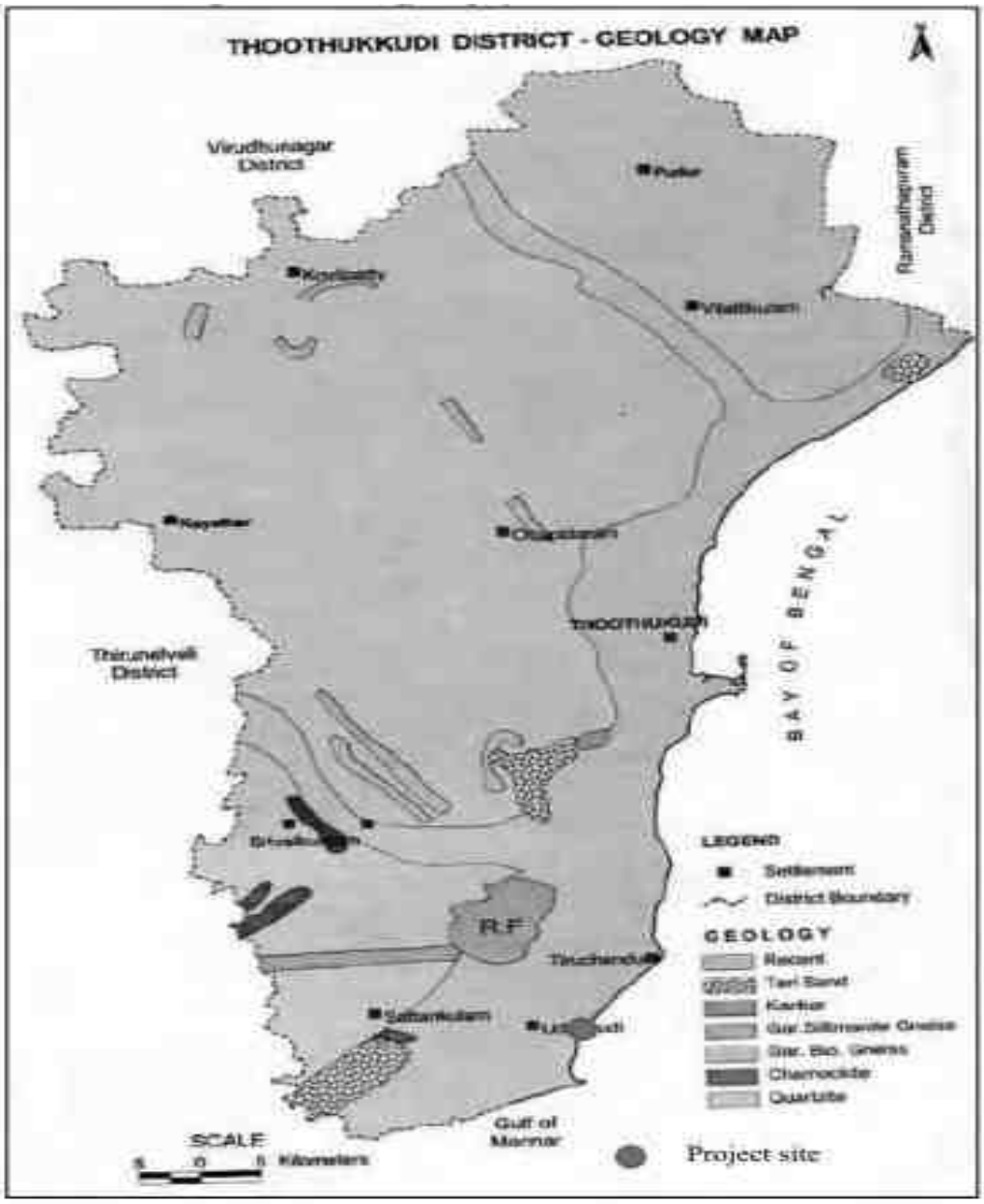


Figure 3-5 Spatial distribution of mixing height in post-monsoon season – 0800 IST and 1700 IST

3.4 Geology and hydrogeological aspects

3.4.1 Geology

Tuticorin district comprises of well-developed litho package of meta-sedimentary sequence inter banded with charnockite Group of rocks. The rock types exposed are of quartzite, calc-granulite, garnet-biotite-sillimanite gneiss, garnet quartzo -feldspathic gneiss and garnet-biotite-cordierite gneiss belonging to Khond alite group of rock. The economic minerals found in the district are gypsum, limestone, beach sand, kankar and shell limestone. Minor occurrences of quartzite were also observed in Thoothukudi District. Major deposits of garnet and ilmenite sand were present in the coastal part of Tiruchendur Taluk whereas proposed project site comprises of recent deposits (younger age of formation, which is called Quaternary comprises of alluvium and coastal sand). The geology map of the district is shown in **Figure.3.6.**

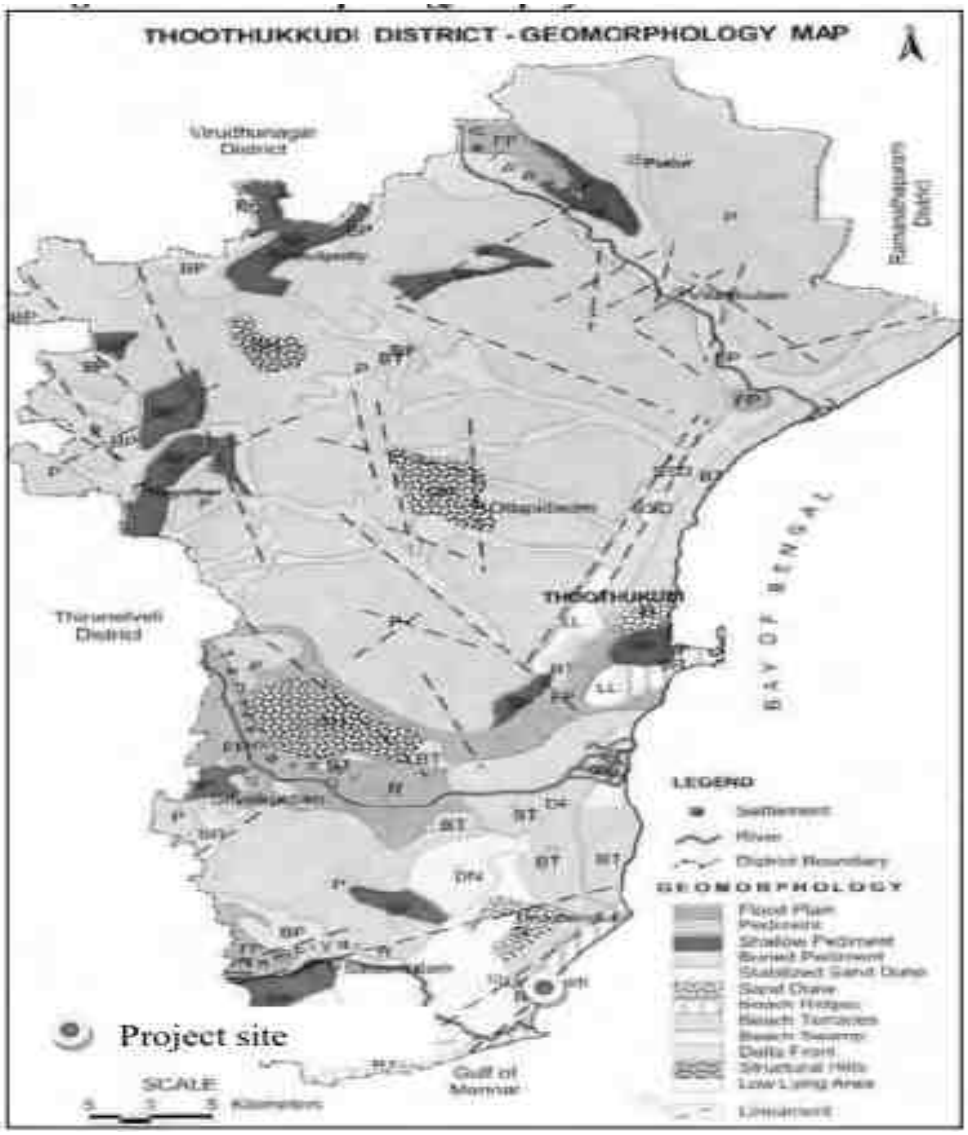


Source: District Census hand book, Thoothukudi

Figure 3-6 Geology map of Tuticorin district

3.4.2 Geomorphology

The district geomorphological map is shown in **Fig. 3.7**. The vital geomorphic units present in the Thoothukudi District are i) Fluvial ii) Marine, iii) Fluvio-marine, iv) Aeolian and v) Erosional landforms. These are further detailed into forms such as flood plain, pediment, shallow pediment, buried pediment, stabilized sand dune, sand dune, Beach ridges, beach terrace, beach swamp, delta front, structural hills and low-lying area. The proposed coastal stretch falls under “Beach Ridge” seen with presence of sand dunes. But the site is divide of any sand dunes.



Source: District Census hand book, Thoothukudi

Figure 3-7 Geomorphology map of Tuticorin district

3.5 Soil

The district is covered by Black Cotton soil in the west with isolated red soil patches in high ground. The sandy soil is present in the coastal tract. Alluvial soil is restricted to river flood plain and coastal part. Alkaline and saline soils are also noticed at places.

3.6 Hydrology/Hydrogeology

The district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) unconsolidated & semi consolidated formations and ii) weathered and fractured crystalline rocks.

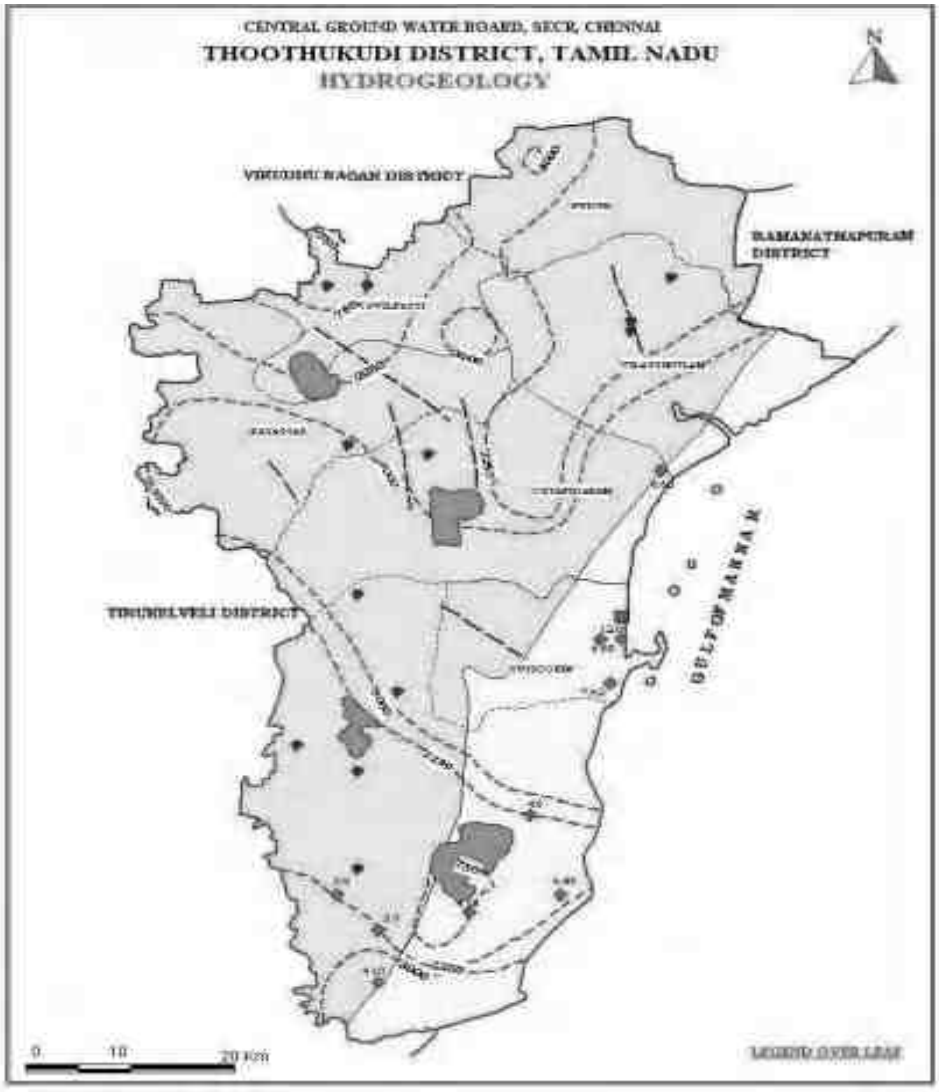
The porous formations in the district include sandstones and clays of Recent to subrecent and Tertiary age (Quaternary). The Recent formations comprising mainly sands, clays and gravels are confined to major drainage courses in the district. The maximum thickness of alluvium is 45m bgl, whereas the average thickness is about 25m. Ground water occurs under water table and semi-confined conditions in these formations and is being developed by means of dug wells and filter points. The productive zones are encountered in the depth range of 29.5 to 62 m bgl. Alluvium, which forms a good aquifer system along the Vaippar and Gundar river bed which is one of the major sources of water supply to the villages.

The water-bearing properties of crystalline formations which lack primary porosity depend on the extent of development of secondary intergranular porosity. The occurrence and movement of ground water in these rocks are under unconfined conditions in the joints & fissures and dependent on the nature and extent of pores and interconnection of fractures zones. The morpho-tectonic analysis of the crystalline tract indicates the presence of deep seated tensile and shear fractures particularly along the fold axes. These tension joints and fractures and shear fractures at deeper depth of 30 to 100 m have been acting as conduits for ground water movement.

The depth of the wells in crystalline rocks ranged from 10 to 15m bgl. The yield of large diameter wells in the district, tapping the weathered mantle of crystalline rocks ranges from 40 to 110 lpm and are able to sustain pumping for 2 to 6 hours per day. The Specific capacity of large diameter wells tested in crystalline rocks ranges from 3 to 141 lpm/m. of drawdown. The yield characteristics of wells vary considerably depending on the topographic set-up, lithology and nature of weathering.

The depth of wells drilled in crystalline rocks ranged from 26 to 200m bgl various state agencies mainly for domestic purposes and the yield wells ranged from 10 to 250 lpm. The yield of successful bore wells drilled down to a depth of 750m bgl during the ground water exploration programme of Central Ground Water Board ranged from 3 to 10 lpm. The aquifer and well parameters of the wells show wide variation, both in crystalline and sedimentary formations.

The depth to water level in the district varied between 1.20 – 12.12m bgl during premonsoon (May 2006) and varied between 0.33 – 9.24 m bgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise in water level, which ranges from 0.20 to 8.41 m bgl. The piezometric head varied between 2.40 to 11.00 bgl during pre-monsoon (May 2006) and 0.33 to 9.24 m bgl during post monsoon (Jan 2007). The project area is located on unconsolidated rock formations.



Source: CGWB, Tuticorin district

Figure 3-8 Hydrogeological map of Tuticorin district

3.7 Drainage

The river originating from the Western Ghats and Tamil Nadu uplands control the drainage network of the district. A few streams originate in the hillocks within the district and confluences directly with the sea after flowing 10 to 20 km. Vaipar, Tamiraparani and Karamanaiyar are the major rivers draining the district. All the rivers are ephemeral in nature and run off is generated during heavy rainfall period only. The study area is demarcated with dentritic drainage pattern as the area is completely covered by recent alluviam. The drainage map of the study area is shown in **Figure. 3.9**.

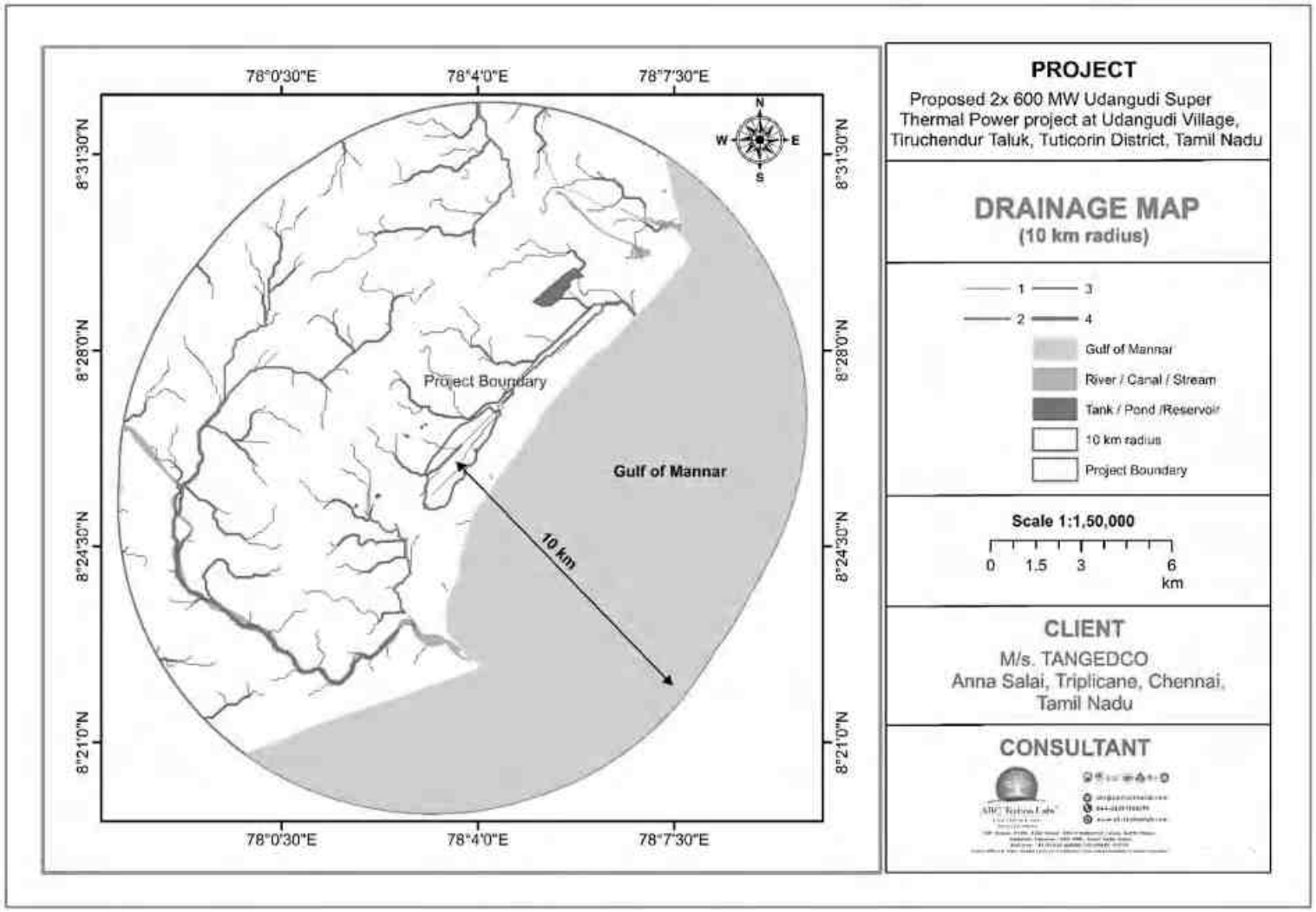


Figure 3-9 Drainage pattern of the study area covering 10 km radius

3.8 Land use studies

The land use pattern is studied for 10km radius area from the project site to determine the present land use pattern and to analyze the impacts on land use due to the proposed plant and to give recommendations for optimizing the future land use pattern.

3.8.1 Land Use Pattern based on Remote Sensing data

Remote sensing satellite imageries were collected and interpreted for the 10-km radius study area for analyzing the land use pattern of the study area. Based on the Landsat 8-9 & TIRS on 1:150000 scale was acquired during May 2024; Land use/Land cover maps have been prepared.

3.8.2 Land Use/Land Cover Classification System

The present land use/land cover maps were prepared based on the classification system of National standards. For explanation for each of the land use category, the details as given in **Table 3.5** were considered.

3.8.3 Data requirements

Landsat 8-9 & TIRS on 1:150000 scale was acquired May 2024 and was used for the mapping and interpretation. Besides, other collateral data as available in the form of maps, charts and census records other reports and especially topographical survey of India maps on 1:150000 scale are used. In addition to this, ground truth survey was also conducted to verify and confirm the ground features.

Table 3-5 land use categories

Sl. No.	Level – 1	Level – 2
1	Built – up Land	Town/Cities
		Villages
		Institution/Industry/Godown etc.,
		Plotted Area/Layout
2	Agriculture Land	Double Crop Land/Irrigated Area
		Plantation
		Fallow
3	Forest	Evergreen/Semi evergreen
		Deciduous
		Forest Plantation
4	Wastelands	Rocky/Stony waste
		Land with / without scrubs
		Saline/sandy & Marshy/swampy
5	Water Bodies	River/Stream
		Lake/Reservoir/Tanks
6	Others	Orchard/ Other Plantation
		Shifting cultivation
		Salt Pans, Snow covered/Glacial
		Barren/Vacant Land

3.8.4 Methodology

The methodology adopted for preparation of Land use/land cover thematic map is monoscopic visual interpretation of Landsat 8-9 & TIRS and field observations are taken. The various steps involved in the study are preparatory field work, field survey and post field work.

3.8.5 Pre-Field- Interpretation of Satellite data

Landsat 8-9 satellite data at 1:150000 scale is used for pre field interpretation work. Drawing the help of toposheets, geology, and geomorphology by using the image elements the features are identified and delineated the boundaries roughly. Each feature is identified on image by their image elements like tone, texture, colour, shape, size, pattern and association. A tentative legend in terms of Land Use/Land cover, Physiography and erosion was formulated. The sample areas for field check are selected covering all the physiography, land use / land cover feature cum image characteristics.

3.8.6 Ground Truth Collection

Both topo sheets and imagery were taken for field verification and a transverse plan using existing road network was made to cover as many representative sample areas as many representative sample areas as possible to observe the broad Land use features and to adjust the sample areas according to field conditions. Detailed field observations and investigations were carried out and noted the land use features on the imagery.

3.8.7 Post Field Work

The final interpreted and classified thematic map was cartographed. The cartographic map was colored with standard color coding and detailed description of feature with standard symbols. All the classes noted and marked by the standard legend on the map.

3.8.8 Final Output

The final output would be the land use/land cover map on 1:150000 scale, numerals were given different color code for each category as shown in map. Area estimation of all features of land use/land cover categories was noted.

3.8.9 Observations

The following are the main interpretation of land use / land cover classes of the study area and their respective areas are given in Sq.km in **Table 3.6**. From the table it can be observed that Barren land is covering 22% (90.48 Sq.km) of the total area followed by mixed plantation 21% (87.58 Sq.km). The satellite imagery of the project site within 10 km radius is shown in **Figure 3.10**. The land use pattern within 10-km radius based on Landsat 8-9 & TIRS is shown in **Figure 3.11**.

Table 3-6 Land use pattern of the study area

Sl. No	LU/LC Classes	Area (Sq.km)	Percentage (%)
1	Buildup Land	24.93	6
2	Industrial Land	4.34	1
3	Agriculture Land	18.15	4
4	Plantation	87.58	21
5	Forest	12.08	3
6	Barren Land	90.48	22
7	Scrub Land	10.32	2
8	Sand Area	2.80	1
9	Coal Jetty Marine Project ITD	0.06	0
10	Marine Structure	0.03	0
11	Gulf of Mannar	163.98	39
12	River / Canal / Stream	3.53	1
13	Tank / Pond /Reservoir	1.05	0
Total area		**419.33**	**100**

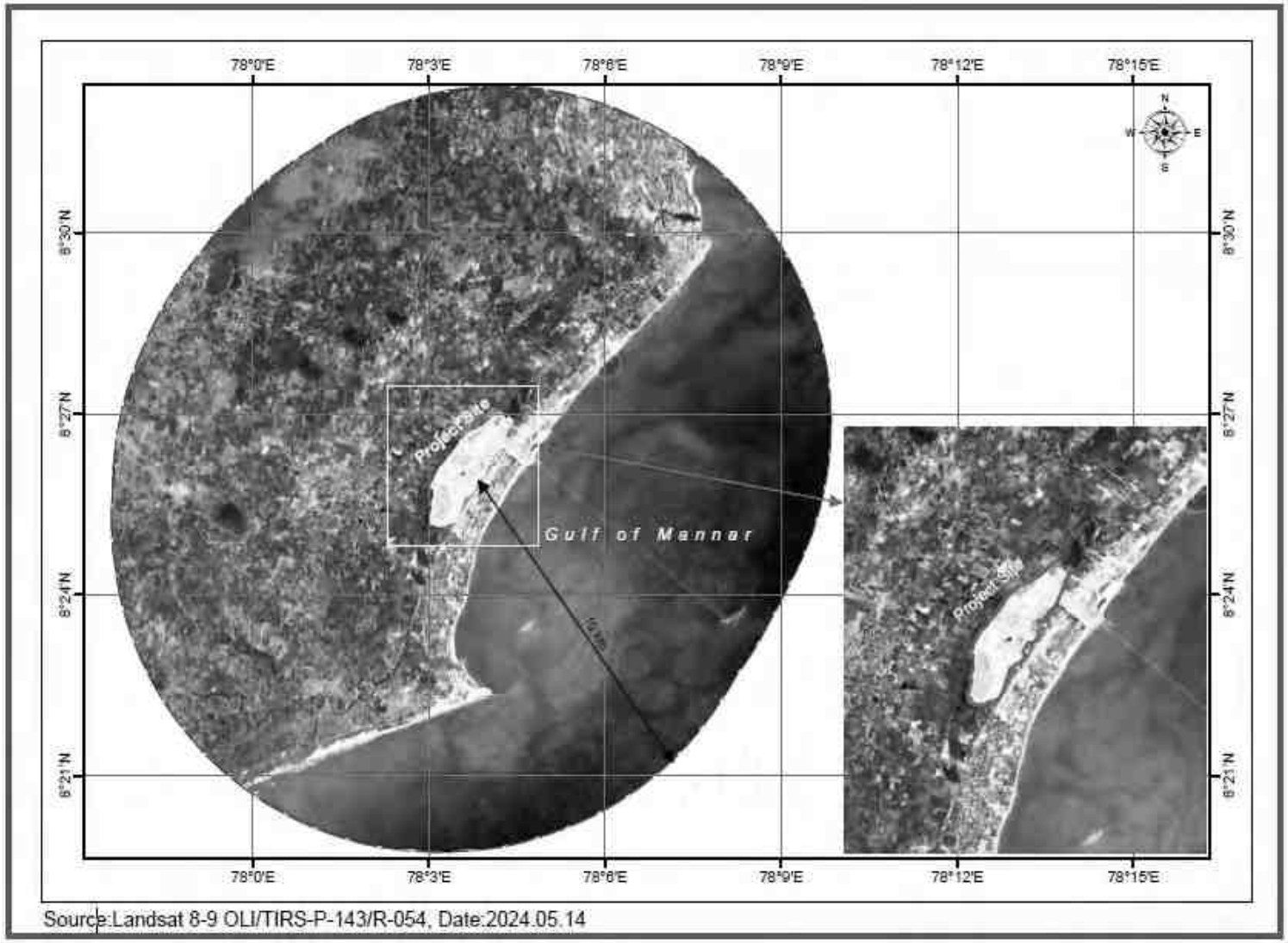


Figure 3-10 Satellite imagery map around 10 km radius

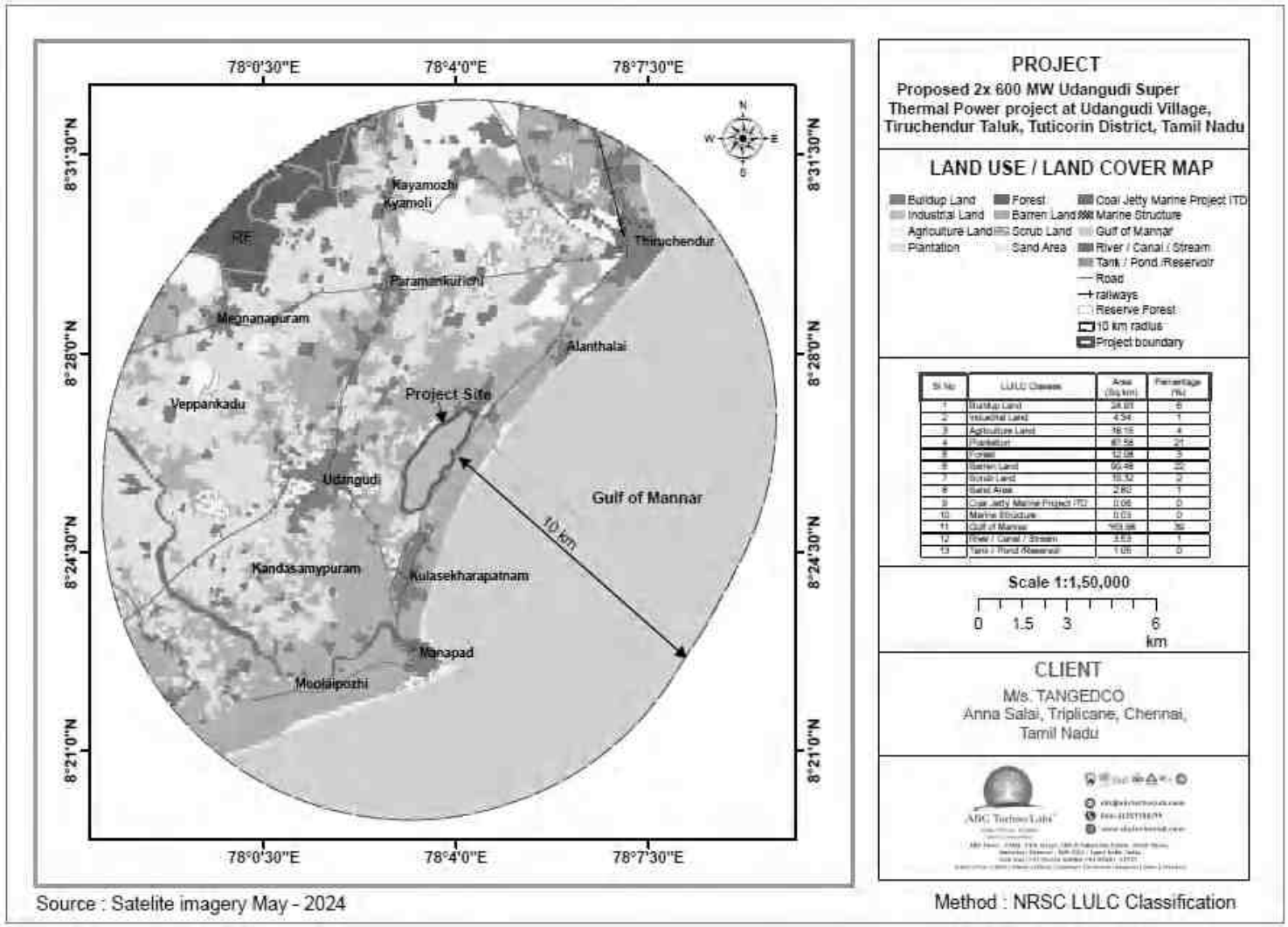


Figure 3-11 The land use pattern within 10 km radius based on Landsat 8-9 & Thermal Infrared Sensor (TIRS)

3.9 Air environment

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

3.9.1 Selection of sampling locations

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality monitoring network. The design of monitoring network in the air quality surveillance programme has been based on the following considerations:

- Topography/Terrain of the study area
- Human Settlements
- Health status
- Accessibility of monitoring site
- Resource Availability
- Representativeness of the region for establishing baseline status
- Representativeness with respect to likely impact areas

Ambient Air Quality Monitoring (AAQM) stations were set up at eight (8) locations with due consideration to the above-mentioned points. The Ambient Air Quality monitoring locations are given in the **Table 3.7** and shown in the **Figure 3.12 & Figure 3.13**.

Table 3-7 Ambient air quality monitoring locations (March 2024 to May 2024)

Ambient Air Quality Monitoring				
Code	**Location/ Landmarks**	**Latitude & Longitude**	**Distance (km) & Direction**	**Environmental Setting**
AAQ 1	Project site	8°26'28.21"N 78°4'9.10"E	-	Industrial
AAQ 2	Thanadavankadu	8°22'42.45"N 78°00' 59.15"E	6.21 SW	Residential
AAQ 3	Nainarpathu	8°27'11.51"N 78°2'42.51"E	2.07 W	Residential
AAQ 4	Muthaiya puram	8°28'26.23"N 78°4'26.79"E	2.93 N	Residential
AAQ 5	Kulasekharapatnam	8°23'30.67"N 78°3'6.49"E	3 S	Residential
AAQ 6	Paramankurichi	8°28'58.02"N 78°2'35.47"E	4.89 NW	Residential
AAQ 7	Mardhurkarai	8°27'23.43"N 78°0'5.90"E	6.6 W	Residential
AAQ 8	Udangudi	8°25'40.59"N 78°1'41.72"E	2.61 W	Commercial

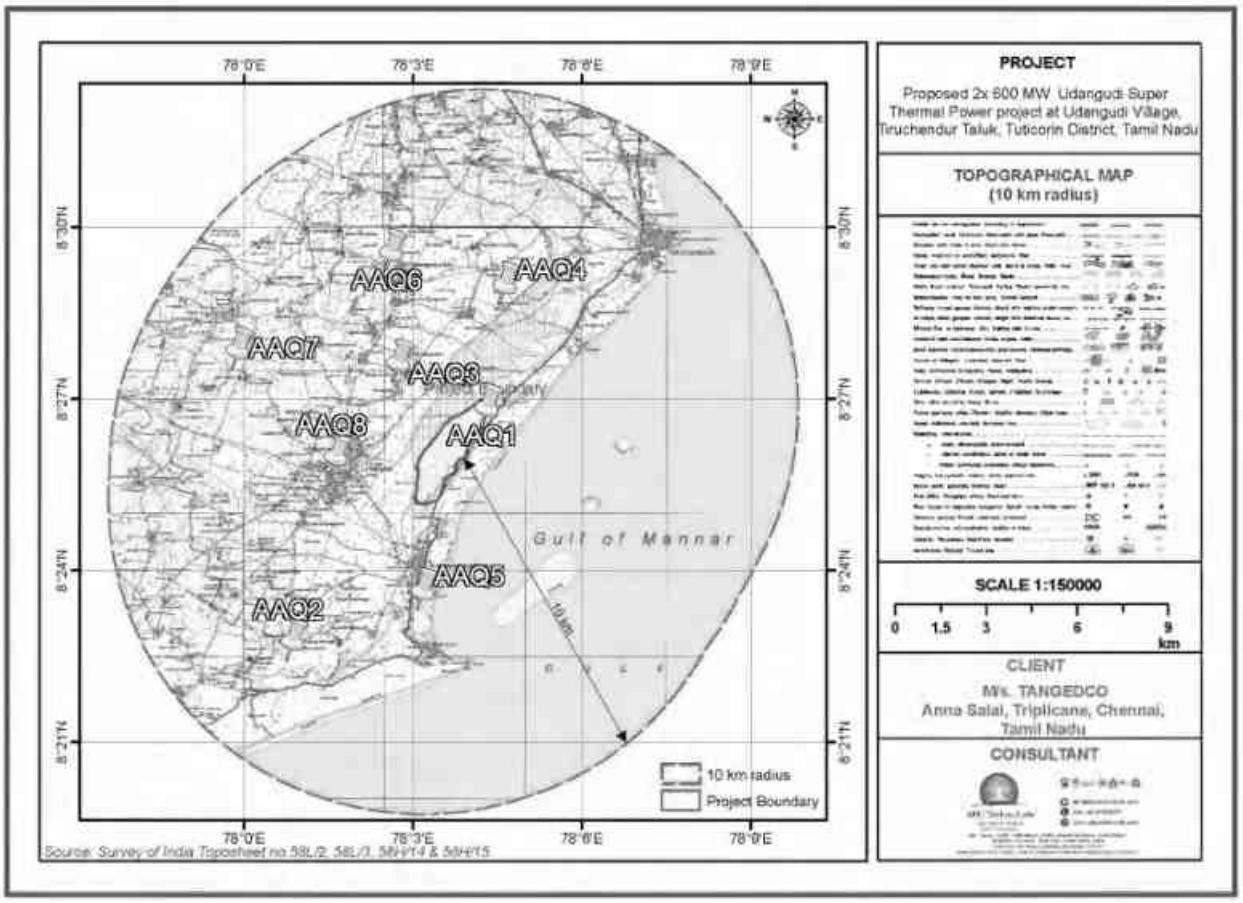


Figure 3-12 Air quality sampling locations

Figure 3-13 Air quality sampling photos

3.9.2 Frequency and parameters for sampling

Ambient air quality monitoring was carried out at a frequency of two days per week at each location for three months. The baseline data of air environment was generated for the following parameters:

- Particulate Matter size less than 10 µm (PM10);

- Particulate Matter size less than 2.5 µm (PM2.5);
- Sulphur oxides (SO2);
- Nitrogen oxides (NOX);
- Carbon Monoixde (CO);
- Ozone (O3);
- Lead (Pb);
- Ammonia (NH3);
- Benzene (C6H6);
- Benzo (a) pyrene (BaP);
- Arsenic (As);
- Nickel (Ni);
- Hydro Carbon (HC) & Non-Methane Hydro Carbon (NMHC)
- Volatile Organic Compound (VOC)

3.9.3 Instruments used for sampling

Respirable Dust Samplers APM 460 BL of Envirotech was used for monitoring Particulate matter (PM10) and Fine Particulate Samplers APM 550 of Envirotech was used for monitoring (PM2.5). For gaseous pollutants APM 411 has been used along with APM-460.

3.9.4 Sampling and analytical techniques

The sampling and analytical techniques used for the monitoring of Ambient Air quality (AAQ) is given in **Table 3.8.**

Table 3-8 Techniques used for ambient air quality monitoring

Sl. No.	Parameter	Technique	Detectable Limit
1	Suspended Particulate Matter (SPM)	IS 5182: Pt 4	2.0 µg/m^3
2	Particulate Matter (PM_{10})	IS 5182: Pt 23	2.0 µg/m^3
3	Particulate Matter ($PM_{2.5}$)	EPA 40 CFR P 50	2.0 µg/m^3
4	Sulphur Dioxide (SO2)	IS: 5182 P2	5.0 µg/m^3
5	Nitrogen Dioxide (NOX)	IS: 5182 P6	5.0 µg/m^3
6	Carbon Monoxide (CO)	IS: 5182 P10	0.1 mg/m^3
7	Ozone (O_3)	ABCTL/SOP/A/07	5.0 µg/m^3
8	Lead (Pb)	IS: 5182 P22	0.1 µg/m^3
9	Ammonia (NH_3)	ABCTL/SOP/A/05	5.0 µg/m^3
10	Benzene (C_6H_6)	IS: 5182 Part 11	0.01 ng/m^3
11	Benzo (a) pyrene – Particulate Phase	IS: 5182 Part 12	0.1 ng/m^3
12	Arsenic (As);	ABCTL/ SOP/A10	1.0 ng/m^3
13	Nickel (Ni):	USEPA Method IO- 3.2	1.0 ng/m^3
14	Hydro Carbon (HC)	EPA TO 12	1 ppm
15	Non Methane Hydro carbon (NMHC)	EPA TO 12	1 µg/m^3

16	Total Volatile organic compound (TVOC)	ABCTL/ SOP/A13	0.1 ppm

3.9.5 Presentation of results

The summary of those results for each location with 98 percentile value is presented in **Table 3.9**. These are compared with the standards prescribed by Central Pollution Control Board (CPCB) norms.

Existing baseline data during **June-September 2021**

Table 3-9 Ambient air quality results

Code	Location	PM2.5, µg/m³			PM10, µg/ m³			SO2, µg/ m³			NO2, µg/ m³			CO, mg/ m³		
		Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
AAQ1	Seerkatchi	19.54	35.34	23.09	49.36	89.34	58.69	5.99	11.16	7.06	15.41	28.08	18.43	BDL(<1)		
AAQ2	Plant site	25.36	31.60	28.29	61.78	76.24	68.56	7.28	9.12	8.08	20.45	24.60	22.10	BDL(<1)		
AAQ3	Pitchivilai	18.71	21.62	20.07	50.05	58.23	53.62	5.67	6.89	6.27	16.23	19.79	17.74	BDL(<1)		
AAQ4	Chettivilai	17.46	24.12	20.55	43.28	60.15	51.51	4.96	6.63	5.77	13.41	18.53	16.13	BDL(<1)		
AAQ5	N Muthaiya puram	17.46	24.12	21.53	42.84	58.98	52.44	4.96	6.69	5.97	13.34	18.75	16.73	BDL(<1)		
AAQ6	Veppankadu	18.30	24.53	22.02	44.85	60.78	54.26	5.47	7.28	6.51	14.52	20.08	17.97	BDL(<1)		
Industrial/Residential /Rural and other Area (CPCB)		**60**			**100**			**80**			**80**			**2**		
Code	**Location**	**NH_3**			**O_3**			**Lead**			**Benzene µg/ m³**			**B[a]P (ng/m³)**		
		Min	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**
AAQ1	Seerkatchi	5.59	10.53	6.68	9.24	20.40	12.28	BDL(<0.02)			BDL(<1)			BDL(<1)		
AAQ2	Plant site	6.60	8.67	7.61	11.60	16.61	13.78	BDL(<0.02)			BDL(<1)			BDL(<1)		
AAQ3	Pitchivilai	5.56	6.24	6.13	9.12	12.89	10.91	BDL(<0.02)			BDL(<1)			BDL(<1)		
AAQ4	Chettivilai	5.38	7.12	6.11	8.06	14.26	11.01	BDL(<0.02)			BDL(<1)			BDL(<1)		
AAQ5	N Muthaiya puram	5.88	8.38	7.26	7.77	14.19	11.27	BDL(<0.02)			BDL(<1)			BDL(<1)		
AAQ6	Veppankadu	5.95	8.15	7.44	8.59	14.88	11.59	BDL(<0.02)			BDL(<1)			BDL(<1)		
Industrial/Residential /Rural and other Area (CPCB)		**400**			**100**			**0.5**			**5**			**1**		

Revalidated data during March - May 2024

Table 3-10 Ambient air quality results

Code	Location	PM2.5, µg/m³				PM10, µg/ m³				SO2, µg/ m³				NO2, µg/ m³				CO, mg/ m³			
		Min	Max	Mean	98 (%)	Min	Max	Mean	98 Per	Min	Max	Mean	98 (%)	Min	Max	Mean	98 (%)	Min	Max	Mean	98 (%)
AAQ1	Project site	21	27	24.58	27	46	58	51.96	57.54	5.9	8.9	7.46	8.808	12.9	16.6	14.60	16.416	0.1	0.21	0.14	0.2012
AAQ2	Thanadavankadu	17	22	19.54	22	37	47	41.79	47	5.1	7.3	6.22	7.208	10.9	15.1	12.96	14.778	BDL(<0.1)			
AAQ3	Nainarpathu	18	25	21	24.54	37	51	44.71	51	5.1	7.4	6.48	7.354	12.8	16.3	14.2	16.162	BDL(<0.1)			
AAQ4	Muthaiya puram	19	26	22.33	26	41	56	47.38	54.62	5.7	8.1	6.94	8.008	13.4	17	14.89	16.954	BDL(<0.1)	0.21	-	-
AAQ5	Kulasekharapatnam	17	24	19.71	23.54	37	49	41.96	48.54	-	7.6	-	-	10.9	14.7	12.85	14.7	BDL(<0.1)	0.14	-	-
AAQ6	Paramankurichi	19	26	22.04	25.54	40	53	46.83	53	5.3	8.7	6.95	8.378	12.5	17	14.96	16.954	0.11	0.21	0.15	0.2008
AAQ7	Mardhurkarai	16	21	18.29	21	33	45	39.04	44.54	BDL(<5)				10.4	13.6	11.92	13.462	BDL(<0.1)			
AAQ8	Udangudi	20	27	23.92	27	43	58	51.04	58	5.9	8.5	7.35	8.454	13.7	17.7	15.63	17.516	0.12	0.28	0.19	0.2708
Industrial/Residential /Rural and other Area (CPCB)		**60**				**100**				**80**				**80**				**2**			
Code	**Location**	**NH3**				**O3**				**Lead**				**Benzene**				**B[a]P**			
		Min	**Max**	**Mean**	**98 Per**	**Min**	**Max**	**Mean**	**98 Per**	**Min**	**Max**	**Mean**	**98 (%)**	**Min**	**Max**	**Mean**	**98 (%)**	**Min**	**Max**	**Mean**	**98 (%)**
AAQ1	Project site	BDL (<5)				8.9	13.1	11.07	12.87	BDL(<0.1)				BDL(<0.1)				BDL(<0.01)			
AAQ2	Thanadavankadu	BDL (<5)				8.2	12.3	10.06	11.97	BDL(<0.1)				BDL(<0.1)				BDL(<0.01)			
AAQ3	Nainarpathu	BDL (<5)				9.8	12.9	11.2	12.854	BDL(<0.1)				BDL(<0.1)				BDL(<0.01)			
AAQ4	Muthaiya puram	BDL (<5)				10.2	13.6	11.88	13.416	BDL(<0.1)				BDL(<0.1)				BDL(<0.01)			
AAQ5	Kulasekharapatnam	BDL (<5)				8.1	12.1	9.91	11.96	BDL(<0.1)				BDL(<0.1)				BDL(<0.01)			
AAQ6	Paramankurichi	BDL (<5)				10.2	13.8	12.35	13.8	BDL(<0.1)				BDL(<0.1)				BDL(<0.01)			
AAQ7	Mardhurkarai	BDL (<5)				8.1	11.6	9.65	11.416	BDL(<0.1)				BDL(<0.1)				BDL(<0.01)			
AAQ8	Udangudi	BDL (<5)				11.6	14.8	13.08	14.524	BDL(<0.1)				BDL(<0.1)				BDL(<0.01)			
Industrial/Residential /Rural and other Area (CPCB)		**400**				**100**				**1**				**5**				**1**			

3.9.6 Observations

Existing baseline data during June-September 2021

PM_{10}: The maximum and minimum concentrations for PM_{10} were recorded as 89.34 µg/m^3 and 42.84 µg/m^3 respectively. The maximum concentration was recorded at Seerkatchi and the minimum concentration was recorded at N Muthaiya puram. The average values were observed to be in the range of 51.51 to 68.56 µg/m^3.

$PM_{2.5}$: The maximum and minimum concentrations for $PM_{2.5}$ were recorded as 35.34 µg/m^3 and 17.46 µg/m^3 respectively. The maximum concentration was recorded at the Seerkatchi and the minimum concentration was recorded at Chettivilai. The average values were observed to be in the range of 18.29 to 24.58 µg/m^3.

SO_2: The maximum SO_2 concentrations were recorded as 11.16 µg/m^3 and miniumum is found to be BDL(<5). The maximum concentration was recorded at Seerkatchi and the minimum concentration was recorded at Chettivilai & N Muthaiya puram. The average values were recorded to be in the range of 5.77 to 8.08 µg/m^3.

NO_x: The maximum and minimum NO_x concentrations were recorded as 28.08 µg/m^3 and 13.34 µg/m^3. The maximum concentration was recorded at Seerkatchi and the minimum concentration was recorded at N Muthaiya puram. The average values were noted to be in the range of 11.92 to 15.63 µg/m^3.

O_3: The maximum and minimum O_3 concentrations were recorded as 20.40 µg/m^3 and 7.77 µg/m^3. The maximum concentration was recorded at Seerkatchi and the minimum concentration was recorded at N Muthaiya puram. The average values were observed to be in the range of 10.91 to 13.78 µg/m^3.

The concentrations of CO, NH_3, C_6H_6, BaP, Pb, As, HC, TVOC and Ni were observed below detection limit and all the parameters were observed well within the standards prescribed by Central Pollution Control Board (CPCB) for Industrial, Rural, Residential and other area.

Revalidated data during March-May 2024

PM_{10}: The maximum and minimum concentrations for PM_{10} were recorded as 58 µg/m^3 and 33 µg/m^3 respectively. The maximum concentration was recorded at Project site & Udangudi and the minimum concentration was recorded at Mardhurkarai. The average values were observed to be in the range of 39.04 to 51.96 µg/m^3.

$PM_{2.5}$: The maximum and minimum concentrations for $PM_{2.5}$ were recorded as 27 µg/m^3 and 16 µg/m^3 respectively. The maximum concentration was recorded at the project site and the minimum concentration was recorded at Mardhurkarai. The average values were observed to be in the range of 18.29 to 24.58 µg/m^3.

SO_2: The maximum SO_2 concentrations were recorded as 8.9 µg/m^3 and miniumum is found to be BDL(<5). The maximum concentration was recorded at project site and the minimum concentration was recorded at Kulasekharapatnam & Mardhurkarai. The average values were recorded to be in the range of 6.22 to 7.46 µg/m^3.

NO_x: The maximum and minimum NO_x concentrations were recorded as 17.7 µg/m^3 and 10.4 µg/m^3. The maximum concentration was recorded at Udangudi and the minimum

concentration was recorded at Marthurkarai. The average values were noted to be in the range of 11.92 to 15.63 µg/m^3.

CO: The maximum CO concentrations were recorded as 0.28 mg/m^3 and minimum recorded is BDL (<0.1). The maximum concentration was recorded at Udangudi and the minimum concentration was recorded at Thanadavankadu, Nainarpathu, Muthaiya puram, Kulasekharapatnam & Mardhurkarai. The average values were observed in the range of 0.14 to 0.19 mg/m^3.

O_3: The maximum and minimum O_3 concentrations were recorded as 14.8 µg/m^3 and 8.1 µg/m^3. The maximum concentration was recorded at Udangudi and the minimum concentration was recorded at Kulasekharapatnam & Mardhurkarai. The average values were observed to be in the range of 9.65 to 13.08 µg/m^3.

The concentrations of NH_3, C_6H_6, BaP, Pb, As, HC, TVOC and Ni were observed below detection limit and all the parameters were observed well within the standards prescribed by Central Pollution Control Board (CPCB) for Industrial, Rural, Residential and other area. When we compared with 2021 baseline data, it is observed that very marginal decrease in the revalidated baseline data.

3.10 Noise environment

Noise survey has been conducted in the study area to assess the background noise levels in different zones viz., Residential, Industrial, Commercial and Silence zones. The main objective of noise monitoring in the study area is to establish the baseline noise levels and assess the impact of the total noise expected to be generated in the surrounding areas.

3.10.1 Methodology

Identification of sampling locations

A preliminary reconnaissance survey was undertaken to identify the major noise generating sources in the area. The noise monitoring has been conducted at eight (8) locations in the study area. The physical location of noise monitoring stations is given in **Table 3.11**. The map showing Noise Quality Monitoring Locations is enclosed as **Figure 3.14 & Figure.3.15.**

Table 3-11 Details of noise monitoring locations

Noise Quality Monitoring				
Code	**Location**	**Latitude & Longitude**	**Distance (km) & Direction**	**Environmental Setting**
N 1	Project site	8°26'28.21"N 78°4'9.10"E	0 km	Industrial
N 2	Thanadavankadu	8°22'42.45"N 78°00' 59.15"E	6.21 SW	Residential
N 3	Nainarpathu	8°27'11.51"N 78°2'42.51"E	2.07 W	Residential
N 4	Muthaiya puram	8°28'26.23"N 78°4'26.79"E	2.93 N	Residential

N 5	Kulasekharapatnam	8°23'30.67"N 78°3'6.49"E	3 S	Residential
N 6	Paramankurichi	8°28'58.02"N 78°2'35.47"E	4.89 NW	Residential
N 7	Mardhurkarai	8°27'23.43"N 78°0'5.90"E	6.6 W	Residential
N 8	Udangudi	8°25'40.59"N 78°1'41.72"E	2.61 W	Commercial

3.10.2 Instrument used for monitoring

Noise levels were measured using a Sound Level Meter. The sound level meter measures the Sound Pressure Level (SPL), the Maximum Sound Pressure Level (max) and the equivalent continuous noise level (Leq) by switching on the corresponding functional modes.

3.10.3 Method of monitoring

Sound Pressure Level (SPL) measurements were taken at the specified locations, with an interval of 1 minute over a period of one hour for 24 hours. The noise levels during day time have been monitored between 6 am to 10 pm and night noise levels during 10 pm to 6 am at all the locations covered in the study area. Noise levels were recorded every one minute in the following manner. To obtain noise levels at 8 am, noise readings, with setting at 'A' response – slow mode, were recorded continuously for 60 minutes. All the readings were obtained for 24 hours.

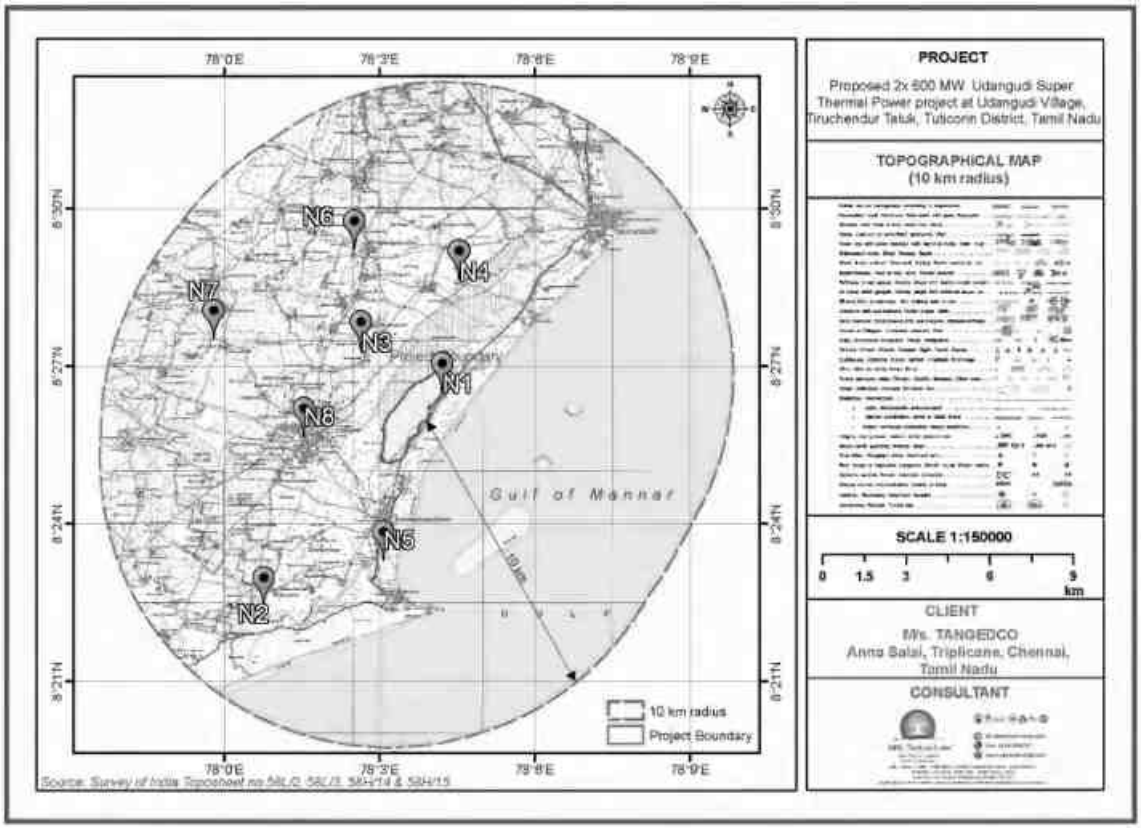


Figure 3-14 Noise monitoring locations

Figure 3-15 Noise sampling photos

3.10.4 Parameters measured during monitoring

For noise levels measured over a given period of time interval, it is possible to derive important features of noise using statistical methods.

- Leq. day average noise levels between 06.00 hours to 22.00 hours.
- Leq. night average noise levels between 22.00 hours to 06.00 hours.

3.10.5 Presentation of results

The summary of computed ambient noise level parameters like Leq.day and Leq.night for all the sampling locations are presented in **Table 3.12** and compared to the standards specified by CPCB has given below in **Table 3.13**.

Table 3-12 Ambient noise levels recorded in the study area

Existing baseline data during June-September 2021

Code	Location	Leq.day [dB(A)]	Leq.night [dB(A)]
N1	Seerkatchi	54.8	44.2
N2	Plant site	54.2	43.8
N3	Pitchavilai	46.8	37.8
N4	Chettivilai	50.1	40.4
N5	keezhanaalumoolai kinaru	48.8	39.3
N6	Veppankadu	47.8	38.5
N7	Tiruchendur	62.1	50.1

Revalidated baseline data during March-May 2024

Code	Location	Leq.day [dB(A)]	Leq.night [dB(A)]	Leq [dB(A)]
N1	Project site	51.7	42.2	50.2
N2	Thandavankadu	48.6	41.1	47.2
N3	Nainarpathu	49.1	41.8	47.7
N4	Muthaiya puram	50.8	42.6	49.4
N5	Kulasekharapatnam	47.5	41.9	46.3
N6	Paramankurichi	51.9	43.5	50.4
N7	Mardhurkarai	47.6	40.8	46.3
N8	Udangudi	53.7	44.5	52.2

Table 3-13 Ambient noise standards

Zone Classification	Leq.day dB(A)	Leq.night dB(A)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

3.10.6 Observations

Existing baseline data during June-September 2021

Day time Noise Levels

The day time noise level at industrial zone was observed to be 54.2 dB(A) which is within the prescribed limit of 75 dB(A). The day time noise level at commercial zone was observed to be 62.1 dB(A) which is within the prescribed limit of 65 dB(A). The day time noise level at all residential zone was observed to be 47.8 to 54.8 dB(A) which is within the prescribed limit of 55 dB(A).

Night time Noise levels

The night time noise level at industrial zone was observed to be 43.8 dB(A) which is within the prescribed limit of 70 dB(A). The night time noise levels at residential locations were found to be 37.8 to 44.2 dB(A) within the prescribed limit of 45 dB(A).

Revalidated baseline data during march-May 2024

Day time Noise Levels

The day time noise level at industrial zone was observed to be 51.7 dB(A) which is within the prescribed limit of 75 dB(A). The day time noise level at commercial zone was observed to be 53.7 dB(A) which is within the prescribed limit of 65 dB(A). The day time noise level at all residential zone was observed to be 47.5 to 53.7 dB(A) which is within the prescribed limit of 55 dB(A).

Night time Noise levels

The night time noise level at industrial zone was observed to be 42.2 dB(A) which is within the prescribed limit of 70 dB(A). The night time noise levels at residential locations were found to be 40.8 to 44.5 dB(A) within the prescribed limit of 45 dB(A).

From the revalidated data, it is observed that the noise level is decreasing when compared with existing baseline data.

3.11 Water environment

Water sampling has been conducted to establish baseline water quality in the area. Water analysis was carried out for physical and chemical parameters as per the methods prescribed in IS and "Standard Methods for the Examination of Water and Wastewater (American Public Health Association)". Water samples were examined to assess the effect of industrial and other activities on ground water. Samples for chemical analysis were collected in polyethylene carboys. Samples collected for metal content were acidified with 1 ml HNO3. Samples for bacteriological analysis were collected in sterilized glass bottles.

To assess physio-chemical and bacteriological characteristics of surface water in the study area, samples were collected from the above location once during the monitoring season. The surface water sources are tanks/lakes/ canals for common usage of thepeople. And compared with surface water quality criteria as per CPCB norms. Sample had been collected and tested for pH, dissolved oxygen content and preserved with the addition of nitric acid for testing metal constituents at the laboratory. The collected samples were analyzed in accordance with Indian Standards for all parameters and the result had been compared with recent CPCB norms class B for surface water quality. For surface water, the existing Avudayar kulam, Thangai kulam will be collected regularly and surface water quality parameter will be tested. For ground water, the Piezometer likely to be install around the ash pond will be monitored once in fort night. In addition, the ground water quality near schools and village plan to be collected every six months and the report will be submitted to RO office.

Table 3-14 Surface water quality criteria as per CPCB

S.No.	Parameter	Class A	Class B	Class C	Class D	Class E
1	pH	6.5–8.5	6.5–8.5	6.0-9.0	6.5–8.5	6.5–8.5
2	Dissolved oxygen, mg/l, min.	6	5	4	4	-
3	BOD, 5 days at 20° C, max.	2	3	3	-	-
4	Total coliform, MPN/100 ml, max	50	500	5000	-	-
5	Free ammonia (as N), mg/l, max	-	-	-	1.2	-
6	Electrical conductivity, µmhos/cm, max	-	-	-	-	2250
7	Sodium absorption ratio, max.	-	-	-	-	26
8	Boron (as B), mg/l, max.	-	-	-	-	2

Class A	Drinking water source without conventional treatment but after disinfection
Class B	Outdoor bathing (organized)
Class C	Drinking water source after conventional treatment and after disinfection
Class D	Propagation of Wild life and Fisheries
Class E	Irrigation, Industrial Cooling, and Controlled Waste Disposal
Below E	Not meeting A, B, C, D and E Criteria

3.11.1 Water sampling locations

Three (3) surface water and Eight (8) ground water samples were collected as grab samples within 10 km radius of the project site and were analyzed for various parameters to compare with the standards for drinking water as per IS: 10500:2012 for groundwater and Class (B) norms were followed for surface water. The water sampling locations of 10 km radius are identified in **Table 3.15** and shown in **Figure 3.16**. In addition, as per specific ToR additional 10 samples have been collected within 2 km radius of the project site and shown in **Fig. 3.17**.

Table 3-15 Ground water and surface water sampling locations

Code	Location	Latitude	Longitude	Distance (km) & Direction	Environmental setting
Ground Water Quality Monitoring in 10 km radius					
GW 1	Project site	8°26'28.21"N	78° 4'9.10"E	0	Industrial
GW2	Thanadavankadu	8°22'42.45"N	78°00' 59.15"E	6.21 SW	Residential
GW 3	Nainarpathu	8°27'11.51"N	78° 2'42.51"E	2.07 W	Residential
GW 4	Muthaiya puram	8°28'26.23"N	78° 4'26.79"E	2.93 N	Residential
GW 5	Kulasekharapatnam	8°23'30.67"N	78° 3'6.49"E	3 S	Residential
GW 6	Paramankurichi	8°28'58.02"N	78° 2'35.47"E	4.89 NW	Residential
GW 7	Mardhurkarai	8°27'23.43"N	78° 0'5.90"E	6.6 W	Residential
GW 8	Udangudi	8°25'40.59"N	78° 1'41.72"E	2.61 W	Commercial
Surface Water Quality Monitoring in 10 km radius					
SW 1	Avudayarkulam	8°29'41.51"N	78° 6'47.81"E	7 NE	Waterbodies
SW 2	Thangai kulam	8°25'4.90"N	77°59'43.70"E	6.27 W	Waterbodies
SW 3	Ellapanayakan kulam	8°28'53.73"N	78° 5'16.77"E	4.17 N	Waterbodies
Ground water quality monitoring in 2 km radius as per specific ToR					
GW1	2 km radius	8°26'29.00"N	78° 4'10.28"E	0	Industrial
GW2	2 km radius	8°26'19.99"N	78° 2'59.55"E	1.22 WNW	Residential
GW3	2 km radius	8°26'53.69"N	78° 3'11.53"E	1.72 NW	Residential
GW4	2 km radius	8°25'57.12"N	78° 2'38.43"E	1.77 W	Residential
GW5	2 km radius	8°25'7.55"N	78° 3'29.24"E	1.76 S	Industrial
GW6	2 km radius	8°25'33.44"N	78° 3'36.56"E	0.98 S	Industrial
GW7	2 km radius	8°25'44.63"N	78° 3'57.56"E	0.98 SE	Industrial
GW8	2 km radius	8°25'42.02"N	78° 2'46.85"E	1.70 WSW	Residential
GW9	2 km radius	8°26'30.08"N	78° 3'17.78"E	0.88 NW	Residential
GW10	2 km radius	8°26'48.17"N	78° 3'25.47"E	1.31 NNW	Residential

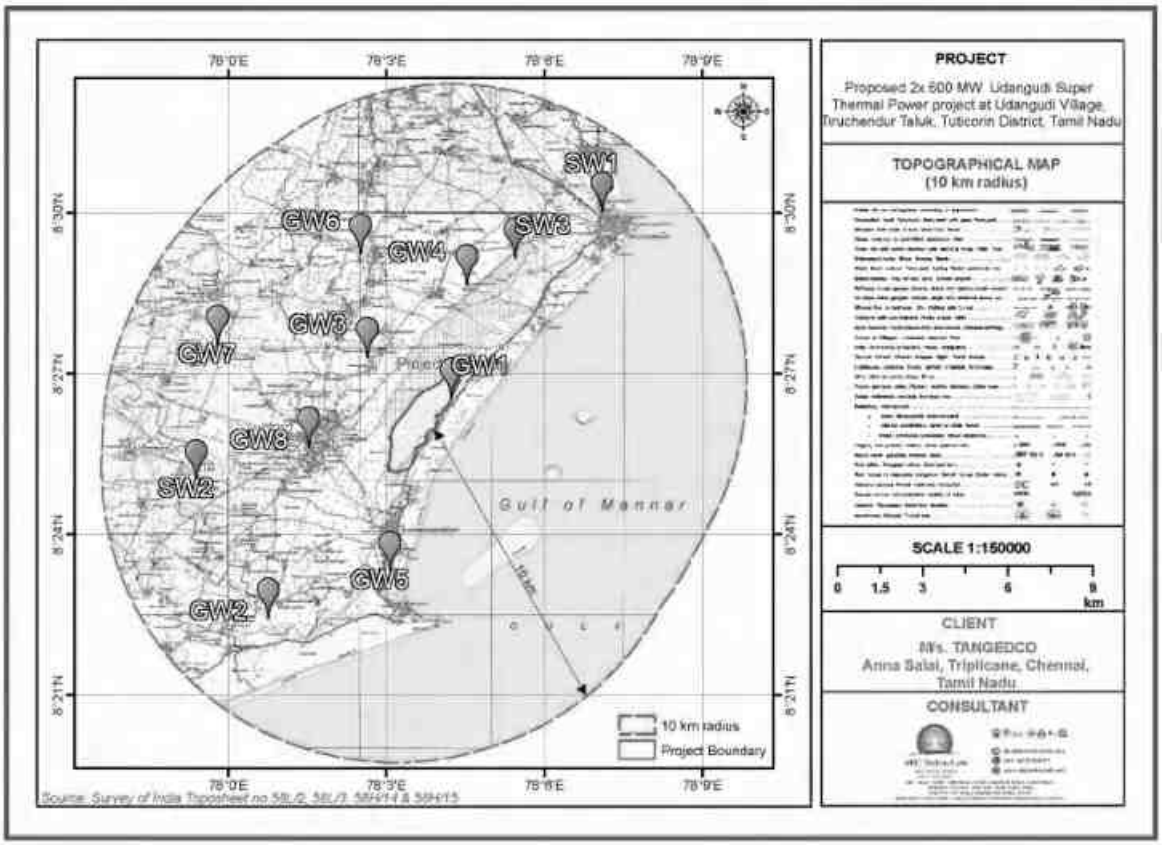


Figure 3-16 Ground and surface water sampling locations in 10 km radius

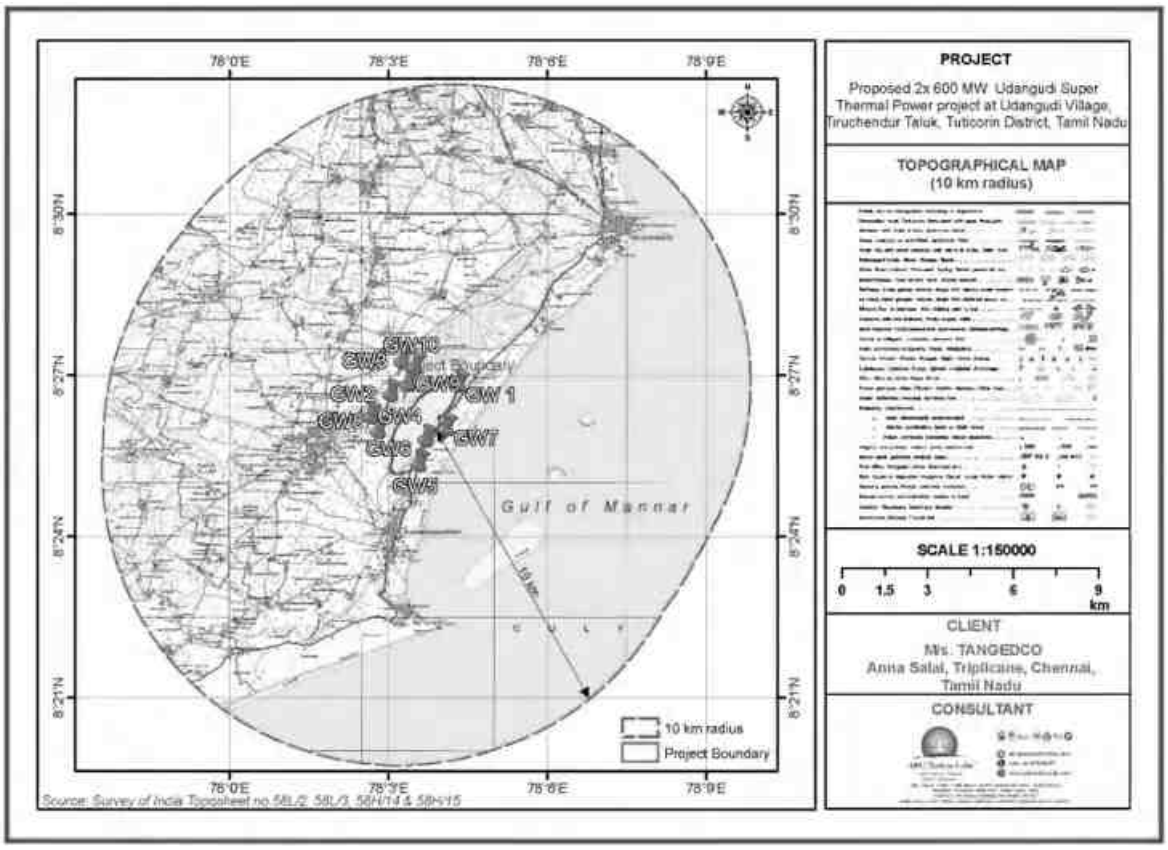


Figure 3-17 Ground water sampling locations in 2 km radius

Figure 3-18 Ground water sampling photos

Figure 3-19 Surface water sampling photos

3.11.2 Presentation of results

The water quality results of the ground water and surface water samples are tabulated in **Table 3.16 & Table 3.17** respectively.

Table 3-16 Ground water sampling results in 10 km radius

Existing baseline data during June – September 2021

S.No	Parameters	GW1	GW2	GW3	GW4	GW5	GW6	GW7	IS10500:2012 Standards	
									Acceptable limit	Permissible limit
1	Colour(Hazen)	10	10	5	5	2	5	2	05	15
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Total Dissolved Solids (mg/l)	8098	3488	2252	7958	4982	2072	2910	500	2000
5	Chloride (as Cl), (mg/l)	3788	1282	826	3400	1709	826	1263	250	1000
6	Fluoride (as F), (mg/l)	1.2	1.2	1.1	1.0	1.3	1.2	1.4	1	1.5
7	Phenolpthalein Alkalinity (as CaCO3) (mg/l)	BLQ(LOQ: 1.0)	5.5	BLQ(LOQ:1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	-	-
8	Cyanide as Cn, (mg/l)	BLQ(LOQ: 0.01)	BLQ(LOQ: 0.01	BLQ(LOQ:0.01	BLQ(LOQ: 0.01	BLQ(LOQ: 0.01	BLQ(LOQ: 0.01	BLQ(LOQ: 0.01	0.05	0.05
9	Mercury as Hg, (mg/l)	BLQ(LOQ: 0.05)	BLQ(LOQ: 0.05)	BLQ(LOQ:0.05)	BLQ(LOQ: 0.05)	BLQ(LOQ: 0.05)	BLQ(LOQ: 0.05)	BLQ(LOQ: 0.05)	0.001	0.001
10	Sodium as Na, (mg/l)	2531	1440	471	2664	1973	303	543	-	-
11	Total Suspended Solids, (mg/l)	5.6	8.5	BLQ(LOQ:1.0)	2	2.4	1.6	BLQ(LOQ: 1.0)	-	-
12	Total Alkalinity (as CaCO3) (mg/l)	470	427	314	431	1066	274	294	200	600
13	Phenolic Compounds (as C6H5OH) (mg/l)	BLQ(LOQ: 0.001)	BLQ(LOQ: 0.001)	BLQ(LOQ:0.001)	BLQ(LOQ: 0.001)	BLQ(LOQ: 0.001)	BLQ(LOQ: 0.001)	BLQ(LOQ: 0.001)	0.001	0.002

S.No	Parameters	GW1	GW2	GW3	GW4	GW5	GW6	GW7	IS10500:2012 Standards	
									Acceptable limit	Permissible limit
14	Electrical Conductivity (µS/cm)	14210	5623	3967	13790	8632	3628	5218	-	-
15	Bio-Chemical Oxygen Demand, (mg/l) (3 days at 27° C)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ:1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	-	-
16	Chemical oxygen demand (mg/l)	BLQ(LOQ: 5.0)	BLQ(LOQ: 5.0)	BLQ(LOQ:5.0)	BLQ(LOQ: 5.0)	BLQ(LOQ: 5.0)	BLQ(LOQ: 5.0)	BLQ(LOQ: 5.0)	-	-
17	Zinc as Zn (mg/l)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ:0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	5	15
18	Oil and Grease @ 105° C, (mg/l)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ:1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	BLQ(LOQ: 1.0)	-	-
19	Dissolved Oxygen(mg/l)	7.1	7.2	7.1	7	7.2	7.3	6.9	-	-
20	Salinity (mg/l)	6.84	2.32	1.49	6.14	3.09	1.49	2.28	-	-
21	Anionic detergent (as MBAS), (mg/l)	BLQ(LOQ: 0.05)	BLQ(LOQ: 0.05)	BLQ(LOQ:0.05)	BLQ(LOQ: 0.05)	BLQ(LOQ: 0.05)	BLQ(LOQ: 0.05)	BLQ(LOQ: 0.05)	-	-
22	Calcium (as Ca), (mg/l)	695	131	123	409	147	286	376	75	200
23	Free Residual Chlorine (mg/l)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ:0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	0.2	1
24	Mineral Oil (mg/l)	BLQ(LOQ: 0.01)	BLQ(LOQ: 0.01)	BLQ(LOQ:0.01)	BLQ(LOQ: 0.01)	BLQ(LOQ: 0.01)	BLQ(LOQ: 0.01)	BLQ(LOQ: 0.01)	0.5	0.5
25	Total Hardness as $CaCO_3$(mg/l)	2856	408	510	1530	816	949	1428	200	600
26	Iron as Fe (mg/l)	0.48	0.78	0.24	0.32	0.18	BLQ(LOQ: 0.02)	BLQ(LOQ: 0.02)	0.3	0.3
27	Boron as (mg/l)	0.48	0.861	0.313	0.861	0.965	0.134	0.296	0.5	1
28	Copper as Cu (mg/l)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ:0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	0.05	1.5

S.No	Parameters	GW1	GW2	GW3	GW4	GW5	GW6	GW7	IS10500:2012 Standards	
									Acceptable limit	Permissible limit
29	Manganese as Mn (mg/l)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ:0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	0.1	0.3
30	Selenium as Se, (mg/l)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ:0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	0.01	0.01
31	Potassium as K, (mg/l)	80	91.1	163	65.8	82.1	20.7	29.3	-	-
32	Nitrate as N (mg/l)	2.7	2.2	5.85	6.3	9	2.4	0.5	45	45
33	Sulphate as SO_4(mg/l)	370	232	51	540	128	34	101	200	400
34	Aluminium as Al (mg/l)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ:0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	0.03	0.2
35	Cadmium as Cd, (mg/l)	BLQ(LOQ: 0.001)	BLQ(LOQ: 0.001)	BLQ(LOQ:0.001)	BLQ(LOQ: 0.001)	BLQ(LOQ: 0.001)	BLQ(LOQ: 0.001)	BLQ(LOQ: 0.001)	0.003	0.003
36	Lead as Pb (mg/l)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ:0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	0.01	0.01
37	Nickel as Ni (mg/l)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ:0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	0.02	0.02
38	Total Arsenic as As (mg/l)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ:0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	0.01	0.05
39	Magnesium as Mg (mg/l)	273	20	50	124	109	57	119	30	100
40	Total Pesticide Residue (mg/l)	BLQ(LOQ: 0.00002)	BLQ(LOQ: 0.00002)	BLQ(LOQ:0.00002)	BLQ(LOQ: 0.00002)	BLQ(LOQ: 0.00002)	BLQ(LOQ: 0.00002)	BLQ(LOQ: 0.00002)	-	-
41	Silica as(SiO2)(mg/l)	30	21	169	65	80	51	41	-	-
42	Total Chromium as Cr (mg/l)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ:0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	BLQ(LOQ: 0.005)	-	-
43	pH Value	7.54	8.53	7.33	7.53	7.61	7.48	7.37	6.5-8.5	6.5-8.5
44	Total Coliform (MPN/100ml)	<2	<2	33	<2	<2	<2	<2	Shall not be detectable in any 100 ml sample	

Revalidated baseline data during March-May 2024

Sl. No.	Parameter	Unit	Results								Standards as per IS 10500 : 2012	
			GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	Acceptable limit	Permissible Limits
1.	Colour	Hazen	<1	<1	<1	<1	<1	1	<1	<1	5	15
2.	Odour	-	No Odour Observed								Agreeable	
3.	Turbidity	NTU	0.7	BDL(<0.5)							1	5
4.	pH at 25 °C	-	7.57	7.63	7.89	8.02	7.62	7.58	7.41	7.85	6.5-8.5	6.5-8.5
5.	Conductivity at 25 °C	µS/cm	1917	1365	1310	1274	994	1180	1346	1281	Not Specified	
6.	Total dissolved solids	mg/l	1112	792	768	741	577	684	781	736	500	2000
7.	Total Suspended solids	mg/l	<2	<2	<2	<2	<2	<2	<2	<2	Not Specified	
8.	Total Alkalinity as CaCO3	mg/l	310	330	370	350	264	350	360	310	200	600
9.	Total Hardness as CaCO3	mg/l	470	390	410	452	330	430	400	470	200	600
10.	Calcium as Ca	mg/l	112	94	97	102	86	101	84	96	75	200
11.	Magnesium as Mg	mg/l	46	37.6	58	48	28	43	36.4	56	30	100
12.	Chloride as Cl-	mg/l	335	198	174	155	118	137	177	181	250	1000
13.	Sulphate as SO4	mg/l	164	102	97	128	74	88	110	98	200	400
14.	Nitrate as NO3	mg/l	1	3	5	7	4	6	4	2	45	45
15.	Iron as Fe	mg/l	0.16	BDL(<0.05)	BDL(<0.05)	0.11	0.05	0.05	0.05	0.11	1	1
16.	Manganese as Mn	mg/l	BDL(<0.01)								0.10	0.3
17.	Fluoride as F	mg/l	0.42	0.33	0.35	0.32	0.35	0.41	0.36	0.41	1.00	1.5
18.	Sodium as Na	mg/l	250	152	152	122	93	110	144	112	Not Specified	
19.	Potassium as K	mg/l	12	5.3	5.5	3.7	3.5	4.6	3.7	4	Not Specified	
20.	Barium as Ba	mg/l	BDL(<0.1)								0.7	0.7
21.	Residual Free Chlorine	mg/l	BDL(<0.1)								0.20	1
22.	Aluminium as Al	mg/l	BDL(<0.03)								0.03	0.2

Sl. No.	Parameter	Unit	Results								Standards as per IS 10500 : 2012	
			GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	Acceptable limit	Permissible Limits
23.	Cadmium as Cd	mg/l	BDL(<0.003)								0.003	0.003
24.	Lead as Pb	mg/l	BDL(<0.01)								0.01	0.01
25.	Copper as Cu	mg/l	BDL(<0.03)								0.05	1.5
26.	Zinc as Zn	mg/l	0.05	0.09	0.05	0.12	0.11	0.02	0.07	0.08	5.00	15
27.	Total Chromium as Cr	mg/l	BDL(<0.03)								0.05	0.05
28.	Arsenic as As	mg/l	BDL(<0.01)								0.01	0.05
29.	Cyanide as CN	mg/l	BDL(<0.02)								0.05	0.05
30.	Selenium as Se	mg/l	BDL(<0.01)								0.01	0.01
31.	Mercury as Hg	mg/l	BDL(<0.001)								0.001	0.001
32.	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)								0.20	1.0
33.	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)								0.001	0.002
34.	Pesticides	mg/l	Absent								Absent	Absent
35.	Total Coliforms	MPN/ 100ml	<2	2	2	<2	<2	<2	<2	<2	Absent/100ml	
36.	E.coli		<2									

Table 3-17 Ground water sampling results in 2 km radius

Sl. No.	Parameter	Unit	Results										Standards as per IS 10500 : 2012	
			GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	GW 9	GW 10	Acceptable limit	Permissible Limits
1.	Colour	Hazen	<1	3	2	<1	<1	<1	1	<1	1	2	5	15
2.	Odour	-	No odour observed										Agreeable	
3.	Turbidity	NTU	0.8	0.6	BDL(<0.5)								1	5
4.	pH at 25 °C	-	7.91	6.99	7.01	7.56	7.32	7.61	7.25	6.84	7.74	7.28	6.5-8.5	6.5-8.5

Sl. No.	Parameter	Unit	Results									Standards as per IS 10500 : 2012	
			GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	GW 9	GW 10	Acceptable limit	Permissible Limits
5.	Conductivity at 25 °C	µS/cm	1780	21490	23180	1419	6180	830	9290	24550	22120	23000	Not Specified	
6.	Total dissolved solids	mg/l	1061	12897	14124	809	3581	473	5468	14960	13274	13815	500	2000
7.	Total Suspended solids	mg/l	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	Not Specified	
8.	Total Alkalinity as CaCO3	mg/l	202	306	240	230	250	184	350	200	168	208	200	600
9.	Total Hardness as CaCO3	mg/l	555	3800	4300	333	787	248	1600	9100	5220	6380	200	600
10.	Calcium as Ca	mg/l	78	514	887	53	113	61	340	1538	871	1052	75	200
11.	Magnesium as Mg	mg/l	87	608	506	49	122	24	182	1276	738	1057	30	100
12.	Chloride as Cl-	mg/l	496	7188	7998	327	1811	134	2890	7345	7444	7236	250	1000
13.	Sulphate as SO4	mg/l	58	590	475	42	254	48	232	470	684	539	200	400
14.	Nitrate as NO3	mg/l	2	3	3	5	2	4	7	3	6	3	45	45
15.	Iron as Fe	mg/l	0.16	0.18	0.21	0.12	0.07	0.05	0.11	0.08	0.13	0.14	1	1
16.	Manganese as Mn	mg/l	BDL(<0.01)										0.10	0.3

Sl. No.	Parameter	Unit	Results										Standards as per IS 10500 : 2012	
			GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	GW 9	GW 10	Acceptable limit	Permissible Limits
17.	Fluoride as F	mg/l	0.42	0.37	0.44	0.37	0.30	0.25	0.39	0.47	0.29	0.22	1.00	1.5
18.	Sodium as Na	mg/l	214	3800	4100	192	1120	90	1600	4200	3420	3870	Not Specified	
19.	Potassium as K	mg/l	5	13	11	3.3	9	2	7	8	11	14	Not Specified	
20.	Barium as Ba	mg/l	BDL(<0.1)										0.7	0.7
21.	Residual Free Chlorine	mg/l	BDL(<0.1)										0.20	1
22.	Aluminium as Al	mg/l	BDL(<0.03)										0.03	0.2
23.	Cadmium as Cd	mg/l	BDL(<0.003)										0.003	0.003
24.	Lead as Pb	mg/l	BDL(<0.01)										0.01	0.01
25.	Copper as Cu	mg/l	BDL(<0.03)										0.05	1.5
26.	Zinc as Zn	mg/l	0.02	0.07	0.05	0.08	0.10	0.08	0.05	0.07	0.06	0.11	5.00	15
27.	Total Chromium as Cr	mg/l	BDL(<0.03)										0.05	0.05
28.	Arsenic as As	mg/l	BDL(<0.01)										0.01	0.05
29.	Cyanide as CN	mg/l	BDL(<0.02)										0.05	0.05
30.	Selenium as Se	mg/l	BDL(<0.01)										0.01	0.01

Sl. No.	Parameter	Unit	Results										Standards as per IS 10500 : 2012	
			GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	GW 9	GW 10	Acceptable limit	Permissible Limits
31.	Mercury as Hg	mg/l	BDL(<0.001)										0.001	0.001
32.	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)										0.20	1.0
33.	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)										0.001	0.002
34.	Pesticides	mg/l	Absent										Absent	Absent
35.	Total Coliforms	MPN/ 100ml	<2	2	2	<2	<2	<2	<2	<2	<2	<2	Absent/100ml	
36.	E.coli		<2											

Table 3-18 Surface water sampling results in 10 km radius

Existing baseline data during June-September 2021

S.No	parameter	SW1	SW2	SW3	IS 2293 standards
1	Colour (Hazen)	25	25	10	Suitable for all class of water use.
2	Odour	Agreeable	Agreeable	Agreeable	
3	Taste	Agreeable	Agreeable	Agreeable	
4	Total dissolved solids, (mg/L)	258	207	5642	SW1 & SW2 follows class A, B and C, D and E required characteristics.SW3 is not suitable and has very high TDS value

S.No	parameter	SW1	SW2	SW3	IS 2293 standards
5	Chloride (as Cl), (mg/L)	51	33	2283	SW1 & SW2 follows class A, B and C, D and E required characteristics.SW3 is not suitable and has very high chlorine value
6	Fluoride (as F), (mg/L)	BLQ (LOQ:0.1)	BLQ (LOQ:0.1)	0.2	Suitable for all class of water use.
7	Phenolpthalein alkalinity (as CaCO3), (mg/L)	BLQ (LOQ:1.0)		47	-
8	Cyanide as CN, (mg/L)	BLQ (LOQ:0.01)	BLQ (LOQ:0.01)	BLQ (LOQ:0.01)	-
9	Mercury as Hg, (mg/L)	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	BLQ(LOQ:0.005)	-
10	Sodium as Na, (mg/L)	48.7	29.7	2154	-
11	Total suspended solids, (mg/L)	42.8	19	24.4	-
12	Total alkalinity (as CaCO3), (mg/L)	95	96	510	-
13	Phenolic compounds (as C6H5OH) (mg/L)	BLQ (LOQ:0.001)	BLQ (LOQ:0.001)	BLQ (LOQ:0.001)	-
14	Electrical conductivity (µmhos/cm)	447.6	363.7	9398	-
15	Bio-chemical oxygen demand, (mg/L) (3 days at 27°C)	12.1	13.2	12.7	Higher than the class A, B, C & D value suggested
16	Chemical Oxygen Demand (mg/L)	49.5	40	59.4	-
17	Zinc as ZN (mg/L)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	0.118	-
18	Oil and grease @ 105°C (mg/L)	BLQ (LOQ:1.0)	BLQ (LOQ:1.0)	BLQ (LOQ:1.0)	-
19	Dissolved oxygen (mg/L)	3.2	3.1	3.3	Lower than the class A, B, C, D & E value suggested
20	Salinity (mg/L)	0.09	0.06	4.12	-
21	Anionic detergent (as MBAS),	BLQ (LOQ:0.05)	BLQ (LOQ:0.05)	BLQ (LOQ:0.05)	-
22	Calcium (as Ca), (mg/L)	24	23	41	-
23	Free residual chloride, (mg/L)	BLQ (LOQ:0.1)	BLQ (LOQ:0.1)	BLQ (LOQ:0.1)	-

S.No	parameter	SW1	SW2	SW3	IS 2293 standards
24	Mineral oil, (mg/L)	BLQ (LOQ:0.01)	BLQ (LOQ:0.01)	BLQ (LOQ:0.01)	-
25	Total hardness (as CaCO3), (mg/L)	98	94	408	-
26	Iron (as Fe), (mg/L)	0.58	0.48	0.62	Not Suitable for all class of water use.
27	Boron as B, (mg/L)	BLQ (LOQ:0.05)	BLQ (LOQ:0.05)	1.56	-
28	Copper as Cu, (mg/L)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	-
29	Manganese as Mn, (mg/L)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	-
30	Selenium as Se, (mg/L)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	-
31	Potassium as K, (mg/L)	7.56	10.2	193	-
32	Nitrate as N (mg/L)	3.17	2.9	4.94	Suitable for all class of water use.
33	Sulphate (as SO4) (mg/L)	17	2.99	472	-
34	Aluminium as Al (mg/L)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	0.213	-
35	Cadmium as Cd, (mg/L)	BLQ (LOQ:0.001)	BLQ (LOQ:0.001)	BLQ (LOQ:0.001)	-
36	Lead as pb, (mg/L)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	Suitable for all class of water use.
37	Nickel as Ni, (mg/L)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	-
38	Total Arsenic as As, (mg/L)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	Suitable for all class of water use.
39	Magnesium as Mg (mg/L)	9.09	8.94	75	-
40	Total pesticide residue (mg/L)	BLQ (LOQ:0.00002)	BLQ (LOQ:0.00002)	BLQ (LOQ:0.00002)	-
41	Silica (as SiO2), (mg/L)	8.75	2.3	56	-
42	Total chromium as Cr, (mg/L)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	BLQ (LOQ:0.005)	-
43	Ph value	7.39	7.46	8.88	SW3 is on the higher side and does not match with any the classes of water use
44	Total coliform (MPN/100ml)	<2	<2	33	In line with class A, B, C, D & E class value suggested.

Revalidated baseline data during March-May 2024

Sl. No.	Parameter	Unit	Results			Test procedure
			SW1	SW2	SW3	
1.	Temperature	^{0}C	30.1	29.4	29.7	APHA 23rd EDN -2550B
2.	Colour	Hazen	3	10	5	APHA 23rd EDN -2120 C
3.	Odour	-	No Odour Observed			APHA 23rd EDN -2150 B
4.	pH at 25°C	-	7.63	7.84	7.42	IS : 3025 Part 11- 1983 (Reaff: 2017)
5.	Electrical Conductivity	µS/cm	632	725	538	IS : 3025 Part 14- 1984 (Reaff: 2019)
6.	Turbidity	NTU	2.4	3.5	1.9	IS : 3025 Part 10-1984 (Reaff: 2017)
7.	Total Dissolved Solids	mg/l	367	421	305	IS : 3025 Part 16-1984 (Reaff: 2017)
8.	Total Hardness as CaCO3	mg/l	150	168	130	IS : 3025 Part 21-1983 (Reaff: 2019)
9.	Total Alkalinity as CaCO3	mg/l	120	142	112	IS : 3025 Part 23 1986 (Reaff: 2019)
10.	Chloride as Cl	mg/l	107	115	96	IS : 3025 Part 32-1988 (Reaff: 2019)
11.	Sulphate as SO4	mg/l	42	48	30	APHA 23rd EDN - 4500- SO42- E
12.	Fluoride as F	mg/l	0.24	0.29	0.16	APHA 23rd EDN - 4500-F B&D
13.	Nitrate as NO3	mg/l	9	14	5	APHA 23rd EDN - 4500- NO3- B
14.	Ammonia as NH3	mg/l	0.52	0.98	0.38	APHA 23rd EDN - 4500- NH3 B&C
15.	Phosphate as PO4	mg/l	0.47	0.64	0.42	IS : 3025 Part 31-1988 (Reaff: 2019)
16.	Sodium as Na	mg/l	80	88	68	IS:3025 Part 45 1993(Reaff: 2019)
17.	Potassium as K	mg/l	2.9	5.2	3.6	IS:3025 Part 45-1993(Reaff: 2019)
18.	Calcium as Ca	mg/l	39	45	33	IS:3025 Part 40-1991(Reaff: 2019)
19.	Magnesium as Mg	mg/l	12.8	13.2	11.5	APHA 23rd EDN 3500 Mg B
20.	Iron as Fe	mg/l	0.19	0.22	0.13	IS : 3025 Part 53- 2003(Reaff: 2019)
21.	Manganese as Mn	mg/l	BDL(<0.02)			APHA 23rd EDN -3111 B
22.	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)			APHA 23rd EDN -5540 C
23.	Total Suspended Solids	mg/l	4	7	3	IS:3025 Part 17- 1984(Reaff: 2017)
24.	DO as O2	mg/l	5.6	4.8	5.9	IS:3025:Part- 38:1989(Reaff: 2019)
25.	Chemical Oxygen Demand	mg/l	18	23	16	IS:3025:Part- 58:2006(Reaff: 2017)
26.	Bio-Chemical Oxygen Demand @ 27°C for 3 days	mg/l	2.3	2.6	BDL(<2)	IS:3025:Part- 44:1993(Reaff: 2019)

Sl. No.	Parameter	Unit	Results			Test procedure
			SW1	SW2	SW3	
27.	Phenolic compounds as C6H5OH	mg/l	BDL(<0.001)			APHA 23rd EDN 5530 B,C,D
28.	Copper as Cu	mg/l	BDL(<0.03)			APHA 23rd EDN -3111 B
29.	Mercury as Hg	mg/l	BDL(<0.001)			APHA 23rd EDN -3112 B
30.	Cadmium as Cd	mg/l	BDL(<0.003)			APHA 23rd EDN -3111 B
31.	Selenium as Se	mg/l	BDL(<0.01)			APHA 23rd EDN -3113 B
32.	Total Arsenic as As	mg/l	BDL(<0.01)			APHA 23rd EDN -3111 B
33.	Cyanide as CN	mg/l	BDL(<0.02)			APHA 23rd EDN-4500-CN E
34.	Lead as Pb	mg/l	BDL(<0.01)			APHA 23rd EDN -3111 B
35.	Zinc as Zn	mg/l	0.09	0.11	0.05	APHA 23rd EDN -3111 B
36.	Total Chromium as Cr	mg/l	BDL(<0.03)			APHA 23rd EDN -3111 B
37.	Nickel as Ni	mg/l	BDL(<0.02)			APHA 23rd EDN -3111 B
38.	Oil & Grease	mg/l	BDL(<1)			IS:3025:Part- 39:1991(Reaff: 2019)
39.	Mineral oil	mg/l	BDL(<0.5)			IS:3025:Part- 39:1991(Reaff: 2019)
40.	Poly Chlorinated Biphenyls (PCBs)	mg/l	BDL (<0.0001)			APHA 23rd EDN -6630 B
41.	Poly Nuclear AromaticHydrocarbon as PAH	mg/l	BDL (<0.0001)			APHA 23rd EDN -6440 B
42.	Total Coliform	MPN/ 100ml	>1600			IS – 1622 -1981 (Reaff – 2019)
43.	Fecal Coliform	MPN/ 100ml	>1600	1100	>1600	IS – 1622-1981(Reaff – 2019)

BDL - Below Detection Limit

3.11.3 Observations

Existing baseline data during June-September 2021

Ground water

The pH value of the collected ground water in the study area varies from 7.33 to 8.53. The conductivity varies from 3628 to 14210 µS/cm. TDS values were found to be in the range of 2072 to 8098 mg/l and meets permissible limit of 2000 mg/l in all locations. Total alkalinity varies from 274 to 1066 mg/l and meets permissible limit of 600 mg/l in all the locations. Total Hardness varied from 408 to 2856 mg/l and meets permissible limit of 600 mg/l in all the locations. The chloride values were found to be in the range 826 mg/l to 3788 mg/l and meets permissible limit of 1000 mg/l in all the locations. Sulphate value varies from 34 to 540 mg/l and meets permissible limit of 400 mg/l in all the locations. The calcium values range from 123 to 695 mg/l and meets permissible limit of 200 mg/l in all the locations. Magnesium values range from 20 to 273 mg/l meets permissible limit of 100 mg/l in all the locations. Iron content ranges from less than 0.05 mg/l to maximum upto 0.78 mg/l and meets permissible limit of 1 mg/l in all the locations. Metals such as zinc, copper, lead, cadmium, chromium, arsenic, selenium, and mercury were observed to be below detection limit in the ground water samples.

Surface water

The pH value of the collected surface water in the study area varies from 7.36 to 8.88. The dissolved oxygen varies from 3.1 to 3.3 mg/l. The Biological oxygen demand (BOD) varies from 12.1 to 13.2 mg/l. The Total coliform count is less than 2. The electrical conductivity of the samples varies from 363.7 to 9398 µS/cm. The total hardness varies from 94 to 408 mg/l. The chloride concentrations were found to be in the range of 33 to 2283 mg/l. Similarly, the fluoride concentration was found to be in the range of BDL>0.001 to 0.2 mg/l. The calcium concentrations varies from 23 to 41 mg/l and magnesium concentrations were found to be 8.94 to 75 mg/l respectively. Total dissolved solids (TDS) concentration is found to be 258 to 5642 mg/l.

Revalidated baseline data during March-May 2024

Ground water in 10 km radius

The pH value of the collected ground water in the study area varies from 7.41 to 8.02 and meets the acceptable limit for drinking water standards. The conductivity varies from 994 to 1917 µS/cm. TDS values were found to be in the range of 577 to 1112 mg/l and meets permissible limit of 2000 mg/l in all locations. Total alkalinity varies from 264 to 370 mg/l and meets permissible limit of 600 mg/l in all the locations. Total Hardness varied from 330 to 470 mg/l and meets permissible limit of 600 mg/l in all the locations. The chloride values were found to be in the range 118 mg/l to 335 mg/l and meets permissible limit of 1000 mg/l in all the locations. Sulphate values varies from 74 to 164 mg/l and meets permissible limit of 400 mg/l in all the locations. The calcium values range from 84 to 112 mg/l and meets permissible limit of 200 mg/l in all the locations. Magnesium values range from 28 to 58 mg/l meets permissible limit of 100 mg/l in all the locations. Iron content ranges from less than 0.05 mg/l to maximum upto 0.16 mg/l and meets permissible limit of 1 mg/l in all the locations. Zinc values found in the range from less than 0.02 to maximum of 0.12 mg/l and meets permissible limit of 15 mg/l in all the locations. Metals

such as copper, lead, cadmium, chromium, arsenic, selenium, and mercury were observed to be below detection limit in the ground water samples.

Ground water in 2 km radius

The pH value of the collected ground water in the study area varies from 6.84 to 7.91 and meets the acceptable limit for drinking water standards. The conductivity varies from 830 to 24550 µS/cm. TDS values were found to be in the range of 473 to 14960 mg/l and meets permissible limit of 2000 mg/l in all locations. Total alkalinity varies from 168 to 350 mg/l and meets permissible limit of 600 mg/l in all the locations. Total Hardness varied from 248 to 9100 mg/l and meets permissible limit of 600 mg/l in all the locations. The chloride values were found to be in the range 134 mg/l to 7998 mg/l and meets permissible limit of 1000 mg/l in all the locations. Sulphate values varies from 42 to 684 mg/l and meets permissible limit of 400 mg/l in all the locations. The calcium values range from 53 to 1538 mg/l and meets permissible limit of 200 mg/l in all the locations. Magnesium values range from 24 to 1276 mg/l meets permissible limit of 100 mg/l in all the locations. Iron content ranges from less than 0.05 mg/l to maximum upto 0.21 mg/l and meets permissible limit of 1 mg/l in all the locations. Zinc values found in the range from less than 0.02 to maximum of 0.11 mg/l and meets permissible limit of 15 mg/l in all the locations. Metals such as copper, lead, cadmium, chromium, arsenic, selenium, and mercury were observed to be below detection limit in the ground water samples.

Surface water in 10 km radius

The pH value of the collected surface water in the study area varies from 7.42 to 7.84. The dissolved oxygen varies from 4.8 to 5.9 mg/l. The Biological oxygen demand (BOD) varies from BDL (<2) to 2.6 mg/l. The Total coliform count is greater than 1600 MPN/100ml. The ammonia concentration varies from 0.38 to 0.98 mg/l. The electrical conductivity of the samples varies from 538 to 725 µS/cm. The total hardness varies from 130 to 168 mg/l. The chloride concentrations were found to be in the range of 96 to 115 mg/l. Similarly, the fluoride concentration was found to be in the range of 0.16 to 0.29 mg/l. The calcium concentrations varies from 33 to 45 mg/l and magnesium concentrations were found to be 11.5 to 13.2 mg/l respectively. Total dissolved solids (TDS) concentration is found to be 305 to 421 mg/l.

From the revalidated data of surface and groundwater samples, it is evident that there is no change in the chemical parameters.

3.12 Soil environment

The present study of the soil quality establishes the baseline characteristics and this will help in future in identifying the incremental concentrations if any, due to the operation of the Udangudi Thermal power plant. The sampling locations have been identified to determine the baseline soil characteristics of the study area and to determine the impact of proposed project on soil characteristics.

3.12.1 Data generation

For studying soil quality of the region, eight (8) sampling locations were selected to assess the soil conditions in and vicinity of the project area based on various land use conditions. The physical and chemical concentrations were determined. The samples were collected from different specified depths viz., 30 cm, 60 cm and 90 cm. The samples

were analyzed for physical and chemical characteristics. The samples have been analyzed as per the established scientific methods for physio-chemical parameters.

3.12.2 Soil sampling locations

The details of the sampling locations selected for soil sampling are given in **Table 3.19** and shown in **Figure 3.20 & Figure.3.21.**

Table 3-19 Details of soil sampling locations

Soil quality monitoring in 10 km radius				
Code	**Location**	**Latitude & Longitude**	**Distance (km) & Direction**	**Environmental Setting**
S 1	Project site	8°26'28.21"N 78°4'9.10"E	-	Industrial
S 2	Thanadavankadu	8°22'42.45"N 78°00' 59.15"E	6.21 SW	Residential
S 3	Nainarpathu	8°27'11.51"N 78°2'42.51"E	2.07 W	Residential
S 4	Muthaiya puram	8°28'26.23"N 78°4'26.79"E	2.93 N	Residential
S5	Kulasekharapatnam	8°23'30.67"N 78°3'6.49"E	3 S	Residential
S 6	Paramankurichi	8°28'58.02"N 78°2'35.47"E	4.89 NW	Residential
S7	Mardhurkarai	8°27'23.43"N 78°0'5.90"E	6.6 W	Residential
S 8	Udangudi	8°25'40.59"N 78°1'41.72"E	2.61 W	Commercial

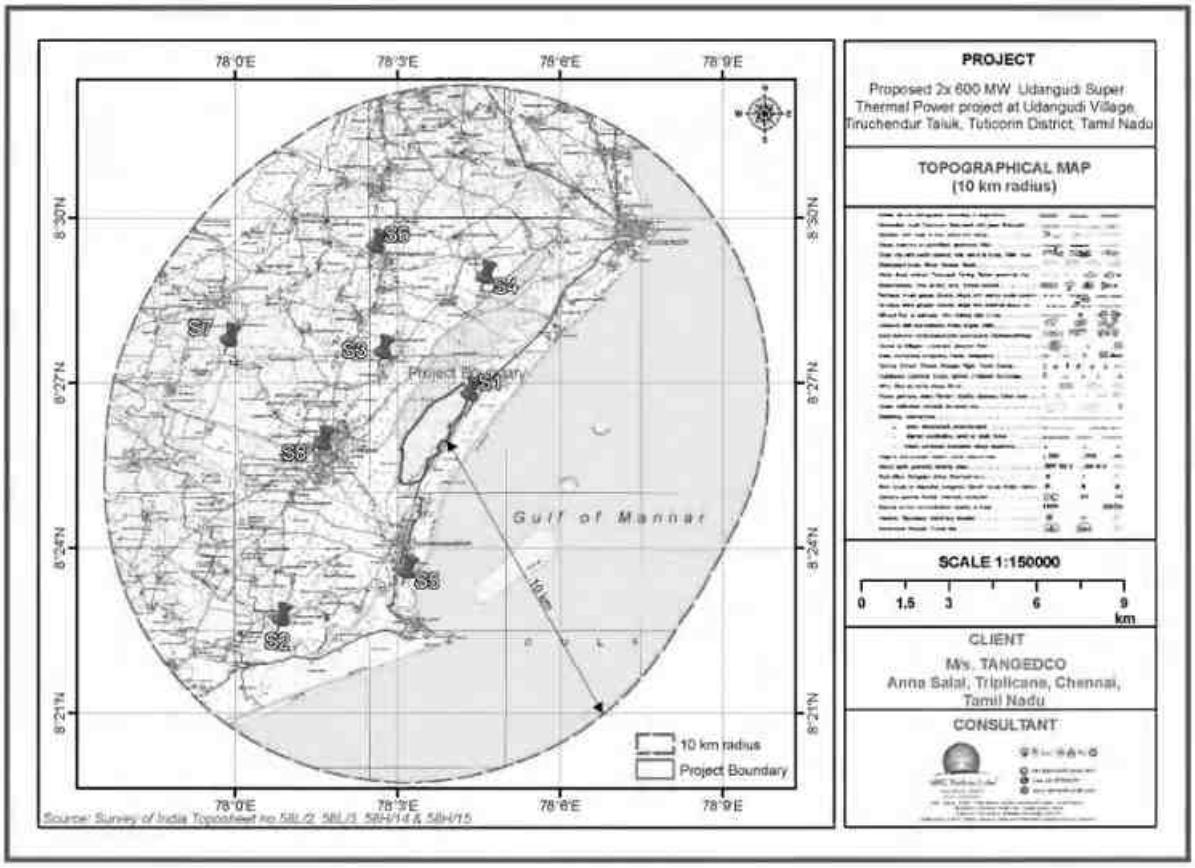


Figure 3-20 Soil sampling locations

Figure 3-21 Soil sampling photos

3.12.3 Baseline soil status

The soil quality at all the locations during the study period is tabulated in **Table 3.20**. The results are compared with “Standard Soil Classification” given in **Table 3.21**.

Table 3-20 Analytical results of soil samples

Existing baseline data during June-September 2021

No	Parameter	Units	S1	S2	S3	S4	S5	Remarks	
1	Texture								
	Sand	%	86.1	40	78.5	82.5	58.9	Dominated by sandy texture	
	Silt	%	9.8	32	7.9	13.2	7.4		
	Clay	%	4.1	28	13.6	4.3	33.7		
2	pH	-	9.0	9.9	9.5	8.7	8.8	<6.5	Acidic[13]
								6.5-7.8	Neutral
								7.8-8.5	Alkaline
								>8.5	Alkali
3	Moisture	%	2.32	9.35	5.46	0.93	4.31	Low moisture content. Soil in the area is relatively dry.	
4	conductivity	µs/cm	162	382	169	143	1208	0-800	Normal[14]
								800-1600	Slightly saline
								1600-3200	Injurious to most crops
								>3200	Critically injurious
5	Specific gravity	-	2.52	2.4	2.56	2.48	2.41	Specific gravity of sandy soil range between 2.65-2.67[15]	
6	Porosity	%	24	32	25	22	29	Typical coarse sand has a porosity range of 35-46%	
7	Sodium as Na	mg/kg	119	680	254	72	1187	-	
8	Available Nitrogen	mg/kg	68	49	82	94	64	Low [16]	<240 kg/ha
								Medium	240-480 kg/ha
								high	>480kg/ha
9	Nitrate Nitrogen	mg/kg	17.3	12.5	20.3	22.8	29.2	-	

No	Parameter	Units	S1	S2	S3	S4	S5	Remarks	
10	Available phosphorus as P	mg/kg	14.7	9.7	16.1	20.3	18.5	Low	<11 kg/ha
								Medium	11-22 kg/ha
								high	>22kg/ha
11	Calcium as Ca	mg/kg	101	192	83	78	66	-	
12	Magnesium as Mg	mg/kg	37	25	49	39	74	-	
13	Acidity as $CaCO_3$	mg/kg	Nil	Nil	Nil	Nil	Nil	-	
14	Alkalinity as CaCO3	mg/kg	497	876	602	292	602	-	
15	Sulphate Sulphur as S	mg/kg	28	51	39	29	49	-	
16	Boron as B	mg/kg	1.5	1.1	1.3	1.8	1.4	-	
17	Total organic carbon	%	0.20	0.98	0.32	0.25	0.64	Low	<0.5
								Medium	0.5-0.75
								high	>0.75
18	Chloride as Cl	mg/kg	52	291	121	73	631	--	
19	Sodium absorption ratio	-	2.56	12.23	5.45	1.65	23.79		
20	Bulk density	g/cm^3	1.50	1.43	1.53	1.47	1.38	Fine to medium soils has a bulk density range of 1.0-1.6[17]	
21	Water holding capacity	%	23.2	34	25.8	22.6	28.9	Sandy soils are porous and permeable	
22	Available potassium	mg/kg	28	110	98	46	86	Low	<110 kg/ha
								Medium	110-280 kg/ha
								high	>280kg/ha
23	permeability	Cm/hr	3.9	1.2	2.8	3.6	1.8	0.5-2.0 will come under moderately slow permeability soil class[18]	
24	Iron as Fe	%	0.27	0.45	0.37	0.42	0.75	-	
25	Cadmium as Cd	mg/kg	BDL (DL:2.0)	BDL (DL:2.0)	BDL (DL:2.0)	BDL (DL:2.0)	BDL (DL:2.0)	-	
26	Chromium as Cr	mg/kg	BDL (DL:5.0)	28.24	16.29	BDL (DL:5.0)	41.2	Low value. Within Dutch intervention standard of 380 mg/kg[19]	
27	Manganese as Mn	mg/kg	34.87	69.18	43.21	44.62	178.52	-	

No	Parameter	Units	S1	S2	S3	S4	S5	Remarks
28	Lead as Pb	mg/kg	BDL (DL:5.0)	30.39	BDL (DL:5.0)	BDL (DL:5.0)	13.77	Low value. Within Dutch intervention standard of 530 mg/kg
29	Zinc as Zn	mg/kg	37.41	63.85	43.12	26.87	53.26	Low value. Within Dutch intervention standard of 720 mg/kg
30	Copper as Cu	mg/kg	BDL (DL:3.0)	58.26	8.37	BDL (DL:3.0)	18.94	Low value. Within Dutch intervention standard of 190 mg/kg
31	Mercury as Hg	mg/kg	BDL (DL:0.2)	BDL (DL:0.2)	BDL (DL:0.2)	BDL (DL:0.2)	BDL (DL:0.2)	Not detected. Dutch intervention value:10 mg/kg
32	Molybdenum as Mo	mg/kg	BDL (DL:10.0)	BDL (DL:10.0)	BDL (DL:10.0)	BDL (DL:10.0)	BDL (DL:10.0)	-
33	Poly Aromatic Hydrocarbons (PAH's)							
	Naphthalene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Acenaphthylene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	2-bromo-naphthalene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Acenaphthene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	fluorene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	phenanthrene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Anthracene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Pyrene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Fluoranthene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	

No	Parameter	Units	S1	S2	S3	S4	S5	Remarks
	Chrysene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Benz[a]pyrene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Benzo[a]fluoranthene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Benzo[ghi]perylene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Dibenz[a,h]anthracene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	
	Indeno[1,2,3-cd]pyrene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	

No	Parameter	Units	S6	S7	S8	S9	S10	S11	Remarks	
1	Texture									
	Sand	%	88.5	82.2	85.0	61.0	82.5	86.3	Dominated by sandy texture	
	Silt	%	6.3	12.5	9.9	28.2	13.4	8.8		
	Clay	%	5.2	5.3	5.1	10.8	4.1	4.9		
2	pH	-	7.2	6.8	6.6	6.4	8.4	6.9	<6.5	Acidic[13]
									6.5-7.8	Neutral
									7.8-8.5	Alkaline
									>8.5	Alkali
3	Moisture	%	1.34	1.46	1.13	0.69	0.98	0.87	Indicate dry soil	
4	conductivity	µs/cm	167	133	210	94	175	116	0-800	Normal[21]
									800-1600	Slightly saline
									1600-3200	Injurious to most crops
									>3200	Critically injurious
5	Specific gravity	-	2.58	2.49	2.45	2.56	2.42	2.49	Specific gravity is slightly on the lower side. Normal reported	

No	Parameter	Units	S6	S7	S8	S9	S10	S11	Remarks	
									value is between 2.65-2.67	
6	Porosity	%	20	24	22	28	26	20	Typical coarse sand has a porosity range of 35-46%	
7	Sodium as Na	mg/kg	53	62	66	41	275	54	-	
8	Available Nitrogen	mg/kg	91	58	71	76	80	76	Low [22]	<240 kg/ha
									Medium	240-480 kg/ha
									high	>480kg/ha
9	Nitrate Nitrogen	mg/kg	18.6	15.2	19.3	14.8	21.5	16.6	-	
10	Available phosphorus as P	mg/kg	22.9	12.6	14.8	16.2	17.2	14.2	Low	<11 kg/ha
									Medium	11-22 kg/ha
									high	>22kg/ha
11	Calcium as Ca	mg/kg	29	40	48	20	121	51	-	
12	Magnesium as Mg	mg/kg	12	49	31	25	49	37	-	
13	Acidity as $CaCO_3$	mg/kg	8	14	20	28	nil	24	-	
14	Alkalinity as CaCO3	mg/kg	55	62	71	32	219	93	-	
15	Sulphate Sulphur as S	mg/kg	14	25	27	18	28	34	-	
16	Boron as B	mg/kg	1.1	1.6	2.1	0.95	1.8	1.01	-	
17	Total organic carbon	%	0.21	0.28	0.25	0.12	0.26	0.21	Low	<0.5
									Medium	0.5-0.75
									high	>0.75
18	Chloride as Cl	mg/kg	58	97	102	97	70	68	--	
19	Sodium absorption ratio	-	2.08	1.55	1.82	1.44	5.32	1.4	-	
20	Bulk density	g/cm^3	1.51	1.46	1.43	1.52	1.38	1.47	Fine to medium soils has a bulk density range of 1.0-1.6[17]	
21	Water holding capacity	%	24.8	26	22.4	24.6	22.6	24	Sandy soils are porous and permeable	
22	Available potassium	mg/kg	24	40	33	17	17	58	Low	<110 kg/ha
									Medium	110-280 kg/ha
									high	>280kg/ha

No	Parameter	Units	S6	S7	S8	S9	S10	S11	Remarks
23	permeability	Cm/hr	4.3	3.7	3.9	3.2	3.6	3.8	-
24	Iron as Fe	%	0.47	0.30	0.30	0.28	0.34	0.39	-
25	Cadmium as Cd	mg/kg	BDL (DL:2.0)	BDL (DL:2.0)	BDL (DL:2.0)	BDL (DL:2.0)	BDL (DL:2.0)	BDL (DL:2.0)	-
26	Chromium as Cr	mg/kg	21.34	18.42	25.16	18.47	22.19	25.61	Low value. Within Dutch intervention standard of 380 mg/kg
27	Manganese as Mn	mg/kg	61.37	32.63	40.19	26.84	51.63	39.24	-
28	Lead as Pb	mg/kg	BDL (DL:5.0)	BDL (DL:5.0)	BDL (DL:5.0)	BDL (DL:5.0)	BDL (DL:5.0)	BDL (DL:5.0)	Low value. Within Dutch intervention standard of 530 mg/kg
29	Zinc as Zn	mg/kg	59.18	40.40	31.29	33.46	59.84	51.25	Low value. Within Dutch intervention standard of 720 mg/kg
30	Copper as Cu	mg/kg	5.91	6.02	5.23	BDL (DL:3.0)	29.2	5.65	Low value. Within Dutch intervention standard of 190 mg/kg
31	Mercury as Hg	mg/kg	BDL (DL:0.2)	BDL (DL:0.2)	BDL (DL:0.2)	BDL (DL:0.2)	BDL (DL:0.2)	BDL (DL:0.2)	Not detected. Dutch intervention value:10 mg/kg
32	Molybdenum as Mo	mg/kg							-
33	Poly Aromatic Hydrocarbons (PAH's)								
	Naphthalene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Acenaphthylene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	2-bromo-naphthalene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Acenaphthene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	fluorene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	phenanthrene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-

No	Parameter	Units	S6	S7	S8	S9	S10	S11	Remarks
	Anthracene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Pyrene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Fluoranthene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Chrysene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Benz[a]pyrene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Benzo[a]fluoranthene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Benzo[ghi]perylene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Dibenz[a,h]anthracene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-
	Indeno[1,2,3-cd]pyrene	mg/kg	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)		-

Revalidated baseline data during March-May 2024

Sl. No.	Parameters	Test Methods	S1	S2	S3	S4	S5	S6	S7	S8
1.	pH	IS -2720(Part 26) 1987(RA 2011)	7.54	7.81	7.37	7.84	7.33	7.62	7.44	7.81
2.	Bulk Density, g/cc	FAO Chapter 3, ABCTL/SOIL/SOP 1	1.57	1.51	1.53	1.38	1.58	1.39	1.41	1.47
3.	Electrical Conductivity, mS/cm	IS -14767:2000 (RA 2010)	0.178	0.114	0.097	0.138	0.214	0.121	0.098	0.154
4.	Total Nitrogen, kg/ha	IS -14684:1999, Reaff:2008	59	87	68	94	45	76	89	53
5.	Available Phosphorous, kg/ha	FAO Chapter 3, ABCTL/SOIL/SOP 2	21.1	32.8	27.4	46.9	30.3	41.1	37.3	22.9

Sl. No.	Parameters	Test Methods	S1	S2	S3	S4	S5	S6	S7	S8
6.	Available Potassium, kg/ha	FAO Chapter 3, ABCTL/SOIL/SOP 7	324	282	364	391	352	258	312	362
7.	Exchangeable Calcium as Ca,m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 4	15.6	16.6	17.1	18.4	14.8	19	17.7	16.5
8.	Exchangeable Magnesium as Mg, m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 5	4.89	6.11	5.84	5.23	5.56	6.87	4.97	5.22
9.	Exchangeable Sodium as Na, m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 6	1.34	1.08	1.47	1.16	1.84	1.34	1.09	1.28
10.	Organic matter (%)	IS 2720 (Part 22):1972, Reaff:2010	0.58	0.91	0.84	0.73	0.51	0.73	0.88	0.64
11.	Lead as Pb	EPA 3500 B & 6020 B	3.21	2.58	4.97	2.78	4.11	2.63	4.84	3.69
12.	Chromium as Cr	EPA 3500 B & 6020 B	4.74	5.69	7.54	6.98	8.21	6.84	9.26	7.45
13.	Nickel as Ni	EPA 3500 B & 6020 B	2.65	4.18	3.11	2.57	4.75	3.62	2.98	5.47
14.	Cadmium as Cd	EPA 3500 B & 6020 B	BDL (<0.5)							
15.	Mercury as Hg	EPA 3500 B & 6020 B	BDL (<0.5)							
16.	Arsenic as As	EPA 3500 B & 6020 B	BDL (<0.5)							
17.	Texture Classification	Robinson Pipette Method	Loamy Sand	Sandy Loam	Sandy Loam	Loam	Loamy Sand	Loam	Loam	Sandy Loam
18.	Sand (%)		81.4	68.4	65.2	39.2	83.6	37.7	38.4	68.1
19.	Clay (%)		1.1	5.4	4.8	26.4	0.8	25.4	26.9	3.7
20.	Silt (%)		17.5	26.2	30	34.4	15.6	36.9	34.7	28.2

Table 3-21 Standard soil classification

Sl. No.	Soil Test	Classification
1	pH	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.00 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline 9.01 very strongly alkaline
2	Electrical Conductivity (mS/cm)	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops
3	Organic Carbon (%)	Upto 0.2: very less 0.21-0.4: less 0.41-0.5 medium, 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4	Nitrogen (Kg/ha)	Upto 50 very less 51-100 less 101-150 good 151-300 Better > 300 sufficient
5	Phosphorus (Kg/ha)	Upto 15 very less 16-30 less 31-50 medium, 51-65 on an average sufficient 66-80 sufficient > 80 more than sufficient
6	Potash (Kg/ha)	0 -120 very less 120-180 less 181-240 medium 241-300 average 301-360 better > 360 more than sufficient

3.12.4 Observations

Existing baseline data during June-September 2021

From the tested results the following conclusions are derived.

- The pH of the soil was ranging from 6.4 to 9.9 indicating the soils are moderately alkaline in nature.

- Conductivity of the soil ranges from 94 to 1208 µs/cm indicating the soil in the study area is non-saline in nature.
- Texture of the soil sample is predominantly loamy sand in nature.
- The nitrogen content ranges between 49 to 94 kg/ha, indicates the soil have less quantity of nitrogen in the locality.
- The value of phosphorus content varies between 9.7 to 22.9 kg/ha indicates that the soil has less to medium quantities of phosphorus.
- The potassium content varies from 17 to 110 kg/ha which indicates that the soils have more than sufficient quantities of potassium.

Revalidated baseline data during March-May 2024

From the tested results the following conclusions are derived.

- The pH of the soil was ranging from 7.33 to 7.84 indicating the soils are moderately alkaline in nature.
- Conductivity of the soil ranges from 0.097 to 0.214 mS/cm indicating the soil in the study area is non-saline in nature.
- Texture of the soil sample is predominantly loamy sand in nature.
- Soil organic content varied from 0.51 to 0.91% which indicates sufficient level of organic matter.
- The nitrogen content ranges between 45 to 94 kg/ha, indicates the soil have less quantity of nitrogen in the locality.
- The value of phosphorus content varies between 21.1 to 46.9 kg/ha indicates that the soil has less to medium quantities of phosphorus.
- The potassium content varies from 258 to 391 kg/ha which indicates that the soils have more than sufficient quantities of potassium.

From the results, it is evident that there is no apparent variation in the tested parameters of soil and thereby it can be concluded the proposed project does not contribute any pollutant to the soil.

3.13 Ecological environment

An ecosystem is composed of plant and animal populations, and it differs from natural community designation in that it involves the total nutrient and energy economics of the system as well as the organisms involved. Ecosystems are self-maintained and self-contained. Natural ecosystems are invariably richer in species and more stable than those of artificially developed, due to their many inter-dependencies and inter-relationships.

The plant and animal populations in an area from recognizable associations called Natural communities. These are characterized by a few species called dominants. Natural communities have structure based on the life forms (e.g. grass) of the species that make them up. A hardwood forest has a given structure by virtue of the trees and shrubs that compose it. The species composition refers to the kinds of species making up to the community. The variety of species and their relative numbers are referred to as species diversity. A community composed of few species is called simple or one of Low diversity. A community composed of many species is called complex or one of high

diversity. The greater the biotic diversity, the greater the number and kind of habitats for the inhabitants of the community. Based on the physical setting and the kind of distribution of flora and fauna, the study area can be classified into crop, terrestrial and aquatic ecosystems.

Ecosystem shows complex inter-relationships between biotic and abiotic components leading to dependence, competition and mutualism. Biotic components comprise both plant and animal communities, interacting not only within and between themselves but also with the abiotic components of the environment. Generally, biological communities are good indicators of climatic and edaphic factors because of their strong relationships with them. The studies on the biological aspects of the ecosystem are important in Environment Impact Assessment studies for the suitability of natural flora and fauna. Information on the impact of environment stress on the community structure serves as an inexpensive and efficient early warning system to check the damage on a particular ecosystem.

A change in the composition of biotic communities under stress is reflected through a change in the distribution pattern, density, diversity, frequency, dominance and abundance of natural species of fauna and flora existing in the ecosystem. These changes over a span of times can be quantified and related to the existing environment.

3.13.1 Objectives of ecological studies

The objectives of ecological study during the study period of EIA study may be outlined as follows:

- To characterize the environmental components like land, water, flora and fauna;
- To understand their present status;
- To understand carrying capacity of the ecosystem;
- To assess present bio-diversity; and
- To identify susceptible and sensitive areas.

3.13.2 Regional biodiversity

Tamil Nadu has a total land area of 1,30,060 km² which constitute of about 3.96% of the total geographical area of the country. Physiographically, the State can be divided into four major regions viz Coastal Plains, Eastern Ghats, Central Plateau and Western Ghats. The main rivers of the State are Cauvery, Bhavani, Palar, Vaigai etc. which drain into the Bay of Bengal. Tamil Nadu has a Humid Tropical Climate.

Forest Biodiversity in the State is mainly confined to Western Ghats and Eastern Ghats. Forest Cover of the State is 21,570 km² which is 16.55% of the State's geographical area (GA). In terms of forest canopy density classes, the State has 3,593 km² (2.76% of GA) very dense forest, 11,034 km² (8.48% of GA) moderately dense forest and 11,729 km² (9.07 % of GA) open forest respectively (Source: FSI, 2021; www.forests.tn.gov.in).

The mangrove cover in the State is 44.83 km², which is 0.035% of the State total geographical area. The Very Dense mangrove comprises 1.04 km² of the mangrove cover, Moderately Dense mangrove is 27.24 km² while open mangroves constitute an area of 16.55 km².

Recorded Forest Area (RFA) in the State is 22,877 km² which constitute of about 17.59% and 2.99% of the total geographical area of the State and Country respectively, of which 20,293 km² is Reserved Forest, 1,782 km² is Protected Forest and 802 km² is Unclassed Forests. The RFA covers 17.59% of geographical area of the State. The reserved, protected and unclassed forests are 88.70%, 7.79% and 3.51% of the recorded forest area in the State respectively.

Tropical dry Deciduous Forest covers an area of 12.23 lakh ha constituting 54.30%, Tropical Thorn Forest covers an area of 5 lakh ha constituting 22.10%, Tropical Moist Deciduous Forest covers an area of 2.60 lakh ha constituting a percentage of 11.10%. The Biodiversity rich forest types are the Tropical Wet Evergreen Forest covering an area of 0.60 lakh ha constituting 2.67%, Tropical Semi Evergreen Forest covering an area of 0.23 lakh ha constituting 1.01%, Subtropical Broad leaved Hill Forest covers an area of 1.14 lakh ha constituting 5.04%, the Tropical Dry Evergreen Forest which is a unique type of Tamil Nadu covers an area of 0.26 lakh ha constituting 1.16%, the mangrove forest covers an area of approximately 0.23 lakh ha constituting 1.01%.

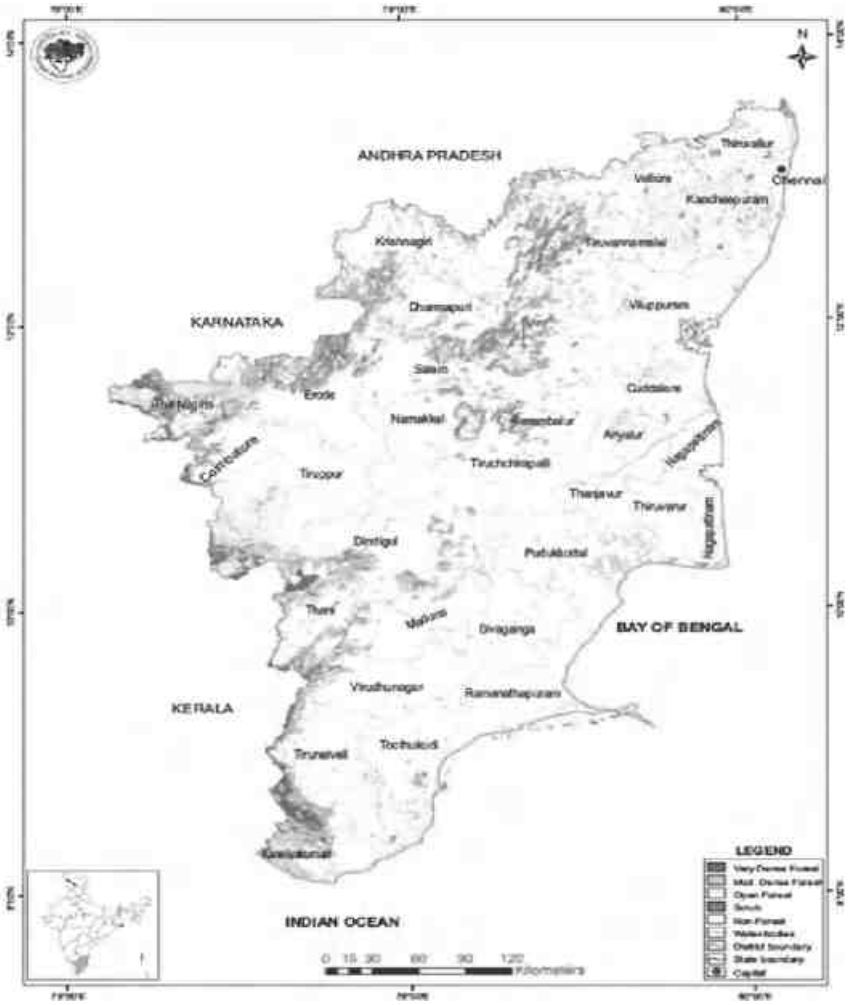


Figure 3-22 Forest Map of Tamil Nadu (Source: Forest Survey of India, 2021)

Habitat fragmentation is the process by which habitats which were once continuous become divided into separate fragments. This mainly happens due to human activities such as agriculture, rural development and urbanization. As cities and civilization grow in

size, the fragmentation of habitats causes extinction of many plant and animal species and is the largest threat to biodiversity on earth. Designing with nature can improve the quality of cities for people, plants and animals. In doing so, ecosystem services can be enhanced.

The state's rich biodiversity and the natural resources are facing a serious threat from the growing human encroachments, cattle grazing, collection of fire wood, man-animal conflict, poaching, illicit felling, mass tourism and pilgrimage etc. and also from various developmental activities. Biodiversity Conservation has been structured covering the Ecosystem Diversity, Species Diversity and Genetic Diversity. Species Diversity has been structured separately for plants and animals. Wild plant diversity has been structured on the lines of Red-listed plants, Endemic plants, Medicinal plants, Wild relatives of cultivated plants, allied species of cultivated species and others.

Wild Animal diversity has been structured on the lines of Red listed animals, Endemic animals, Flagship species, Keystone species, Pollinators and others. Domesticated species diversity has been structured on the lines of Cultivated Plants and Domesticated animals.

Thoothukudi District

Thoothukudi District lies in the south-eastern part of Tamil Nadu. It is bounded on the north by the districts of Tirunelveli, Virudhunagar, and Ramanathapuram, on the east and southeast by the Gulf of Mannar and on the west and southwest by Tirunelveli district. The total area of the district is 4621 km². The entire Thoothukudi district is a flat terrain with the slope less than 1%. The total length of the coast in the east is 90 km.

Tamiraparani River which rises in Agasthiyamalai of the western ghats, flows through Srivaikundam and Thiruchendur taluks and joins the sea at Punnakayl in Srivaikundam taluks. Pambayar and Manimuthar are the chief tributaries of Tamiraparani, which pass through the district. The Malattar and Uppodai flowing in Kovilpatti taluk are drainage courses. Tamiraparani and Manimutharu are the catchment areas of river basins, which have their place of origin in the Pothigaimalai. There are no large reservoirs in this district as the Papanasam and Manimuthar dams located in the Tirunelveli District in the Thamirabarani River's flow are the main sources of irrigation.

The soil of the district is covered by Black Cotton soil in the west with isolated red soil patches in high ground. The sandy soil is present in the coastal tract. Alluvial soil is restricted to river flood plain and coastal part. Alkaline and saline soils are also noticed at places.

Most of the agricultural activity is dominated by Paddy, Cumbu, Cholam, Kuthiraivali and other pulses, fruit crops and vegetables. The major cash crops Coconut, Groundnut, Sugarcane and Banana are also cultivated in considerable area.

3.13.3 Biogeographic zone, Province

This study has been carried out during the month of March 2024 for the purpose of providing an independent and comprehensive baseline assessment of the flora, terrestrial vertebrate, aquatic fauna and associated habitat values of the site and within

10 km radius area around the project site at Thoothukudi District, Tamil Nadu and a subsequent assessment of potential ecological impacts.

The study area falls under coastal category as far as the Indian biogeographical zones (*Rodger, Panwar, Mathur 2000*) are concerned. Under the biogeographical provinces, the study area falls under the category of **8B: Coasts - East Coast.**

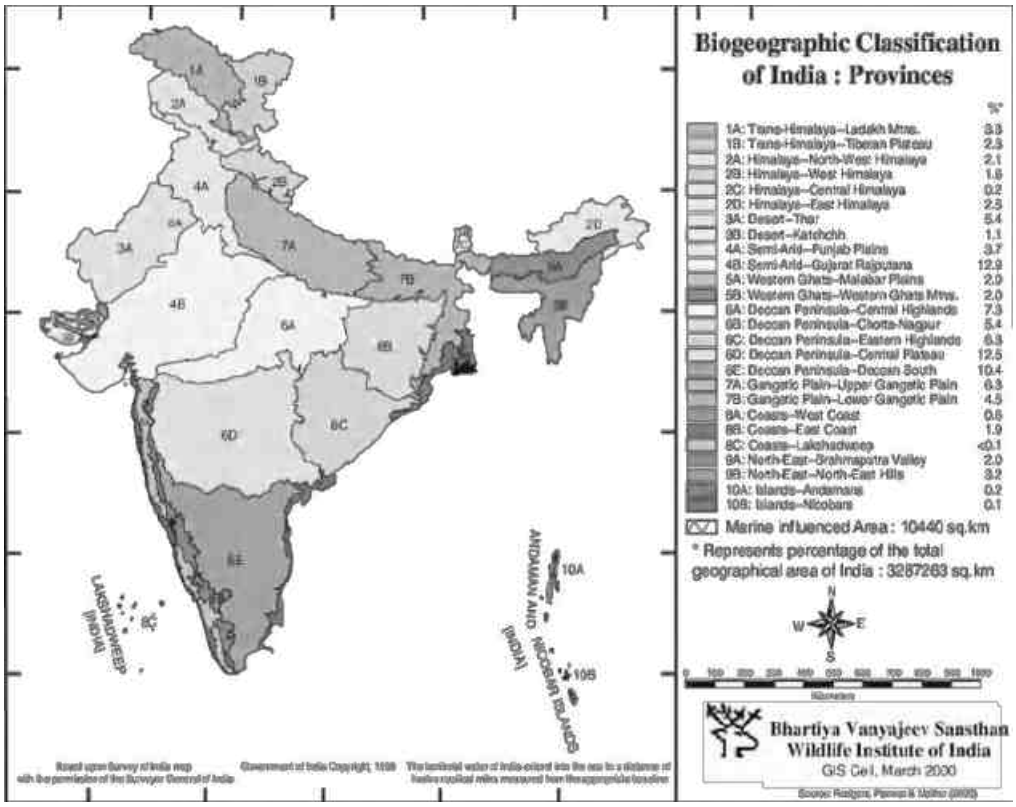


Figure 3-23 Map showing the Bio-geographic provinces of India

The field investigation and satellite imagery data show that the study area is a mixture of coastal region, forest land, agricultural and get irrigated by tanks and bore wells. The study area includes Karumeni River located about 3.75 km towards South, Thangaikulam located about 6.08 km towards West, Ellappanayakan kulam located about 4 km towards North and Avudayarkulam located about 7 km towards Northeast. Mangroves and sand dunes are located about 8.08 km and 0.5 km respectively from the project site.

Gulf of Mannar Marine National Park, a biosphere reserve is located at 45 kms approximately towards Northeast from the project site.

During the field study, it was observed the dominance of herbs and grasses like Boerhavia diffusa, Cynodon dactylon, Achyranthes aspera, Amaranthus spinosus, Ageratum conyzoides, Mimosa pudica etc. From the primary observations, the tree species recorded in the forest were Cocos nucifera, Azadirachta indica, Musa paradisiaca, Acacia nilotica, Psidium guajava etc. The terrestrial flora in the study area consisting of various under shrubs and herbs is conspicuous during and after the rainy season only. Some of the common shrub species are Prosopis juliflora, Lantana camara, Datura metel, Calotropis procera, Tecoma stans etc.

The detailed ecological assessment of the study area has been carried out with the following objectives:

- To establish the present status of ecological conditions surrounding the project location;
- To study the existing anthropogenic stresses on the prevailing ecosystem.
- To identify and predict the likely impacts on the local ecosystem from the proposed activities;
- To list out floral species, terrestrial vertebrate and aquatic flora and fauna present within the study area, and significance status under The Wildlife (Protection) Act, 1972;
- To define ecological/conservation status of each species as per IUCN categories (Red Data List).
- To formulate migratory measures and a sustainable Environmental Management Plan (EMP) basing upon the likely impacts.

During survey, following aspects were considered for ecological studies:

- Assessment of present status of flora and fauna;
- Identification of rare and endangered species of plants and animals (if any);
- Identification of ecologically sensitive areas within the study area;
- Assessment of migratory route of wildlife (if any); and
- Assessment of Aquatic Ecology with specific reference to aquatic birds and fishery resources.

3.13.4 Methodology adopted for the study

A desktop review (published documents etc.) was conducted to determine the forest area through Satellite imagery, vegetation type (Champion and Seth, 1962), floral and faunal assemblage in the study area. Terrestrial investigations for flora and fauna records were collected by random field survey and a checklist was prepared. During field survey, discussions with the local people were carried-out to collect information related to local biodiversity in and around the villages. The ecological status of the study area has been assessed based on the following methodology:

- Primary field surveys to establish primary baseline of the study area;
- Compilation of secondary information available in published literatures/working plans was referred from State Forest Department.
- Site Verification and finalization in consultation with local inhabitants.

A. Floral study

The assessment of the flora of the study area is done by an extensive field survey of the area.

- Plants species were identified based on their specific diagnostics characters of family, genus and species using available floral, other related literature.
- Besides the identification of plant species, information was collected on the vernacular names and uses of plants made by local inhabitants.

- Qualitative analysis of vegetation is made by two different methods such as floristic (by simple studying various genera and species of various plant groups i.e. herbs, shrubs, trees etc).

B. Faunal study

Ground surveys are carried out by trekking the study area for identification of important animal groups such as birds, mammals and reptiles for sampling of animals through the following methods.

- For sampling birds/ avifauna 'point sampling' along the fixed transects (foot trails) were done to record all the species of birds with the help of binoculars; field guides and photography for more than 1 hour on each transect (n=4).
- For sampling mammals, 'direct count on open width (20 m) transect' were used on the same transects. Besides, information on recent sightings/records of mammals by the locals was also collected from the study areas.
- 'Reptiles' mainly lizards were sampled by 'direct count on open width transects'.
- Secondary information collected from local villagers, published government data etc.

List of the endangered and endemic species as per the schedule of The Wildlife Protection Act, 1972

Emphasis is given to identify avifauna and mammals to determine the presence and absence of Schedule-1 species, listed in The Wildlife Protection Act 1972, as well as in Red List of IUCN. Various methods used for study animals are as follows:

1. Point Survey Method: Observations were made at each site for 15-30 min duration.
2. Road Side Counts: The observer travelled by motor vehicles from site to site and all sightings were recorded.

3.13.5 Flora in the study area

During the primary survey, about 121 floral species observed. The most dominant tree species in the entire study area was dominated Cocos nucifera, Azadirachta indica, Musa paradisiaca, Acacia nilotica, Psidium guajava etc. Most dominant shrubs in the study area were, Prosopis juliflora, Lantana camara, Datura metel, Calotropis procera, Tecoma stans etc. Among the herb species observed are Boerhavia diffusa, Cynodon dactylon, Achyranthes aspera, Amaranthus spinosus, Ageratum conyzoides, Mimosa pudica, etc. The list of flora observed in the entire study area is given below:

Table 3-22 List of Flora observed in the study area

S. No.	Scientific Name	Local Name/Common Name	Family	IUCN Conservation Status
Tree				
1	*Acacia Arabica*	Karuvel	Mimosaceae	Least Concern
2	*Albizia lebbeck.*	Peruvagai	Mimosaceae	Least Concern
3	*Annona squamosal*	Seetha	Annonaceae	Least Concern
4	*Azadirachta indica*	Vembu	Meliaceae	Least Concern
5	*Borassus flabellifer*	Panai	Arecaceae	Endangered
6	*Cocos nucifera*	Thennai	Areacaceae	Least Concern
7	*Cordia dichotoma*	Naruvili	Ehretiaceae	Least Concern
8	*Delonix elata*	Vaathanarayani	Fabaceae	Least Concern
9	*Erythrina indica*	Kalyana Murungai	Fabaceae	Least Concern
10	*Ficus benghalensis*	Aal	Moraceae	Least Concern
11	*Ficus racemosa*	Atthi	Moraceae	Not assessed
12	*Ficus religiosa*	Arasu	Moraceae	Not assessed
13	*Mangifera indica*	Maa	Anacardiceae	Least Concern
14	*Manilkara achras*	Sappotta	Sapotaceae	Least Concern
15	*Millingtonia hortensis*	Maramalli	Bignoniaceae	Least Concern
16	*Morinda tinctoria*	Nuna	Rubiaceae	Least Concern
17	*Moringa olefera*	Karimurungai	Moraginaceae	Least Concern
18	*Murraya koenjii*	Karivembu	Rubiaceae	Least Concern
19	*Musa paradisiac*	Naatu Vazhai	Musacaea	Least Concern
20	*Musa serpentia*	Vazhai	Musacaea	Least Concern
21	*Phyllanthus acidus.*	Arai Nelli	Euphorbiaceae	Least Concern
22	*Phyllanthus embilica*	Nelli	Euphorbiaceae	Least Concern
23	*Pithecellobium dulce*	Kuduka Puli	Mimosaceae	Least Concern

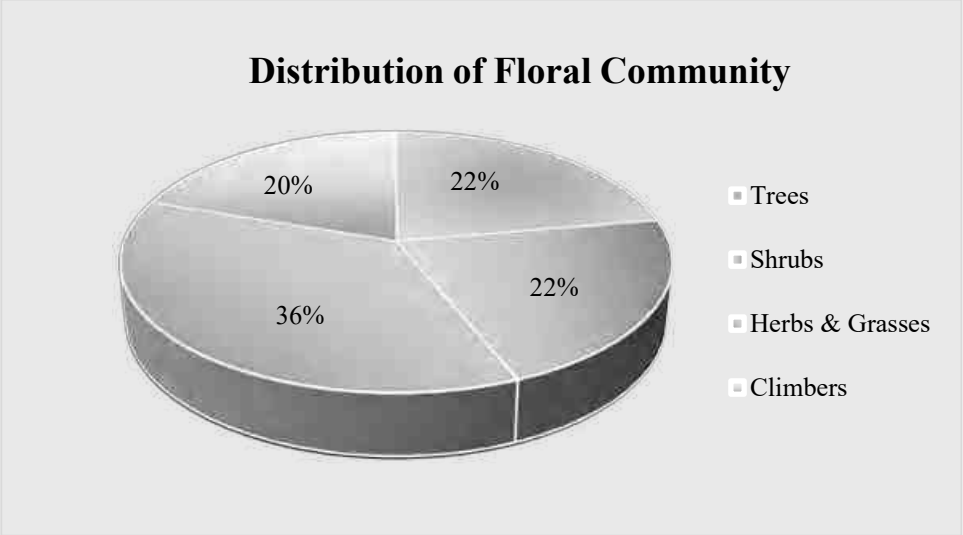
S. No.	Scientific Name	Local Name/Common Name	Family	IUCN Conservation Status
24	*Polyalthia longifolia.*	Nettilingam	Annonaceae	Least Concern
25	*Tamarindus indica*	Puli	Caesalpinaceae	Least Concern
26	*Thespesia populnea*	Poovarasu	Malvaceae	Not assessed
27	*Ziziphus jujubha*	Ilanthai	Rhamnaceae	Least Concern
Shrub				
1	*Datura metel*	Umathai	Solanaceae	Not assessed
2	*Ammannia baccifera*	Kalluruvi	Lythraceae	Least Concern
3	*Prosopis juliflora*	Vaelikaruvai	Fabaceaae	Not assessed
4	*Capparis decidua*	Cirakkoli	Capparaceae	Least Concern
5	*Bougainvillea spectabilis*	Kaagithapu	Nyctaginaceae	Not assessed
6	*Cassia auriculata*	Avaram	Caesalpiniaceae	Not assessed
7	*Calotropis gigantea*	Erukku	Asclepiadaceae	Not assessed
8	*Calotropis procera*	Vellai Erukku	Asclepiadaceae	Not assessed
9	*Datura stramonium*	Umathai	Solanaceae	Not assessed
10	*Citrus limon*	Elumicchai	Rutaceae	Least Concern
11	*Euphorbia tirucalli*	Amman-paccarici	Euphorbiaceae	Least Concern
12	*Hibiscus rosa-sinensis*	Chemparuththi	Malvaceae	Not assessed
13	*Jatropha curcas*	Kattukkottai	Euphorbiaceae	Least Concern
14	*Lantana camara*	Unnichedi	Verbenaceae	Not assessed
15	*Lawsonia inermis*	Maruthani	Lythraceae	Least Concern
16	*Nerium oleander*	Arali	Apocynaceae	Least Concern
17	*Oxalis corniculata*	Paliakiri	Oxalidaceae	Not assessed
18	*Ricinus communis*	Amanakku	Euphorbiaceae	Not assessed
19	*Sida cordifolia*	Arivalmukku	Malvaceae	Not assessed
20	*Vitex negundo*	Nochi	Lamiaceae	Least Concern
21	*Solanum incanum*	Karimulli	Solanaceae	Least Concern
22	*Tarenna asiatica*	Tharani	Rubiaceae	Not assessed
23	*Tecoma stans*	Manjarali	Bignoniaceae	Least Concern
24	*Thevetia peruviana*	Ponnarali	Apocynaceae	Vulnerable
25	*Xanthium strumarium*	Marul-umattai	Asteraceae	Not assessed
26	*Ziziphus nummularia*	Narielandai	Rhamnaceae	Not assessed
Herb & Grasses				

S. No.	Scientific Name	Local Name/Common Name	Family	IUCN Conservation Status
1	*Acalypha indica*	Kuppaimeni	Euphorbiaceae	Least Concern
2	*Achyranthus aspera*	Naayuruvi	Amarantheceae	Least Concern
3	*Aerva tomentosa*	Perumpelai	Amarantheceae	Least Concern
4	*Aerva lanata*	Siru Kanpelai	Amarantheceae	Least Concern
5	*Amaranthus viritis*	Kuppaikeerai	Amarantheceae	Least Concern
6	*Ammania baccifera*	Neermel Neruppu	Lythraceae	Least Concern
7	*Aristolochia bractiolata*	Aaduthendapaalai	Aristolochiaceae	Least Concern
8	*Asystasia gangetica*	Meti Keerai	Acanthaceae	Least Concern
9	*Barleria mysorensis*	Poochi Mullu	Acanthaceae	Least Concern
10	*Blumea oblique*	Kuththu Karanthai	Asteraceae	Least Concern
11	*Boerhaavia diffusa*	Mukkirattai	Nyctaginaceae	Not assessed
12	*Brassica juncea*	Kaduku	Brassaceae	Least Concern
13	*Cassia absus*	Iddikollu	Caesalpinaceae	Least Concern
14	*Cassia italic*	Surathu Nilavagai	Caesalpinaceae	Least Concern
15	*Cassia nigricans*	Nilapuli	Fabaceae	Least Concern
16	*Hybanthus enneaspermus*	Orithalthamarai	Violaceae	Not assessed
17	*Hyptis suaveolens*	Ganga Thulasi	Lamiaceae	Least Concern
18	*Indigofera tinctoria*	Avuri	Fabaceae	Least Concern
19	*Justicia quinqueangularis*	Thavasi Murungai	Fabaceae	Least Concern
20	*Lepidacanthis cristata*	Karapan Poondu	Acanthaceae	Least Concern
21	*Leucas aspera*	Thummbai	Acanthaceae	Least Concern
22	*Leucas zeylanica*	Nai Thumbai	Acanthaceae	Least Concern
23	*Ludwigia octovalvis*	Kaatu Kirambu	Lamiaceae	Least Concern
24	*Malva coromantaliana*	Punnakku Keerai	Lamiaceae	Least Concern

S. No.	Scientific Name	Local Name/Common Name	Family	IUCN Conservation Status
25	*Melochia corchorifolia*	Punnaku Keerai	Onagraceae	Least Concern
26	*Mollugo cereviana*	Parpadagam	Malvaceae	Least Concern
27	*Mollugo nudicalis*	Kaatu Parpadagam	Sterculiaceae	Least Concern
28	*Ocimum americanum*	Kanchankoorai	Molluginaceae	Least Concern
29	*Ocimum campechianum*	Ramathulasi	Molluginaceae	Least Concern
30	*Ruellia tuberosa*	Katu Amukara	Lamiaceae	Least Concern
31	*Sphaeranthus indicus*	Kottaikaranthai	Poaceae	Not assessed
32	*Sida acuta*	Arivvalmanai Poondu	Poaceae	Not assessed
33	*Sida cordifolia*	Kurunthotti	Poaceae	Least Concern
34	*Sida rhombifolia*	Sittamatti	Cyperaceae	Least Concern
35	*Sida cordata (vernonicifolia)*	Pazhampasi	Poaceae	Least Concern
36	*Spermococce hispida*	Naththaisoori	Poaceae	Least Concern
37	*Stylosanthes fruticosa*	Pura Kaali	Poaceae	Least Concern
38	*Synedrella nodiflora*	Mudiyendra Pachchai	Poaceae	Least Concern
39	*Apluda mutica*	Kattu Kanchippul	Poaceae	Least Concern
40	*Chloris barbata*	Kattuk Kothumai	Cyperaceae	Least Concern
41	*Echinocola colona*	Kuthirai Vaal Arusi	Poaceae	Least Concern
42	*Eragrostis ferruginea*	Pullu	Poaceae	Least Concern
43	*Kyllinga brevifolia*	Musthakasu	Cyperaceae	Least Concern
44	*Setaria verticillata*	Amarippul, Chataippul	Poaceae	Least Concern
		Climbers		
1	*Abrus precatorius*	Kunrimani	Fabaceae	Least Concern
2	*Canavalia ensiformis*	Kuthira Avarai	Fabaceae	Least Concern
3	*Canavalia gladiata*	Vaal Avarai, (Segapputampattai)	Fabaceae	Least Concern

S. No.	Scientific Name	Local Name/Common Name	Family	IUCN Conservation Status
4	*Cardiospermum halicacabum.*	Mudakaruthan	Sapindaceae	Least Concern
5	*Cissus quadrangularis*	Pirandai	Vitaceae	Least Concern
6	*Cissus quadrangularis varity trifolia*	Muppirandai	Vitaceae	Least Concern
7	*Clitoria ternatea*	Sangu Pushpam	Fabaceae	Not assessed
8	*Coccinia grandis*	Kovai	Cucurbitaceae	Least Concern
9	*Ctenolepis garcinii*	Kollam Paakal, Kollankovai	Cucurbitaceae	Least Concern
10	*Hemidesmus indicus.*	Nannari	Poriplocaceae	Least Concern
11	*Ipomoea marginata*	Narun Tali	Convolvulaceae	Least Concern
12	*Ipomoea obscura*	Ven Tali	Convolvulaceae	Least Concern
13	*Ipomoea pes tigridis*	Pulisuvadi	Convolvulaceae	Least Concern
14	*Kedrostis rostrata*	Appakovai	Cucurbitaceae	Least Concern
15	*Lagenaria siceraria*	Surai	Cucurbitaceae	Not assessed
16	*Luffa cylindrical*	Milagu Peerkupeipeerkku	Cucurbitaceae	Least Concern
17	*Merremia dissecta*	Savolikkoti	Convolvulaceae	Least Concern
18	*Oxystelma secamone (esculentum)*	Uci Paalai	Apocynaceae	Least Concern
19	*Passiflora foeitida*	Poonai Pudukan	Passifloraceae	Least Concern
20	*Pergularia daemea*	Veli Paruththi	Asclepiadaceae	Least Concern
21	*Rhynchosia minima*	Kaliyan Tuvarai, Katu Kollu	Fabaceae	Least Concern
22	*Solanum trilobatum.*	Thuthuvalai	Solanaceae	Least Concern
23	*Tinospora cordifolia*	Seenthil	Menispermaceae	Least Concern
24	*Tragia involucrate*	Kaanchori	Euphorbiaceae	Least Concern

Source: ABC Techno labs India Private Limited



3.13.6 Economically important flora of the study area

- Agricultural crops: The major crops cultivated in Thoothukudi District are Paddy, Sugarcane, Millets, Black gram and green gram. In canal fed areas paddy occupies the largest area of cultivation followed by green gram and black gram. Other crops grown in the region are pulses, groundnut and coconut. Different fruits like banana, papaya, mangoes, sapota, guava and vegetables like brinjal, tomato, lady's finger, drumsticks, coriander and chilies also grown by the local people.
- Medicinal plant species: The nearby area is also endowed with the several medicinal plants which are commonly available in the shrub forest and waste lands. The common medicinal plants of the region is Azadirachta indica (Neem).
- Fuel wood plant species: Local villagers use to collect dry leaves, stems and log to fulfil their daily need for fuel wood requirement. Azadirachta indica (Neem), Mangifera indica, etc. are the species used for fuel wood collection from the surrounding forest area.
- Rare and endangered floral species: As per IUCN redlist Borassus flabellifer (Panai) categorized as endangered species. During the vegetation survey in the study area did not encounter any such species which are endangered or threatened under IUCN (International Union for Conservation of Nature and Natural resources) guidelines.

3.13.7 Fauna in the study area

To prepare a detailed report on the status of faunal diversity within study area, field studies were conducted. Both direct (sighting) and indirect (evidences) observations methods were used to survey the faunal species around the study area. Additionally, reference of relevant literatures (published/ unpublished) and dialogues with local villagers were also carried out to consolidate the presence of faunal distribution in the area (Smith 1933-43, Ali and Ripley 1983, Daniel 1983, Prater 1993, Murthy and Chandrasekhar 1988).

Mammals: Total 10 mammalian species observed and recorded within the entire study area. There is no record of large herbivores and large carnivores in the oil fields. Among mammalian species Mole rat, large bandicoot Rat, Five striped squirrel, Indian Grey

Mongoose, Indian Crested Porcupine, Indian Hare, Indian Field Mouse, House mouse, Common house Rat, Indian Wild Boar, etc were observed during primary survey.

Avifauna: Since birds are considered to be the indicators for monitoring and understanding human impacts on ecological systems (Lawton, 1996) attempt was made to gather quantitative data on the avifauna by walk through survey within the entire study area. From the primary survey, a total of 39 species of avifauna were identified and recorded from the entire study area. The diversity of avifauna from this region was found to be quite high and encouraging. List of animals present in the study area are given below:

Table 3-23 List of Fauna observed in the study area

S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
Mammals					
1	*Bandicota bengalensis*	Mole rat	--	Least Concern	DS
2	*Bandicota indica*	Large bandicoot Rat	--	Least Concern	DS
3	*Funambulus pennantii*	Five striped squirrel	--	Least Concern	DS
4	*Funambulus palmarum*	Three stripped Palm Squirrel	--	Least Concern	DS
5	*Herpestes edwardsii*	Indian Grey Mongoose	Appendix III	Least Concern	DS
6	*Sus scrofa*	Indian Wild Boar	II	Least Concern	NS
7	*Lepus nigricollis*	Indian Hare	II	Least Concern	DS
8	*Mus booduga*	Indian Field Mouse	--	Least Concern	DS
9	*Mus musculus*	House mouse	--	Least Concern	DS
10	*Rattus rattus*	Common house Rat	--	Least Concern	DS
Birds					
1	*Milvus migrans*	Common Pariah Kite	II	Least Concern	DS
2	*Alcedo atthis*	Common kingfisher	II	Least Concern	DS
3	*Acridotheres tristis*	Common Myna	II	Least Concern	DS
4	*Dicrurus macrocercus*	Ashy Drongo	II	Least Concern	DS
5	*Anastomus oscitans*	Asian Openbill Stork	II	Least Concern	DS

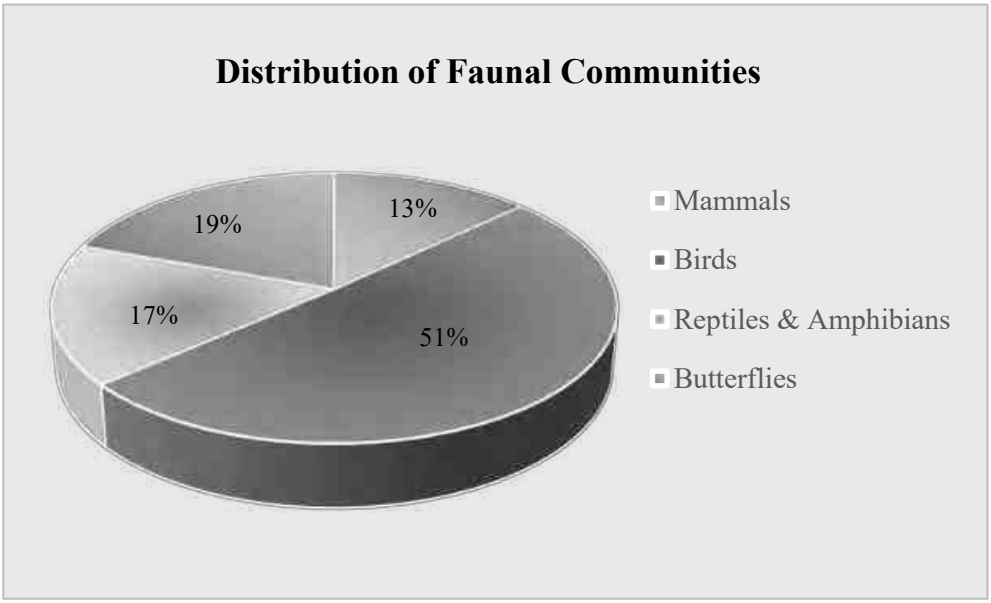
S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
6	*Dicrurus adsimilis*	Fork-tailed drongo	II	Least Concern	DS
7	*Elanus caeruleus*	Black-winged Kite	II	Least Concern	DS
8	*Gallinula chloropus*	Common Moorhen	II	Least Concern	DS
9	*Egretta garzetta*	Little Egret	II	Least Concern	DS
10	*Eudynamys scolopaceus*	Asian Koel	II	Least Concern	DS
11	*Tringa hypoleucos*	Common Sandpiper	II	Least Concern	DS
12	*Oriolus oriolus*	Eurasian Golden Oriole	II	Least Concern	DS
13	*Charadrius leschenaultia*	Greater Sand Plover	II	Least Concern	DS
14	*Turdoides striatus*	Jungle Babbler	II	Least Concern	DS
15	*Ardeola grayii*	Indian Pond-Heron	II	Least Concern	DS
16	*Hydrophasianus chirurgus*	Pheasant-tailed Jacana	II	Least Concern	DS
17	*Lanius schach*	Long-tailed Shrike	II	Least Concern	DS
18	*Nectarinia minima*	Crimson-backed Sunbird	II	Least Concern	DS
19	*Centropus sinensis*	Crow pheasant	II	Least Concern	DS
20	*Apus apus*	Common Swift	II	Least Concern	DS
21	*Cuculus canorus*	Cuckoo	II	Least Concern	DS
22	*Dendrocitta leucogastra*	White-bellied treepie	II	Least Concern	DS
23	*Phalacrocorax niger*	Little Cormorant	II	Least Concern	DS
24	*Nectarinia asiatica*	Purple Sunbird	II	Least Concern	DS
25	*Vanellus indicus*	Red-wattled Lapwing	II	Least Concern	DS
26	*Psittacula krameri*	Rose ringed Parakeet	II	Least Concern	DS
27	*Pycnonotus cafer*	Red-vented Bulbul	II	Least Concern	DS

S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
28	*Turdoides caudatus*	Common Babbler	II	Least Concern	DS
29	*Athene brama*	Spotted Owlet	II	Least Concern	DS
30	*Bubulcus ibis*	Cattle Egret	II	Least Concern	DS
31	*Merops orientalis*	Green bee eater	II	Least Concern	DS
32	*Columba livia*	Rock Pigeon	--	Least Concern	DS
33	*Corvus macrorhynchos*	Jungle Crow	II	Least Concern	DS
34	*Corvus splendens*	House Crow	--	Least Concern	DS
35	*Halcyon smyrnensis*	White-throated Kingfisher	II	Least Concern	DS
36	*Coracias benghalensis*	Indian Roller	II	Least Concern	DS
37	*Ceryle rudis*	Pied Kingfisher	II	Least Concern	DS
38	*Ardea alba*	Great Egret	II	Least Concern	DS
39	*Streptopelia chinensis*	Spotted Dove	II	Least Concern	DS
Reptiles & Amphibians					
1	*Ahaetulla nasuta*	Common Vine snake	--	Not assessed	DS
2	*Boiga dightoni*	Pirmad Cat Snake	--	Not assessed	NS
3	*Calotes versicolor*	Common garden lizard	--	Not assessed	DS
4	*Hoplobatrachus tigerinus*	Common Indian Bull Frog	--	Least Concern	DS
5	*Naja naja*	Indian Cobra	Appendix II	Least Concern	NS
6	*Bungarus caeruleus*	Common Indian Krait	--	Not assessed	NS
7	*Hemidactylus flaviviridis*	House lizard	--	Not assessed	DS
8	*Hemidactylus giganteus*	Giant Gecko	--	Least Concern	DS
9	*Cnemaspis littoralis*	Coastal day gecko	--	Data Deficient	DS
10	*Duttaphrynus melanostictus*	Common Indian Toad	--	Least Concern	DS

S. No.	Scientific Name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
11	*Polypedates leucomystax*	Tree Frog	--	Least Concern	DS
12	*Gecko gecko*	Common gecko	--	Not assessed	DS
13	*Euphlyctis cyanophlyctis*	Skipper frog	II	Least Concern	DS
Butterflies					
1	*Danaus chrysippus*	Plain tiger	-	Least Concern	DS
2	*Danaus genutia*	Common tiger	-	Not assessed	DS
3	*Euploea core*	Common crow	-	Least Concern	DS
4	*Eurema brigitta*	Small Grass Yellow	-	Not assessed	DS
5	*Eurema hecabe*	Common Grass yellow	-	Not assessed	DS
6	*Graphium Agamemnon*	Green-spotted triangle	-	Not assessed	DS
7	*Hypolimnas bolina*	Great Eggfly	-	Not assessed	DS
8	*Hypolimnas misippus*	Danaid eggfly	-	Least Concern	DS
9	*Ixias Marianne*	White orange tip	-	Not assessed	DS
10	*Mycalesis perseus*	Common bushbrown	-	Not assessed	DS
11	*Neptis hylas*	Common sailor	-	Not assessed	DS
12	*Pachliopta hector*	Crimson rose	-	Not assessed	DS
13	*Papilio demoleus*	Lime butterfly	-	Not assessed	DS
14	*Papilio polytes*	Common Mormon	-	Not assessed	DS
15	*Troides minos*	Southern birdwing	-	Least Concern	DS

N.B: NS= Not sighted but included as per the information provided by villagers, DS = Direct Sighting

Source: ABC Techno Labs India Pvt. Ltd.



From the above diagramme, it is evident that avifauna found to be abundant (50%) within the study area and less number of mammals (13%) and reptiles/amphibians (19%) observed during field study.

Livestock like cattle, buffalo, goat, poultry, and duck are reared for dairy products, meat, egg and for agriculture purpose. Majority of cattle and buffalo are of local variety. Backyard poultry farms are mostly common in this area; however, some commercial poultry farms are also recorded in the study area.

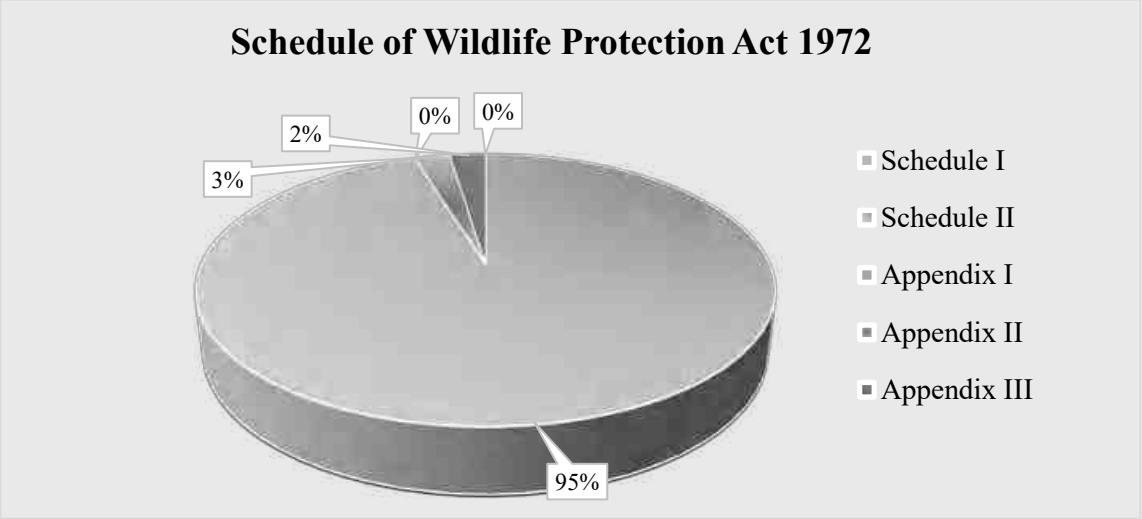
The study area is marked with moderate population of flora and fauna. With reference to the Wildlife Protection Act 1972 (Last Updated 1-4-2023) total number of wildlife tabulated in this study can be characterized as given in the **Table.3.24.**

Table 3-24 Characterization of Fauna in the study area

(As Per W.P Act, 1972; Last Updated 1-4-2023)

S. No.	Schedule of Wildlife Protection Act 1972	No. of species	Remark
1	Schedule I	0	-
2	Schedule II	40	-
3	Appendix I	0	-
4	Appendix II	1	-
5	Appendix III	1	-

Source: ABC Techno Labs India Pvt. Ltd.



The detailed interpretation of flora and fauna identified within study area are tabulated In **Table.3.25.**

Table 3-25 Description of Flora & Fauna

S. No.	Type of Species	Scientific Name	Common Name
Flora			
1	Endangered species	*Borassus flabellifer*	Panai
2	Threatened species	None	-
3	Near Threatened species	None	-
		Thevetia peruviana	Ponnarali
Fauna			
1	Endangered species	None	-
2	Threatened species	None	-
3	Near Threatened species	None	-
4	Vulnerable species	None	-
5	Migratory Corridors & Flight Paths	No corridors & flight paths	-
6	Breeding & Spawning grounds	None	-

Source: ABC Techno Labs India Pvt. Ltd.

A comprehensive Central Legislation namely Wild Life (Protection) Act was enforced in 1972 to provide protection to wild animals. Schedule-I of this act contains the list of rare and endangered species, which are completely protected throughout the country. The list of wild animals and their conservation status as per Wild Life Act (1972) (Last Updated 1-4-2023) are presented in Table 3.23 species recorded/reported from study area, out of which 40 species belongs to schedule-II, 1 species belongs to Appendix II and 1 species belongs to Appendix III of Wildlife protection Act, 1972 (Last Updated 1-4-2023).

3.14 Aquatic ecology

Evaluation of the biological impulses on potential coastal development site is an integral part of an environmental impact assessment as the consequences of perturbations in the environment ultimately may affect the habitat. Development zones should be selected avoiding areas of intense breeding/nursery grounds of economically important living resources. Though organisms have evolved to withstand the change within certain limits,

they may not be well adapted to manmade stresses. Thus, the monitoring programme should sufficiently target the entire potential at risk. Critical biological variables covering productivity at different trophic levels should be identified. Biological productivity has to be evaluated on the basis of phytoplankton pigments/cell counts as a measure of renewable primary resources; zooplankton standing stock in terms of biomass and population density and community structure; benthic population, biomass and group diversity at intertidal and sub tidal zones to evaluate benthic productivity associated with the sediment; information on larval stages of fish to evaluate probable occurrence of breeding grounds of economically important fish species and microbial examination to investigate the extent of contamination by pathogens as a measure of human influence.

While considering assessment of aquatic pollution and its implications, it must be realized that, despite many changes in the physico-chemical properties of the water body and seabed sediment, the ultimate consequences of pollutants may be reflected inevitably on the biological system. Hence, the investigations of an ecosystem and particularly of its communities constitute an integral part of any ecological assessment. This can be achieved by selecting a few reliable parameters from a complex community structure. The parameters considered have phytoplankton (cell count, and generic diversity), zooplankton (standing stock i.e., faunal groups) and status of fishery and mammals as well as birds. The first two reflect the productivity of a water column at the primary and secondary levels, respectively. Ultimate commercial interest being fisheries, the status of the exploitable fishery resources was assessed. Information on larval stages of fishes and decapods was used to evaluate probable occurrence of spawning and breeding grounds of economically important species.

To assess the planktonic profile of Phytoplankton and Zooplankton, 3 water samples from estuary region, intertidal zone and coastal water were collected at sub surface level. The marine ecological study was conducted in different water bodies of the study area and the flora and fauna was recorded.

The biological parameters considered in the present study are phytoplankton, zooplankton and fish species. Phytoplankton and zooplankton reflect the productivity of a water column at primary and secondary levels.

3.14.1 Primary productivity

Marine primary production plays an important role in food web dynamics, in biogeochemical cycles and in marine fisheries. Primarily, phytoplankton depends on carbon dioxide, sunlight and nutrients for growth, but some other factors such as water depth, water temperature, wind and grazers also play a significant role. Primary productivity varies from freshwater to estuarine and from estuarine to marine water bodies. Its major components are net and gross primary production.

3.14.1.1 Plankton

Planktons can be broadly grouped into two categories those with plant origin are called ‘Phytoplankton’ and those with animal origin are called ‘Zooplankton’.

A. Phytoplankton

Phytoplankton is the major primary producers of organic matter in the aquatic ecosystem and especially oceans whose 90% productivity is from the planktons. Phytoplankton

samples were collected without filtering the water. To preserve, 0.3 mL lugol's solution was added to 100 ml sample. Subsequently, phytoplankton were concentrated by centrifugation and analysed microscopically in laboratory. Identification of phytoplankton was done using standard taxonomic keys.

The Lackey Drop (microtransect) method (Lackey 1938) is a simple method for obtaining counts of considerable accuracy (APHA 2017).

Chemicals/reagents used: Lugol's iodine

Equipment used: Centrifuge tubes of 15ml capacity, cover slips, glass slides, dropper, plastic bottles (100 ml capacity)

Instruments used: Centrifuge and Microscope.

Table 3-26 Phytoplankton species

S. No.	Species	Order	Class
1	*Ankistrodesmus* sp.	Sphaeropleales	Chlorophyceae
2	*Chlamydomonas* sp.	Chlamydomonadales	Chlorophyceae
3	*Chlorella vulgaris*	Chlorellales	Trebouxiophyceae
4	*Asteromphalus* sp.	Centrales	Bacillariophycea
5	*Bacteriastrum varians*	Centrales	Bacillariophycea
6	*Bellerochea malleus*	Centrales	Bacillariophycea
7	*Chaetoceros affinis*	Centrales	Bacillariophycea
8	*Chaetoceros curvicetus*	Centrales	Bacillariophycea
9	*Chaetoceros lorenzianus*	Centrales	Bacillariophycea
10	*Coscinodiscus wailesii*	Centrales	Bacillariophycea
11	*Coscinodiscus centralis*	Centrales	Bacillariophycea
12	*Corethron* sp.	Centrales	Bacillariophycea
13	*Ditylum brightwellii*	Centrales	Bacillariophycea
14	*Eucampia zoodiacus*	Centrales	Bacillariophycea
15	*Lithodesmium undulatum*	Centrales	Bacillariophycea
16	*Odontella mobiliensis*	Centrales	Bacillariophycea
17	*Odontella sinensis*	Centrales	Bacillariophycea
18	*Rhizosolenia alata*	Centrales	Bacillariophycea
19	*Schroederella delicatula*	Centrales	Bacillariophycea
20	*Skeletonema costatum*	Centrales	Bacillariophycea
21	*Stephanopyxis palmeriana*	Centrales	Bacillariophycea
22	*Thalassiosira subtilis*	Centrales	Bacillariophycea
23	*Triceratium rediculatum*	Centrales	Bacillariophycea
24	*Entomonis* sp.	Pennales	Bacillariophycea
25	*Gyrosigma* sp.	Pennales	Bacillariophycea
26	*Navicula* sp.	Pennales	Bacillariophycea
27	*Nitzschia* sp.	Pennales	Bacillariophycea

S. No.	Species	Order	Class
28	*Pleurosigma directum*	Pennales	Bacillariophycea
29	*Thalassionema nitzschioides*	Pennales	Bacillariophycea
30	*Thalassiothrix longissima*	Pennales	Bacillariophycea
31	*Ceratium furca*	Gonyaulacales	Dinophyceae
32	*Dinophysis caudate*	Dinophysiales	Dinophyceae
33	*Prorocentrum micans*	Prorocentrales	Dinophyceae
34	*Peridinium depressum*	Peridiniales	Dinophyceae
35	*Protoperidinium divergens*	Peridiniales	Dinophyceae
36	*Anabaena* sp.	Nostocales	Cyanophyceaea
37	*Anacystis* sp.	Chroococcales	Cyanophyceaea
38	*Oscillatoria* sp.	Oscillatoriales	Cyanophyceaea
39	*Spirulina* sp.	Spirulinales	Cyanophyceaea

Source: ABC Techno Labs India Pvt. Ltd.

B. Zooplankton

The significance of zooplanktons is found in their role in transferring biological production from phytoplankton to larger organisms in the food web. Sample collection was carried out in the similar method as that of phytoplankton. The result of the zooplankton analysis is tabulated in **Table.3.27**.

Table 3-27 Zooplankton species

S. No.	Species	Order	Class
1	*Dictyocysta* sp.	Tintinnids (Ciliate groups)	Oligotrichea
2	*Eutintin nustenuis*	Tintinnids (Ciliate groups)	Oligotrichea
3	*Favella* sp.	Tintinnids (Ciliate groups)	Oligotrichea
4	*Tintinnopsis* sp.	Tintinnids (Ciliate groups)	Oligotrichea
5	*Brachionus* sp.	Ploima	Eurotatoria
6	*Daphnia* sp.	Anomopoda	Branchiopoda
7	*Globigerina* sp.	Rotaliida	Globothalamea
8	*Hydromedusa*	Testudines	Hydrozoa
9	*Siphonophora*	Siphonophorae	Hydrozoa
10	*Acartiaerythraea*	Calanoida	Copepoda
11	*Acartiaspinicauda*	Calanoida	Copepoda
12	*Canthocalanus* sp.	Calanoida	Copepoda
13	*Calocalanus pavo*	Calanoida	Copepoda
14	*Centropages furcatus*	Calanoida	Copepoda
15	*Calanopia minor*	Calanoida	Copepoda
16	*Eucalanus elongates*	Calanoida	Copepoda
17	*Labidocera acuta*	Calanoida	Copepoda
18	*Labidocera pectinata*	Calanoida	Copepoda

S. No.	Species	Order	Class
19	*Pontella danae*	Calanoida	Copepoda
20	*Temora discaudata*	Calanoida	Copepoda
21	*Temora turbinata*	Calanoida	Copepoda
22	*Corycaeus danae*	Cyclopoida	Copepoda
23	*Oithona similis*	Cyclopoida	Copepoda
24	*Oncaea venusta*	Cyclopoida	Copepoda

Source: ABC Techno Labs India Pvt. Ltd.

3.14.2 Fish & other marine community

The fish and other marine species reported from the study area are tabulated in **Table.3.28**.

Table 3-28 Fish and marine species reported

S. No.	Scientific Name	Common Name	Family
1	*Alectis ciliaris*	African pompano	Carangidae
2	*Alepes mate*	Smallmouth scad	Carangidae
3	*Arius maculatus*	Spotted catfish	Ariidae
4	*Alectis indica*	Indian threadfish	Carangidae
5	*Crassostrea madrasensis*	Indian oyster	Ostreidae
6	*Cynoglossus macrolepidotus*	Largescaledtonguesole	Cynoglossidae
7	*Ephippus orbis*	Orbfish	Ephippidae
8	*Holothuria atra*	Lollyfish	Holothuriidae
9	*Leiognathus fasciatus*	Striped ponyfish	Leiognathidae
10	*Lepturacanthus savala*	Savalaihairtail	Trichiuridae
11	*Liza seheli*	Bluespot mullet	Mugilidae
12	*Parapenaeopsis stylifera*	Kiddi shrimp	Penaeidae
13	*Scomberoides tol*	Needlescaledqueenfish	Carangidae
14	*Sardinella longiceps*	Indian oil sardine	Clupeidae
15	*Sardinella gibbosa*	Goldstripesardinella	Clupeidae
16	*Sardinella clupeoides*	Bleekersmoothbellysardinella	Clupeidae
17	*Sardinella albella*	White sardinella	Clupeidae
18	*Stolephorus indicus*	Indian anchovy	Engraulidae
19	*Stolephorus commersonnii*	Commerson's anchovy	Engraulidae
20	*Thryssama labarica*	Malabar thryssa	Engraulidae
21	*Chanos chanos*	Milkfish	Chanidae
22	*Tylosurus strongylurus*	Spottail needlefish	Belonidae
23	*Lutjanus fulviflamma*	Dory snapper	Lutjanidae
24	*Lutjanus russellii*	Russell's snapper	Lutjanidae
25	*L. johnii*	John's snapper	Lutjanidae
26	*L. argentimaculatus*	Mangrove red snapper	Lutjanidae
27	*Johnius dussumieri*	Sin croaker	Sciaenidae
28	*Etroplus suratensis*	Pearlspot	Cichlidae

S. No.	Scientific Name	Common Name	Family
29	*Leiognathus equulus*	Common ponyfish	Leiognathidae
30	*Liza dussumieri*	Dussumier's mullet	Mugilidae
31	*Liza macrolepis*	Largescale mullet	Mugilidae
32	*Gerres filamentosus*	Whipfin silver-biddy	Gerreidae
33	*Ambassis ambassis*	Commerson's glassy	Ambassidae
34	*Ambassis gymnocephalus*	Bald glassy	Ambassidae
35	*Anguilla bengalensis*	Indian mottled eel	Anguillidae
36	*Anguilla bicolor*	Indonesian shortfin eel	Anguillidae
37	*Megalaspis cordyla*	Torpedo scad	Carangidae
38	*Oreochromis mossambicus*	Mozambique tilapia	Cichlidae
39	*Mugil cephalus*	Flathead grey mullet	Mugilidae
40	*Liza parsia*	Goldspot mullet	Mugilidae
41	*Siganus javus*	Streaked spinefoot	Siganidae
42	*Sillago sihama*	Silver sillago	Sillaginidae
43	*Johnius coitor*	Coitor croaker	Sciaenidae
44	*Platycephalus indicus*	Bartail flathead	Platycephalidae
45	*Leiognathus dussumieri*	Dussumier'sponyfish	Leiognathidae
46	*Lates calcarifer*	Barramundi	Latidae

Source: ABC Techno Labs India Pvt. Ltd.

3.14.3 Coastal vegetation

Coastal dune ecosystems occupy the small but highly dynamic zone at the intersection of ocean and land. Coastal dunes fulfill many different valuable ecosystem functions. They act as protective buffers against storm surge, wave attack, and erosion of the hinterland, and provide a unique habitat for flora and fauna. The ecosystem functions of coastal dunes are integrally linked to both short term (i.e. severe episodic storms) and long-term (i.e. accretion of windblown sediment, sea level rise) coastal processes.

Plants are thought to play a pivotal role in these processes by strengthening the dune sediment with root systems to reduce erosion, dissipating storm wave energy, and helping trap additional wind-blown sediment, which in turn provides continual dune growth. Study area conducted in the project region indicated the presence of coastal vegetation which includes Ipomea pre-caprae, Casuarina sp., Optunia stricta, Spinifex sp. and Cocus nucifera. However, the proposed project will not have any major impacts on the coastal vegetation.

3.14.4 Seaweeds and Sea grasses

The marine ecosystem provides a vast habitat for macro algal communities as they occupy the rock. Sea grass and seaweeds provide food, shelter for diverse organisms and act as a nursery ground for many fishes of commercial importance and play a vital role in the fisheries production of the region. Both are economically important marine living resources. Sea grass and Sea weeds has been reported 1.2 km away from the project site.

3.14.5 Coral reefs

In Tamilnadu, the coral reefs are distributed along the Gulf of Mannar, Palk Bay and at restricted places in Chennai, Pondicherry and Cuddalore. The reef formation of southeast coast of India along the Tamilnadu coast is scattered between 79° to 79°9'E to 8°45' to 9°11'N covering nearly 21 islands from Tuticorin to Rameswaram (ENVIS 2022). The dominant genera include Acropora, Montipora and Pocillopora among the ramose forms. Massive forms are represented by Porites, Favia, Favites, Goniastrea, Platygyra and rarely Symphyllia, Cyphastrea and Leptastrea are very common on all reef habitats of this area. Corals and any associated reef have been reported 6.7 km away from the project site.

3.14.6 The mangroves

Mangroves are salt tolerant plants. They are found in tropical and subtropical coastal areas. Mangroves are of two dominant types, riverine-type that fringes rivers and tidal creeks and the open water type that is directly exposed to waves. The former type is the most common. In India, Mangroves at Pichavaram and Gulf of Mannar Islands are examples of above types.

The word mangrove may be derived from Portuguese and English. 'Mangue' means tree, and 'grove' means group of trees. The vegetation in Mangrove consists of many species. It may be a woody plant in the form of a tree or a shrub. The ability to live in brackish to seawater conditions vary with species. Mangroves has been reported 8.08 km away from the project site.

Importance of Mangroves

Mangroves act as a barrier against cyclonic storms, protecting the land behind. They also act as a buffer against floods, preventing soil erosion.

Mangroves trap fine sediments that are carried into the coastal zone by floodwaters, and there is a significant net export of nutrients from the Mangroves into the coastal zone, which acts as a source of enrichment for the marine environment. Mangroves prevent inorganic nutrients being sunk in the sea through swift flowing terrestrial runoff and synthesis organic matter absorbing the inorganic nutrients. Hence various inorganic nutrients from the terrestrial runoff are recycled within the Mangrove environment.

3.14.7 Marine mammals

There are no reports in recent years about regular occurrence of marine mammals in the coastal waters of Tamil Nadu region.

3.14.8 Marine environment

3.14.9 Marine water quality

One-time marine water monitoring was conducted by qualified Marine Expert of ABC Techno Labs India Pvt Ltd, Chennai. Samples of marine water for analysis were collected at five (5) selected locations using a 5L Van Dorn Water Sampler (PARTEX make) for analyzing major physio-chemical and biological parameters. Plankton net (WP net) was used for collecting plankton samples. A Van Veen grab was operated at all stations for collecting sediments and benthic fauna.

Details on the marine sampling locations is presented as given below in **Table 3.29** and **Figure 3.24.**

Table 3-29 Marine water sampling locations

Monitoring Location Code	Latitude	Longitude	Direction	Distance from project site
MW 1	08°24'31.05"N	78° 04'19.24"E	SE	2.99 km
MW2	08°26'01.21"N	78° 05'20.92"E	E	2.84 km
MW 3	08°28'10.09"N	78°07'16.38"E	NE	7.5 km
MW 4	08°25'59.84"N	78°07'25.93"E	E	6.66 km
MW 5	08°23'32.28"N	78°06'13.92"E	SE	6.44 km

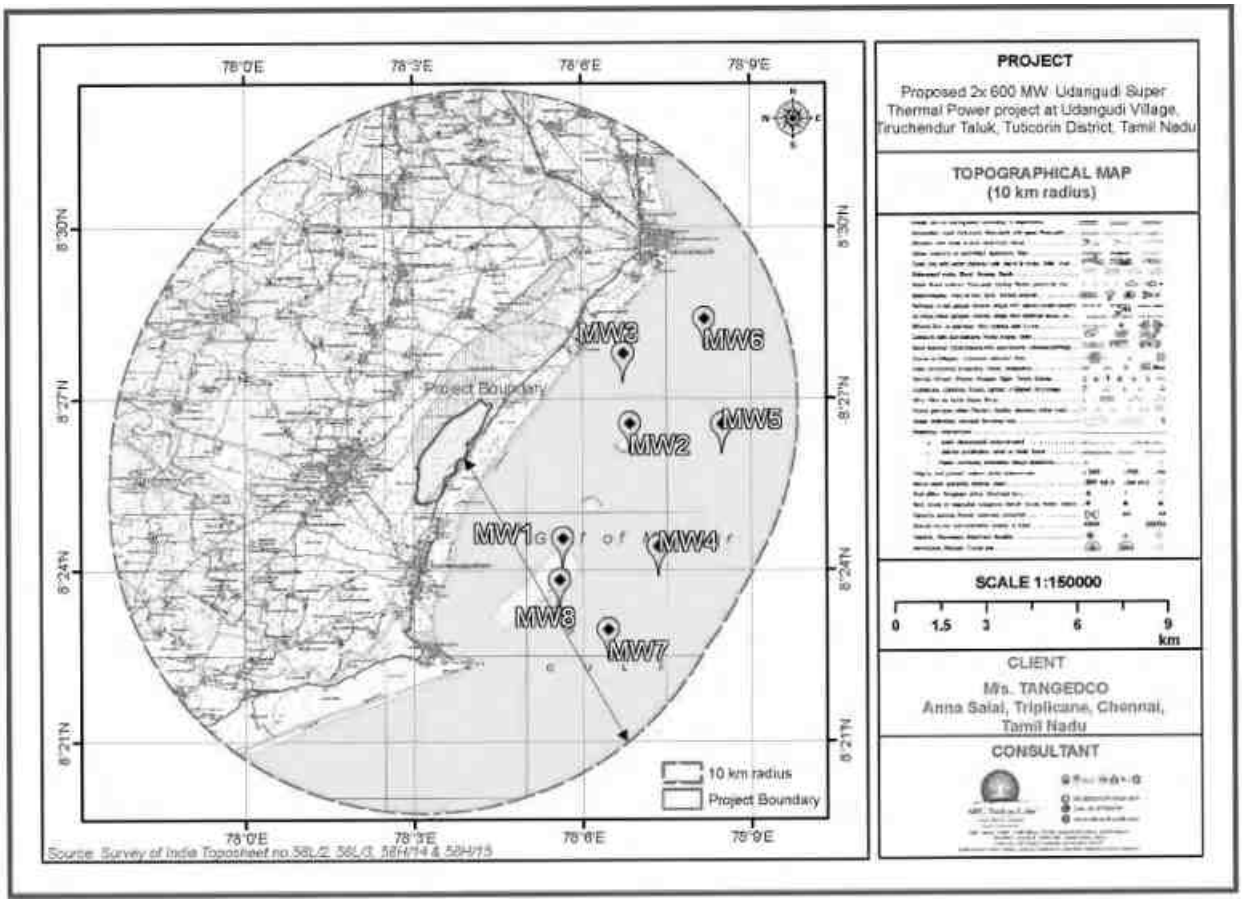


Figure 3-24 marine water sampling locations

Existing Marine Water Quality data during June – September 2021

Table 3-30 Marine water quality during June – September 2021

S.NO	Parameters	Units	Surface Sampling				Typical Value
			MW1	MW2	MW3	MW4	
1	Salinity	ppt	36.4	36.6	36.7	36.3	30-42
2	Temperature	ºC	28.2	27.8	28.5	27.9	-
3	Total Suspended solids	mg/l	26	31	24	16	-
4	pH at 25°C	-	7.8	2.0	7.9	8.1	7.6-8.4
5	Electrical Conductivity	µS/cm	53560	53820	54080	53440	50,000-56,000
6	Dissolved Oxygen	mg/l	6.2	5.8	6.2	6.3	<2.0 indicate low DO content
7	Bio-Chemical Oxygen Demand @ 27°C for 3 days	mg/l	10	12	11	8	-
8	Chemical Oxygen Demand	mg/l	116	124	118	114	-
9	Total Dissolved Solids	mg/l	36420	36598	36744	36340	34283
10	Oil and Grease	mg/l	<2	<2	<2	<2	-
11	Nitrite NO_2	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	BDL(DL:0.01)	BDL(DL:0.01)	
12	Nitrate NO_3	µg/l	720	520	680	930	-
13	Phosphate as PO_4	mg/l	130	210	140	160	-
14	Silica as SiO_2	mg/l	0.09	0.14	0.11	0.22	-
15	Iron as Fe	mg/l	0.16	0.22	0.10	0.09	-
16	Calcium as Ca	mg/l	445	442	448	445	400
17	Sodium as Na	mg/l	10360	10480	10510	10310	10566
18	Potassium as K	mg/l	398	410	418	416	380
19	Magnesium as Mg	mg/l	1292	1287	1306	1280	1262
20	Cadmium as Cd	mg/l	BDL(DL:0.002)	BDL(DL:0.002)	BDL(DL:0.002)	BDL(DL:0.002)	-
21	Copper as Cu	mg/l	1.12	1.06	1.06	1.02	-
22	Lead as Pb	mg/l	0.67	0.71	0.21	0.24	-
23	Mercury as Hg	mg/l	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	-
24	Zinc as Zn	mg/l	BDL(DL0.08)	BDL(DL0.08)	BDL(DL0.08)	BDL(DL0.08)	-
25	Manganese as Mn	mg/l	0.19	0.23	0.21	0.24	-

26	Arsenic as As	mg/l	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	-
27	Total Chromium as Cr	mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
28	Barium as Ba	mg/l	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	-
29	**Petroleum Hydrocarbons:**						
	Deccane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Docosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Dodecane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Dontriacontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Eicosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Hexacosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Hexadecane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Hexatriacontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Octacosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Octadecane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Octane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Octatriacontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Tetracontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Tetracosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Tetradecane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Tetratriaontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Triacontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
Microbiology:							
30	Total Coliform	MPN/100ml	500	900	500	900	
31	*E.coli*	MPN/100ml	70	240	90	170	-
32	Total Viable Count	CFU/ml	780	910	640	1200	-

S.NO	Parameters	Units	Surface Sampling				Typical Value
			MW5	MW6	MW7	MW8	
1	Salinity	ppt	36.4	36.5	36.4	36.7	30-42
2	Temperature	ºC	28.4	28.0	28.5	27.9	-
3	Total Suspended solids	mg/l	36	39	27	31	-

4	pH at 25°C	-	7.9	8.1	8.0	7.8	7.6-8.4
5	Electrical Conductivity	µS/cm	53570	53710	53480	53910	50,000-56,000
6	Dissolved Oxygen	mg/l	6.0	5.8	6.1	5.9	<2.0 indicate low DO content
7	Bio-Chemical Oxygen Demand @ 27°C for 3 days	mg/l	10	13	10	12	-
8	Chemical Oxygen Demand	mg/l	132	124	116	122	-
9	Total Dissolved Solids	mg/l	36428	36522	36366	36658	34283
10	Oil and Grease	mg/l	<2	<2	<2	<2	-
11	Nitrite NO_2	mg/l	BDL(DL:0.01)	BDL(DL:0.01)	BDL(DL:0.01)	BDL(DL:0.01)	
12	Nitrate NO_3	µg/l	490	770	880	290	-
13	Phosphate as PO_4	mg/l	180	120	240	180	-
14	Silica as SiO_2	mg/l	0.13	0.10	0.15	0.11	-
15	Iron as Fe	mg/l	0.23	0.19	0.18	0.15	-
16	Calcium as Ca	mg/l	438	445	445	441	400
17	Sodium as Na	mg/l	10240	10310	10170	10220	10566
18	Potassium as K	mg/l	396	46	394	410	380
19	Magnesium as Mg	mg/l	1287	1296	1326	1312	1262
20	Cadmium as Cd	mg/l	BDL(DL:0.002)	BDL(DL:0.002)	BDL(DL:0.002)	BDL(DL:0.002)	-
21	Copper as Cu	mg/l	1.08	0.99	1.03	1.02	-
22	Lead as Pb	mg/l	0.19	0.26	0.22	0.23	-
23	Mercury as Hg	mg/l	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	-
24	Zinc as Zn	mg/l	BDL(DL0.08)	BDL(DL0.08)	BDL(DL0.08)	BDL(DL0.08)	-
25	Manganese as Mn	mg/l	0.19	0.23	0.21	0.24	-
26	Arsenic as As	mg/l	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	BDL(DL:0.001)	-
27	Total Chromium as Cr	mg/l	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	BDL(DL0.01)	-
28	Barium as Ba	mg/l	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	BDL(DL0.02)	-
	Petroleum Hydrocarbons:						
	Deccane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Docosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Dodecane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-

	Dontriacontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Eicosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Hexacosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Hexadecane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Hexatriacontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Octacosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Octadecane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Octane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Octatriacontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Tetracontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Tetracosane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Tetradecane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
	Tetratriaontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
29	Triacontane	µg/l	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	BDL(DL:0.05)	-
Microbiology:							
30	Total Coliform	MPN/100ml	500	900	500	900	
31	*E.coli*	MPN/100ml	70	240	90	170	-
32	Total Viable Count	CFU/ml	780	910	640	1200	-

BDL: Below detection limit

Revalidated marine water quality during March – May 2024

Table 3-31 Marine water quality during March – May 2024

S.No	Parameter	Unit	Test Method	MW1	MW2	MW3	MW4	MW5
1	Temperature	°C	APHA 23rd EDITION	28.7	28.5	27.8	28.2	27.3
2	Phosphate as PO4	mg/l	IS:3025:Part-31:1988 (Reaff:2019)	0.14	0.07	0.09	0.11	0.12
3	Turbidity	NTU	IS : 3025 Part 10-1987 (Reaff: 2017)	2.8	1.5	1.8	2.9	2.2
4	pH at 25 °C	-	IS : 3025 Part 11- 1987 (Reaff: 2017)	8.14	8.25	8.20	8.19	8.23
5	Salinity	ppt	APHA 22nd EDITION-2520B	34	34.5	34.3	34.1	34.3
6	Nitrate as NO3	mg/l	APHA 23rd EDN -4500- NO3- B	2.3	1.8	2	1.8	2.1
7	Iron as Fe	mg/l	IS : 3025 Part 53-1987 (Reaff:2019)	BDL(<0.05)				
8	Manganese as Mn	mg/l	APHA 23rd EDN -3500-Mn D	BDL(<0.02)				
9	Nickel as Ni	mg/l	APHA 23rd EDN -3111 B	BDL (<0.02)				
11	Cadmium as Cd	mg/l	APHA 23rd EDN -3111 B	BDL(<0.01)				
12	Lead as Pb	mg/l	IS:3025 Part 47-1987 (Reaff:2019)	BDL(<0.01)				
13	Copper as Cu	mg/l	APHA 23rd EDN -3111 B	BDL(<0.03)				
14	Zinc as Zn	mg/l	IS:3025 Part:49-1987 (Reaff:2019)	0.06	0.05	0.03	0.03	0.04
15	Total Chromium as Cr	mg/l	APHA 23rd EDN -3111 B	BDL(<0.03)				
16	Arsenic as As	mg/l	IS:3025 Part:37-1987 (Reaff:2019)	BDL(<0.01)				
17	Mercury as Hg	mg/l	IS:3025 Part 48-1987 (Reaff:2019)	BDL(<0.001)				
18	Total Nitrogen as N	mg/l	IS 3025 Part 34 (Reaff:2019)	3.7	3	3.4	3.7	4
19	Dissolved Oxygen as O2	mg/l	IS 3025 Part 38 (Reaff:2019)	6.8	6.7	6.8	6.6	6.7
20	Biochemical Oxygen Demand @ 27 for 3 days	mg/l	IS 3025 Part 44 (Reaff:2019)	<2				
21	Total Suspended Solids	mg/l	IS : 3025 Part 17-1984	2	BDL(<2)	BDL(<2)	3	2
22	Nitrite as NO2	mg/l	APHA 22nd EDN-4500- NO2- B	0.05	0.03	0.04	0.03	0.02

S.No	Parameter	Unit	Test Method	MW1	MW2	MW3	MW4	MW5
23	Total Petroleum Hydrocarbon	mg/l	ABCTL/INS/SOP/31	BDL(<0.001)				

BDL: Below detection limit

Observations on marine water quality during June – September 2021

Temperature- It was observed that temperature did not show much variation, it ranged from 27.6^{0}c to 28.6^{0}C at surface.

pH- The pH of the coastal water did not show much variation, it ranged from 7.6 to 8.4 at surface.

Salinity- The concentration of salinity did not show much variation at different depths; it ranged from 36.3 ppt to 36.8 ppt at surface.

Dissolved Oxygen (DO) - Values of Dissolved Oxygen (DO) at surface, Depth ranged from 5.9 mg/l to 6.6 mg/l.

Observations on marine water quality during March – May 2024

Temperature- It was observed that temperature did not show much variation, it ranged from 27.3^{0}c to 28.7^{0}C at surface.

pH- The pH of the coastal water did not show much variation, it ranged from 8.14 to 8.25 at surface.

Salinity- The concentration of salinity did not show much variation at different depths; it ranged from 34 ppt to 34.5 ppt at surface.

Dissolved Oxygen (DO) - Values of Dissolved Oxygen (DO) at surface, Depth ranged from 6.6 mg/l to 6.8 mg/l.

3.14.10 Comparison of baseline data with current data

Marine water samples were collected from 5 locations in the current EIA study. A comparison of average value recorded in the earlier EIA study and current study is given in **Table 3.32**.

Table 3-32 Comparison Marine water quality between earlier and current data

S.no.	Parameter	Unit	Earlier marine water quality	Current Marine water quality
1.	pH	-	8.0	8.2
2.	DO	mg/l	6.2	6.7
3.	Temperature	^{0}C	28.1	28.1
4.	Salinity	ppt	36.5	34.2
5.	BOD	mg/l	12	<2
6.	NO_2	mg/l	<0.1	0.03
7.	NO_3	mg/l	0.66	2
8.	PO_4	mg/l	0.17	0.10

Comparison of long-term data between earlier and current data indicate no major deviations. Minor variations are evident which can be seasonal and acceptable for a dynamic environment like seawater.

3.15 Sediment quality

Geochemical and texture analysis were carried out for understanding the characteristics of sediments. Metals such as Cadmium (Cd), Copper (Cu), Chromium (Cr), Iron (Fe), Manganese (Mn), Nickel (Ni), Zinc (Zn), Lead (Pb) were estimated from all the stations. Grain size analyses were accomplished to determine the contribution of various sediment components such as sand, silt and clay. In addition, samples of benthos from the sediments were also collected.

Marine sediment quality monitoring was carried out at 5 (five) locations in the study area to understand the physical and chemical characteristics of the sediments. Details of the sediment sampling locations are presented in **Table 3.33 & Fig 3.25**.

Table 3-33 Marine sediment quality sampling locations

Monitoring Location Code	Latitude	Longitude	Direction	Distance from project site
MS 1	08°24'31.05"N	78° 04'19.24"E	SE	2.99 km
MS 2	08°26'01.21"N	78° 05'20.92"E	E	2.84 km
MS 3	08°28'10.09"N	78°07'16.38"E	NE	7.5 km
MS 4	08°25'59.84"N	78°07'25.93"E	E	6.66 km
MS 5	08°23'32.28"N	78°06'13.92"E	SE	6.44 km

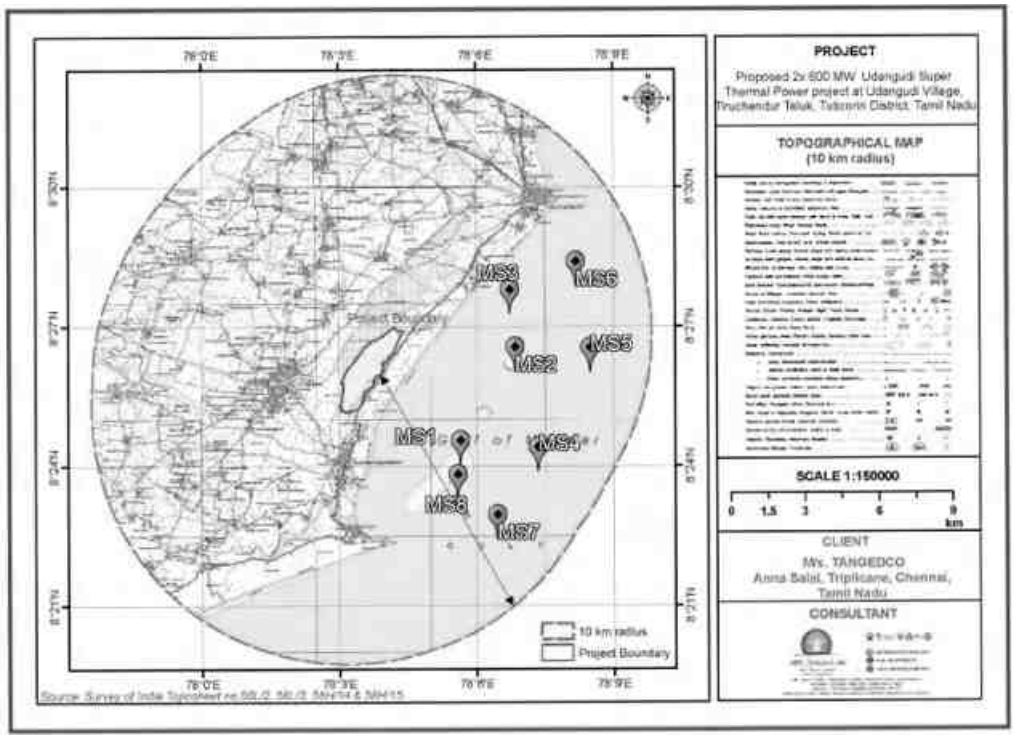


Figure 3-25 Marine sediment sampling locations

The observed marine sediment quality of the area is as per details given in Table 3.34.

Existing Marine sediment quality data during June – September 2021

Table 3-34 Marine sediment quality during June – September 2021

S.NO	Parameters	Units	MS1	MS2	MS3	MS4
1	Texture					
	Sand	%	30.71	83.74	13.29	88.50
	Silt	%	28.67	8.57	1049	5.21
	Clay	%	40.62	7.69	76.22	6.29
2	pH	-	8.7	8.8	8.3	8.4
3	Total Organic Carbon	%	1.62	0.69	2.78	0.48
4	Calcium carbonate as $CaCo_3$	%	17.36	31.76	21.70	28.22
5	Organic Nitrogen	%	0.18	0.11	0.29	0.090
6	Oil and Grease	mg/kg	<10	<10	<10	<10
7	Copper as Cu	mg/kg	47.28	64.17	54.61	49.84
8	Zinc as Zn	mg/kg	38.26	34.73	49.28	37.11
9	Iron as Fe	%	0.53	0.47	0.40	0.66
10	Lead as Pb	mg/kg	40.89	64.12	48.42	76.20
11	Cadmium as Cd	mg/kg	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)
12	Manganese as Mn	mg/kg	112.80	109.21	149.12	104.90
13	Mercury as Hg	mg/kg	BDL(DL:0.2)	BDL(DL:0.2)	BDL(DL:0.2)	BDL(DL:0.2)
14	Total Chromium as Cr	mg/kg	27.32	29.61	31.46	34.21
15	Arsenic as As	mg/kg	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)
16	Barium as Ba	mg/kg	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)
	Petroleum Hydrocarbons:					
	Deccane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Docosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Dodecane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Dontriacontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Eicosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Hexacosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)

17	Hexadecane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Hexatriacontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Octacosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Octadecane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Octane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Octatriacontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Tetracontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Tetracosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Tetradecane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Tetratriaontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Triacontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)

S.NO	Parameters	Units	MS5	MS6	MS7	MS8
1	Texture					
	Sand	%	64.95	14.38	12.88	32.25
	Silt	%	15.59	12.57	7.45	26.11
	Clay	%	19.46	73.05	79.67	41.64
2	pH	-	8.7	8.4	8.5	8.4
3	Total Organic Carbon	%	1.37	2.24	2.68	1.72
4	Calcium carbonate as $CaCo_3$	%	28.60	21.20	24.76	26.74
5	Organic Nitrogen	%	0.14	0.34	0.39	0.23
6	Oil and Grease	mg/kg	<10	<10	<10	<10
7	Copper as Cu	mg/kg	91.22	60.36	106.59	51.41
8	Zinc as Zn	mg/kg	38.6	45.92	50.29	54.32
9	Iron as Fe	%	0.34	0.27	0.45	0.59
10	Lead as Pb	mg/kg	114.20	132.42	121.30	99.20
11	Cadmium as Cd	mg/kg	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)	BDL(DL:2.0)
12	Manganese as Mn	mg/kg	99.68	136.70	114.53	105.83
13	Mercury as Hg	mg/kg	BDL(DL:0.2)	BDL(DL:0.2)	BDL(DL:0.2)	BDL(DL:0.2)
14	Total Chromium as Cr	mg/kg	19.63	23.18	20.37	24.15

15	Arsenic as As	mg/kg	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)
16	Barium as Ba	mg/kg	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)	BDL(DL:0.5)
17	**Petroleum Hydrocarbons:**					
	Deccane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Docosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Dodecane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Dontriacontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Eicosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Hexacosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Hexadecane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Hexatriacontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Octacosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Octadecane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Octane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Octatriacontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Tetracontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Tetracosane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Tetradecane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Tetratriaontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)
	Triacontane	mg/kg	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)	BDL(DL:1.0)

Revalidated Marine sediment quality during March – May 2024

Table 3-35 Marine sediment quality during March – May 2024

S.No	Parameter	Test Method	Unit	MS 1	MS 2	MS 3	MS 4	MS 5
1.	pH	IS -2720(Part 26) 1987(RA 2016)	-	7.28	7.41	7.39	7.64	7.14
2.	Texture	Robinson Pipette Method	-	Sand	Sand	Sand	Silt Loam	Silty Clay
3.	Total Organic Carbon as C	IS 2720 (Part 22):1972 (RA 2015)	%	2.33	1.74	2.36	3.24	2.98
4	Phosphorous as P	EPA 3050 B & FAO Chapter 3/ ABCTL/SOIL SOP02	mg/kg	118	132	174	234	205
5.	Zinc as Zn	EPA3050 B & 7000 B	mg/kg	67	89	82	118	98
6.	Cadmium as Cd	EPA3050 B & 7000 B	mg/kg	BDL(<2)				
7.	Copper as Cu	EPA3050 B & 7000 B	mg/kg	24.5	19.3	26.1	39.7	31.4
8.	Lead as Pb	EPA3050 B & 7000 B	mg/kg	5.23	3.74	6.78	9.25	7.81
9.	Mercury as Hg	EPA3050 B & 7000 B	mg/kg	BDL(<1)				
10.	Chromium as Cr	EPA3050 B & 7000 B	mg/kg	15.6	12.2	15.5	24.7	19.1
11.	Iron as Fe	EPA3050 B & 7000 B	mg/kg	474	332	674	811	634
12.	Arsenis as As	EPA3050 B & 7000 B	mg/kg	BDL(<2)				
13.	Manganese as Mn	EPA3050 B & 7000 B	mg/kg	94	73	134	171	116
14.	Nickel as Ni	EPA3050 B & 7000 B	mg/kg	BDL(<2)				
15.	Total Petroleum Hydrocarbon	ABCTL/INS/SOP/31	mg/kg	BDL(<0.05)				

Observations on marine sediment quality during June – September 2021

Hydrocarbon - Concentration of Total Petroleum Hydrocarbon (TPH) was found to be below detectable limits (BDL) in all the eight (8) samples analyzed.

Heavy Metals - Copper ranged from 47.28 mg/kg to 106.59 mg/kg with highest at MS 7. Concentration of, iron and manganese varied from, 0.27% to 0.66% and 99.68 mg/kg to 149.12 mg/kg respectively. Cadmium was found to be below detectable limit (BDL) at all the eight locations. Concentration of Content of zinc ranged between 34.73 mg/kg to 54.32 mg/kg respectively in the study area. Concentration of lead in the study area range between 40.89 to 132.42 mg/kg.

Observations on marine sediment quality during March – May 2024

Hydrocarbon - Concentration of Total Petroleum Hydrocarbon (TPH) was found to be below detectable limits (BDL) in all the five (5) samples analyzed.

Heavy Metals - Copper ranged from 19.3 mg/kg to 39.7 mg/kg with highest at MS 4. Concentration of, iron and manganese varied from, 332 mg/kg to 811 mg/kg and 73 mg/kg to 171 mg/kg respectively. Cadmium was found to be below detectable limit (BDL) at all the five locations. Concentration of Content of nickel and zinc ranged between BDL (<2) & 67 mg/kg to 118 mg/kg respectively in the study area. Concentration of lead in the study area range between 3.74 to 9.25 mg/kg.

3.15.1 Comparison of baseline data with current EIA study

Marine sediment samples were collected from 5 locations in the current EIA study. A comparison of average value recorded in the earlier EIA study and current study is given in **Table 3.36**.

Table 3-36 Comparison Marine water quality between earlier and current data

S.no.	Parameter	Unit	Earlier marine sediment quality	Current Marine sediment quality
1.	pH	-	8.5	7.37
2.	Texture	-	Clay & Sand	Clay & Sand
3.	Total Organic Carbon as C	%	1.69	2.53
4.	Phosphorous as P	mg/kg	-	172.6
5.	Zinc as Zn	mg/kg	43.56	90.8
6.	Cadmium as Cd	mg/kg	BDL (<2)	BDL (<2)
7.	Copper as Cu	mg/kg	67.935	28.2
8.	Lead as Pb	mg/kg	87.09	6.56

Comparison of long-term data between earlier and current data indicate no major deviations. Minor variations are evident which can be seasonal and acceptable for a dynamic environment.

3.16 Traffic density during the study period March 2024 – May 2024

The traffic studies have been conducted to know the prevailing traffic volumes on the existing roads. It is essential to consider these details for assessing the anticipated future traffic volumes as a part of overall impacts assessment for the project. The variations of traffic densities depend upon the working days and time and also vary in day and night times. In order to assess the prevailing traffic volumes on the roads, the survey was conducted during normal working days of the week by avoiding local holidays or abnormal situations like full moon day religious festival at Tiruchendur to reflect the true picture of the traffic densities. The traffic study was conducted at one location for 24 hours.

3.16.1 Methodology

3.16.1.1 Vehicle count

The vehicles passing through the road (in both ways) were counted separately for 24 hours at the two selected locations from 06.00 AM to 06.00 AM hrs. next day continuously. Category-wise vehicle counting has been done continuously and recorded in the traffic volume count on hourly basis under respective categories.

3.16.1.2 Categorization of Traffic

The engine driven vehicles were categorized into various heads viz. Motor Cycles or Scooters, Three Wheelers or Auto Rickshaw, Four Wheelers or Cars, Truck or Bus, Agricultural Tractor and Light Commercial Vehicle.

3.16.1.3 Sampling locations

One traffic location is represented in **Table 3.37**.

Table 3-37 Details of traffic monitoring locations

Location Code	Location Details
T-1	SH 176 (Thoothukudi - Tiruchendur - Kanyakumari Road)

3.16.1.4 Existing traffic scenario

The hourly vehicular traffic densities for continuous normal day at the location observed during the study period and the same are presented in **Table 3.38.** The Level of Service (LOS) and the capacity of the Roadway segments computed is based on the Indian Roads Congress (IRC) standards sourced from Guidelines for Capacity of Urban Roads in Plain Areas IRC 106-1990. Following table provides the LOS standards adopted based on the volume to capacity (V/C) ratios at the intersections and its performance.

Location Number: T-1-SH-176 (Thoothukudi - Tiruchendur - Kanyakumari Road)

Table 3-38 Hourly existing traffic load on the road

S. No	Type of Vehicle	No. of vehicles/1 hour	No. of vehicles/ day	PCU Factors IRC (SP 41)	PCU/day
1.	Motor Cycles or Scooters etc.	336	8064	0.75	6048
2.	Three Wheelers/ Auto Rickshaw	44	1056	1.2	1267.2

S. No	Type of Vehicle	No. of vehicles/1 hour	No. of vehicles/ day	PCU Factors IRC (SP 41)	PCU/day
3.	Four Wheelers/Cars	105	2520	1.0	2520
4.	Truck/Bus	126	3024	3.7	11188.8
5.	Agricultural Tractor	5	120	4.0	480
6.	Light Commercial Vehicle	4	96	1.4	134.4
	Total	**620**	**14880**	**--**	**21638.4**

Table 3-39 Existing Traffic Scenario and LOS

Type of Road	Existing Volume (PCU/day)	Capacity in (PCU/day)	V/C Ratio	LOS
SH-176	21638.4	36000	0.60	A

Proposed vehicular movement during operation phase

Proposed vehicular movement during operation phase/day	No. of vehicles/ day	PCU/day
No. of Two-wheeler Parking	345	258.75
Four Wheelers/Cars	90	90
Truck/Bus	60	222
Light Commercial Vehicle	20	28
Total	515	598.75

Table 3-40 LOS standards

LOS	V/C	Performance
A	0.60 or less	Excellent, free flow
B	0.70 or less	High, stable flow
C	0.80 or less	Good, Stable flow
D	0.90 or less	Adequate approaching unstable flow
E	1.0 or near about	Inadequate, unstable flow
F	Exceeding 1.0	Unacceptable, forced flow

100% traffic load has been calculated on SH-176 Thoothukudi - Tiruchendur - Kanyakumari Road. The LOS study shows that the existing traffic scenario is “Excellent” and the free flow of vehicles is observed during the study period March 2024 - May2024. Increase in PCU/day due to proposed project is given below in **Table 3.41**.

Table 3-41 Existing and Increase in PCU/day

Road	Existing	Proposed volume (V)	Capacity (C)	Modified V/C ratio	LOS
SH-176	21638.4	21638.4 + 598.75 = 22237.15	36000	0.61	B

3.16.1.5 Interpretation

The density of heavy vehicles was comparatively low. The LOS study shows that the existing traffic scenario is “Excellent” and the free flow of vehicles is observed during the study period March 2024 – May 2024. Out of the total traffic vehicles, 2 wheelers are very high followed by Trucks & Bus, 4-wheeler light and medium vehicles. Due to the proposed 2 x 660 MW supercritical thermal power plant, the traffic density will have negligible increase and traffic scenario is “High” and stable flow.

3.17 Coal analysis

Based on specific ToR given by MoEF&CC, imported and indigenous coal was analyzed and the results were within the stipulated norms. The results are given in **Table.3.42.**

Table 3-42 Coal analysis results

Imported coal results

S.No.	Test parameters	Test method	Result	Unit
1	Sulphur content	IS 1350 (Part-3): 1969	0.52	%
2	Ash Content	IS 1350 (Part-1): 1984	8.09	%
Heavy metals				
1	Lead as Pb	MBT/CL/SOP/091	9.16	mg/kg
2	Arsenic as AS		BLQ(LOQ:0.01)	mg/kg
3	Chromium as Cr		3.18	mg/kg
4	Mercury as Hg		BLQ(LOQ:0.01)	mg/kg

BLQ: Below Limit of Quantification; LOQ: Limit of Quantification

S.No.	Nuclides Analyzed	Activity Determination Limit Of Instrument MDA (3σ)	Method of Testing	Result (Bq / kg)	Exemption levels as per IAEA BSS
1.	Nat.Thorium-232	17.19 Bq/kg	AERB – Standard Analytical method (Clause 4.3.4: 2003)	BDL	1000 Bq/kg
2.	Nat. Uranium-238	17 Bq/kg		BDL	1000 Bq/kg
3.	K - 40	73.59 Bq/kg		BDL	10,000 Bq/kg

BDL: Below Detectable Level, MDA: Minimum Detectable Activity & Bq: Becquerel

Domestic coal results

S.No.	Test parameters	Test method	Result	Unit
1	Sulphur content	IS 1350 (Part-3): 1969	3.10	%
2	Ash Content	IS 1350 (Part-1): 1984	43.5	%
Heavy metals				
1	Lead as Pb	MBT/CL/SOP/091	7.29	mg/kg
2	Arsenic as AS		BLQ(LOQ:0.01)	mg/kg
3	Chromium as Cr		10.16	mg/kg
4	Mercury as Hg		BLQ(LOQ:0.01)	mg/kg

BLQ: Below Limit of Quantification; LOQ: Limit of Quantification

S.No.	Nuclides Analyzed	Activity Determination Limit Of Instrument MDA (3σ)	Method of Testing	Result (Bq / kg)	Exemption levels as per IAEA BSS
1.	Nat.Thorium-232	12.86 Bq/kg	AERB – Standard Analytical method (Clause 4.3.4: 2003)	56.36 ± 12.63	1000 Bq/kg
2.	Nat. Uranium-238	12.73 Bq/kg		45.12 ± 12.75	1000 Bq/kg
3.	K - 40	58.08 Bq/kg		91.62 ± 58.08	10,000 Bq/kg

BDL: Below Detectable Level, MDA: Minimum Detectable Activity & Bq: Becquerel

4 ANTICIPATED IMPACTS AND MITIGATION MEASURES

4.1 General

Environmental clearance for the proposed project was initially obtained vide MoEF&CC F. No. J 13012/19/2008—IA. II(T), dt. 14.10.2013. Subsequently, TANGEDCO obtained amendment to the above-mentioned Environmental Clearance for reduction of unit sizes from 2 x 800 MW to 2 x 660 MW, vide MOEF/GOI's Lr.No.13012/199/2008—IA II(T), dt 26.04.2017. Originally Validity of EC was given for 5 years. i.e., upto 13.10.2018. Thereafter, the validity of EC was extended for further two more years, .ie., up to 13.10.2020 vide MOEF/GOI's Lr.No. J.13012/19/2008 – IA. II (T) dt. 10.09.2018. Then MOEF&CC/GOI has extended validity of EC for the Project three years i.e., upto 13.10.2023 vide MOEF/GOI's Lr.No. J 13012/19/2008- 1A. II(T), dt.25.09.2020.

Presently, the physical work progress is completed to the tune of 85%, for which EC was granted. Since, the validity of EC was extended for all the projects on account of Covid-19 pandemic (vide MoEF&CC OM F.No.22-25/2020-IA.III dated: 18.1.2021), the validity of EC for Udangudi Supercritical Thermal Power Plant is deemed to be valid till 13.10.2024. As the validity of EC is nearing completion, it is planned to obtain fresh EC for the project.

The proposed project envisages the following equipments:

- Steam Generator and its Auxiliaries;
- Steam Turbine and its Auxiliaries;
- Electrical Generators, Transformers and Switchyard
- Control and Instrumentation systems
- Air Pollution Control Systems like Dust Suppression and Extraction Systems, Electrostatic Precipitators, Flue Gas Desulphurization System and NOx Control System;
- Water Intake and Treatment Systems;
- Condenser and Auxiliary Cooling System;
- Fuel Oil System;
- Coal Handling and Storage System;
- Ash Handling, Utilization and Disposal System;
- Site Drainage, Sewage Treatment Systems with facilities for Recycle and Reuse;
- Green belt, afforestation and landscaping systems.

The proposed project is likely to cause impacts on the terrestrial and marine environment. Predominantly being a terrestrial infrastructure development, the proposed project activity will have major impact on the terrestrial environment. This chapter describes the anticipated impacts on the terrestrial and marine environment during the construction and operation phase of the proposed project. Detailed assessment of the construction phase and operation phase for various environmental components are discussed quantitatively and qualitatively with the help of scientific tools and references. Appropriate mitigation measures have been suggested based on the nature and magnitude of impact envisaged.

Even though overall 85% of construction activity for the proposed project has been completed, still construction of various project components at different completion rates. No project components have been completed 100%. Therefore, for the purpose of defining impacts as a worst-case scenario, the project has been considered as a fresh construction process capturing all possible impacts. Also, wherever applicable, existing mitigation measures are highlighted. The impacts due to off normal operations and environmental disaster scenarios are considered and detailed in Chapter 07. Impact prediction is a way of mapping the environmental consequences along the phases of activities of the proposed plant. The impact assessment will broadly cover the following information and components:

Assessment of physical effects for all phases including location, design, construction, operation and possible accidents
Prediction of impacts of the various facilities envisaged in TANGEDCO due to pollutants during construction and operation
Estimation by type and quantity of expected contaminants and emissions (air, water, noise, solid wastes) resulting from the operation of the proposed plant
Assessment of any significant irreversible impacts

The anticipated environmental impacts & mitigations of the proposed project are discussed below under the following categories as the plant is already designed and in operation. The details regarding siting and design are already dealt in Chapter 2.

- Impacts and mitigation measures during construction
- Impacts and mitigation measures during operation

4.2 Impacts and mitigation measures during construction phase

This is the first phase of activity in the project and involves:

- Site clearing and leveling
- Construction of the plant, fabrication and erection of equipment
- Plantation development and others

As the project site (total area 380 Ha) is under possession of TANGEDCO and preparatory activities like construction of access roads, temporary offices and godowns, piling, storage of construction materials etc. will be confined within the project area. The possible safety aspects to be considered during the construction phase are primarily limited to material transport, construction and erection of material and structures. The direct and indirect impacts due to construction activities are discussed in this section.

4.2.1 Site clearing and levelling

This activity would involve clearing the site and further development into Land use units of power house building, Boiler and auxiliaries, Cooling Tower, Pump house, raw water storage tank, Utilities viz. DM plant and cooling tower, Ash handling system, Fuel storage & handling system, and raw materials. It also comprises of construction of roads, laying of utility pipelines (Water supply, effluent conveyance, storm water, telephone, power supply, etc) Effluent treatment plant and other warehouse and storage facilities for hazardous wastes.

Topography of the proposed site appears to be flat with level + 2.00 m AMSL and it may not require any major excavation. The excavated material will be limited and will be used for proposed site leveling. The filling material will be fly ash from Tuticorin Thermal Power station of TANGEDCO (TNEB). The filling material will be transported by closed trucks through all-weather metalled road. However, the above activities are already completed and suitable mitigation measures taken and hence does not warrant for further analysis.

4.2.2 Impact of physiography and drainage

As described in Chapter - 3, under geology and hydrogeology, the project site being a coastal area encompasses only single geological formation namely unidentified Fluvial//Coastal/Aeolian and older coastal plains, Pediment pediplain complex and younger coastal plain. The project site is mainly governed by dendritic drainage system. The surface run-off water from the project site is naturally diverted into surface water network system which is constructed one side of the road and all along the boundary wall and finally diverted to rainwater harvesting pits. The plant is located on an elevated area with height ranging 2-10m AMSL.

Estimation of change in peak flood discharges in pre and post construction scenarios for project site

To estimate the run-off in pre and post construction scenarios for the site a value of 0.4 and 0.9 run-off coefficients are considered respectively. The annual average rainfall of Tuticorin district for the past thirty years (IMD data) is computed to be 630.2 mm. **Table 4.1** shows the estimated run-off volume for pre and post construction scenarios for project site. The annual average run-off volume increases from 9,60,640 m^3 to 14,75,397 m^3, showing an increase of 5,14,757 m^3 of run-off about 34.9% in post construction scenario of TNPGCL (TANGEDCO).

Table 4-1 Estimated run-off volume for pre and post construction scenarios for project site

Sl. No	Description	Run-off coefficient considered	Normal rainfall in m/annum	Total area in m^2	Run-off volume (m^3/yr)
I	**Pre-construction**				
1	Total area	0.4	0.63	38,00,000	9,60,640
2	Total run-off				9,60,640
II	**Post construction**				
3	Proposed TANGEDCO footprints	0.9	0.63	16,43,800	9,32,034.6
4	Green belt	0.4	0.63	21,56,200	5,43,362.4
5	Total run-off-post construction (3+4+5)		0.63		14,75,397
Increase in run-off (5-2)					5,14,757

From the above table, it can be concluded that there is an annual increase in surface water run –off due to construction of Udangudi Supercritical Thermal Power plant. The

increase runoff will be directed to 100 m^3 rainwater storage pond. The excess runoff (i.e., pre-construction stage quantity) will be drained into rainwater harvesting pits 30 Ns. which is having 180 m^3 carrying capacity. The harvested water will be used for plant purposes.

4.2.3 Erosion and sediment control

Impacts

The present project does not involve land disturbance as the land is almost plain. Hence, soil erosion is not expected as there is no land fill envisaged. However, a minor amount of erosion may occur due to foundation activities, Soil removed by erosion may become sediments and create problem to the existing natural waterways and pollute them.

Mitigation measures

The following mitigation measures will be adopted to minimise erosion:

- Schedule measures to avoid and reduce erosion by phasing the work program to minimize land disturbance in the planning and design stage
- Keep vehicles to well-defined haul roads
- Rehabilitate cleared areas promptly
- Silt traps will be provided along the storm water drain at suitable place

4.2.4 Dust control

To ensure that there is no health risk or damage to amenity due to dust emission, many measures to reduce dust problems are the same as those taken to minimize erosion and sediment run-off. Additional measures are:

- Implementing a dust prevention strategy, developed at the project planning stage
- Implementing dust suppression measures, such as wetting of exposed areas when visible dust is observed.
- Erection of wind curtains around the plant erection site

4.2.5 Contaminated storm water

Impacts

Soil/construction material eroded during construction can wash away and contaminate the storm-water emanating from the construction site. If contaminated storm-water enters a drainage line or storm-water drainage system, it will eventually discharge/seep into an adjacent waterway/ groundwater aquifer and pollute the same.

Mitigation measures

The construction planning will be done in such a manner that major excavation will be done during non-monsoon season and all loose material is lifted to earmarked site so that there are no chances of soil flowing through with run-off and clogging the storm system.

- During construction phase, strict administrative measures will be enforced to store all materials such as aggregate, sand, bricks in earmarked zones. Material like cement will be stored under covered sheds/silos
- Minimize the generation of contaminated storm-water

- Minimize the quantity of uncontaminated storm-water entering cleared areas
- Establish cut-off or intercept drains to redirect storm-water away from cleared areas and slopes to stable (vegetated) areas or effective treatment installations
- Reduce water velocities by providing mild slopes in the drains

4.2.6 Influx of labors

The construction of any development activities is undertaken by segregating the total project into various independent packages. In the tender specification for various packages, the requirements related to environmental aspects and applicable mitigation measures to be adopted in the package are specified. The inspection/monitoring of the same are built-in within the quality assurance procedures/plans of the package.

The supply of manpower for different packages, is contractor's/sub-contractor's responsibility including providing residential facilities for those personnel's being brought from outside. The contractor's laborer's will be accommodated by the contractor in the surrounding villages. As the plant is completing the construction stage, labor camps are not permitted inside the plant.

Impacts and mitigation measures

It has been envisaged that during construction phase maximum of 500 persons may be temporarily deployed.

For prediction of impact of manpower influx, the peak construction phase has been considered. Out of the total 614 construction man-power, 10% will be engineers, supervisors, skilled & semiskilled manpower and 90% will be labors. Thus, making the break-up of manpower during peak construction stage as given in **Table 4.2.**

Table 4-2 Break-up of manpower during peak construction stage

Sl. No.	Type of construction manpower	Number
1	Engineers, Supervisors, Skilled & Semi-skilled	62
2	Labors	552
	Total	**614**

As the major construction work is completed and deployment of peak man powers is not anticipated now. The existing construction workers of about 200 would be sufficient to complete the project. Hence, influx due to man power at site is not anticipated.

4.2.7 Air quality

The dust emissions associated with construction activities is likely to be generated from loading and unloading, leveling, grading, earthwork, foundation works and other construction related activities and wind erosion. Vehicular emissions are the major source of emissions such as diesel-powered vehicles used in haulage of aggregates, earth and other construction material. Air quality could also be affected by dust & particulate matter arising due to site clearing, vehicular emissions, processing & handling of construction materials Most of the construction dust will be generated from the movement of construction vehicles on dirt roads. Loading and removal of spoil material will also be the potential source for dust nuisance.

Mitigation Measures

The most direct and effective dust suppression measures are regular watering for the main haul roads within site formation area. With the help of regular watering all over the exposed area, at least twice a day, a 50% reduction on the dust contribution from the exposed surface can be reduced.

Construction of drains, sewers and water mains will require excavation of trenches. Laying these new infrastructures are likely to be conducted section by section, thus the quantity of the excavated material which will help in reducing dust nuisance.

It is anticipated that excavated material will only be stockpiled on each local works area. The impact of such activities would be temporary and restricted to the construction phase.

The following mitigation measures are suggested:

- Proper and prior planning, sequencing and scheduling of all major construction activities is done, and timely availability of infrastructure supports needed for construction are ensured to shorten the construction period in turn to reduce pollution
- Construction materials are stored in covered go-down or enclosed spaces to prevent the windblown fugitive emissions
- Wet suppression and wind speed reduction barriers are used to control open dust sources at construction sites
- Stringent construction material handling/overhauling procedures are being followed.
- Truck carrying soil, sand, stone dust, and stone are duly covered to avoid spilling and fugitive emissions
- Adequate dust suppression measures such as regular water sprinkling at vulnerable areas of construction sites are undertaken to control fugitive dust during material handling and hauling activities in dry seasons
- The construction material delivering vehicles are covered in order to reduce spills
- It ensured that all construction equipment and vehicles are in good working condition, properly tuned and regularly maintained to keep emission within the permissible limits
- Monitoring of air quality at regular intervals are conducted during construction phase in line with the requirements of SPCB.

4.2.8 Surface water

Impacts

The impacts on surface water quality during construction phase mainly arise due to site clearing, leveling, excavation, storage of construction material etc. A leveling and excavation activity normally increases the level of suspended solids in the surface water run-off.

Mitigation measures

The mitigation measures are:

- Quality of construction wastewater generated from the construction site are controlled through the drainage system with sediment traps (silting basin as water intercepting ditch) for arresting the silt/sediment load before its disposal
- All the washable construction material are stored under sheds or enclosed space by fencing it with brick or earth in order to prevent spillage into the drainage network, so that the same does not find its way into the surface water run-off
- The sediment traps and storm water drainage network are periodically cleaned and especially before monsoon season
- Majority of the water generated are utilized for dust suppression and plantation within the plant premises
- The vehicle maintenance/washing area are maintained with proper drainage system having oil trap mechanism to avoid contamination of surface and ground water by oil/lubricants
- Silt settlement tanks are provided with suitable retention time

4.2.9 Ground water

Impacts

The ground water will not be used for construction work. The construction water source will be drawn from private tankers. Therefore, the construction phase of the proposed plant will have insignificant impact on the ground water.

Mitigation measures

As the construction mainly structural related work major impact on ground water regime is not anticipated.

4.2.10 Noise levels

Major sources of noise during the construction phase are mobile machineries within the site, general construction activities and from movements of vehicles servicing the site. Noise on construction site results from machinery used for excavation, levelling and from fixed machineries such as compressors, concrete mixers and dumpers. The damage caused by noise is a function of type as well as loudness.

With increasing distance from the source, the noise level decreases due to wave divergence. Additional decrease also occurs due to atmospheric effects and interaction with objects in the transmission paths. Based on the above principle a noise model has been developed in house, which has been used to predict the noise. It is predicted that the noise levels in the surrounding environment due to above said noise sources at a distance of 100m will be 92 dB(A) and at 500m will be 78 dB(A). It is also predicted that the noise levels from these sources at 1500m distance will be 66 dB(A). Therefore, background noise levels in the nearest village which is located at a distance of about 2.17 km will not be receiving the impact. The above prediction is for worst scenario case like during construction if all the construction equipment is working together which is not likely to occur. Further, the above prediction is without any attenuation factors like green belt, wind curtains etc. With mitigation measures it will be limited to ambient level.

4.3 Impacts and Mitigation Measures during operation

The operational activities of the project are likely to have some stress on the environment as mentioned below

- Conventional air pollutants generation from the process and dispersion
- Domestic and effluent generation and treatment
- Solid waste generation and disposal
- Impact on ecology

The environmental parameters likely to be affected are quality of air, water, and soil/land due to release of pollutants from process.

4.3.1 Impact of conventional pollutant

4.3.1.1 Air environment

The proposed project is a coal-based supercritical Thermal Power Plant comprising of two units capable of generating 2x660 MW. The major source of pollution from proposed power plant is emissions from chimney. The basic fuel proposed to burn is imported coal with ash content 26%. Coal requirement for the proposed project is 5.893 MTPA. The important air pollutants generated from thermal power plant are Particulate Matter (PM), Sulphur dioxide (SO_x) and Oxides of Nitrogen (NO_X) due to burning of coal.

Point source emissions from the proposed project

Table 4-3 Predicted emissions from the proposed units

Sl. No.	Emission source	Capacity	Fuel used	Stack details					Emission (g/s)		
				No of Stack	Height (m) AGL	Dia. (m)	Exit Temp (°C)	Ext Velocity (m/s)	PM	SO_x	NO_X
1.	Multi Flue Gas Chimney	2 x 660 MW	Coal	1	275	7.1	393.15	22.88	112.33	101.493	181.19

The above emissions are expected to be released from the proposed stack of 275m. Once the pollutants are emitted into the atmosphere, the dilution and dispersion of the pollutants are controlled by various meteorological parameters like wind speed and direction, ambient temperature, mixing height, etc.

Line source emissions

It is planned to transport the ash through road. The TANGEDCO Limited plant will be operating with the production capacity of 2x 660 MW.

Based on the above, the no. of trucks for transporting ash of 1,09,166.66 MT/month is estimated to be 1500 trucks/month. The estimates emissions due to transportation of ash via. roads are given in **Table 4.4.**

Table 4-4 Estimated emission rates due to road transportation

S No.	Type of Vehicle	No. of. Vehicle (Based on maximum operation capacity)	PM	SO_x	NO_x
1	Bike	345	2.8E-06	2.8E-07	1.1E-02
2	Car/Bus	100	3.5E-04	1.4E-07	3.5E-03
3	Ash	1500	2.5E-04	1.3E-07	4.4E-02

Prediction of impacts using AERMOD

In order to study the ground level concentrations in future scenario and to predict the impact on the ambient air quality due to the pollution load from the proposed project, air quality impact prediction modelling has been conducted considering site specific meteorological data to estimate the incremental Ground level concentrations. The US Environmental Protection Agency's (EPA's) AERMOD computer code is used to estimate atmospheric dispersion and concentrations of the released emissions in the immediate vicinity of the sources. The modelling is conducted to be inclusive of the weather conditions that are possible and representative of the sources and transportation of raw materials.

Both airborne and surface concentrations are modelled with AERMOD considering complex terrain. Hourly derived air concentrations (DAC) are modelled for an array of receptors covering the sources and surrounding areas. Peak values of time-integrated air concentrations at these major receptors points are derived from these hourly values, with modelled results reported as total incremental air concentrations in DAC-hours occurring over the selected time period. Total pollutants concentrations over the areas are evaluated with AERMOD using the same array of receptors, with results reported as microgram per m^3.

The GLCs has been predicted over a 5 km X 5 km area with the location of the main TANGEDCO Limited Stack as the center. Meteorological data plays an important role in computation of Ground Level Concentration using AERMOD model. The actual monitored site meteorological data for one full season of summer has been considered. The meteorological data was generated near the plant site for three month's period on hourly basis.

The maximum GLCs for each grid point were predicted with respect to pollutants PM10, PM2.5, SO_x and NO_x. In order to obtain the impact due to proposed project, Background concentration recorded in the study area are considered and the contribution due to proposed project is added to it. The predicted cumulative GLC values have been predicted and given in **Table 4.5** and the isopleths showing the incremental concentration due to the proposed project for the monitoring period is shown in **Figure 4.1 to 4.3**. From the results it can be observed that the predicted ambient air quality is well within the limit of ambient air quality standards. The incremental concentrations due to proposed power plant for PM, SO_x and No_x are 1.17, 1.89 and 1.06 µg/m^3. The AAQ concentration at the receptor are shown in **Table.4.6.**

Table 4-5 Concentration at the receptor

Pollutant	Monitoring stations	Incremental Concentrations (in $\mu g/m^3$)	Distance of GLC (km)	Direction from Project site
PM	AAQ 1	1.0912	-	-
	AAQ 2	0.8544	6.21	SW
	AAQ 3	0.7083	2.07	W
	AAQ 4	0.7920	2.93	N
	AAQ 5	0.4677	3	S
	AAQ 6	0.5093	4.89	NW
	AAQ 7	0.3261	6.6	W
	AAQ 8	0.8850	2.61	W
SOx	AAQ 1	0.9860	-	-
	AAQ 2	0.7719	6.21	SW
	AAQ 3	0.6400	2.07	W
	AAQ 4	0.7156	2.93	N
	AAQ 5	0.4226	3	S
	AAQ 6	0.4602	4.89	NW
	AAQ 7	0.2946	6.6	W
	AAQ 8	0.7996	2.61	W
NOx	AAQ 1	1.7602	-	-
	AAQ 2	1.3782	6.21	SW
	AAQ 3	1.1425	2.07	W
	AAQ 4	1.2776	2.93	N
	AAQ 5	0.7545	3	S
	AAQ 6	0.8215	4.89	NW
	AAQ 7	0.5260	6.6	W
	AAQ 8	1.4276	2.61	W

Table 4-6 Resultant concentrations due to incremental GLC's at project site

Pollutant	**Maximum AAQ Concentrations Recorded During the Study Period in Project site ($\mu g/m^3$)**	**Incremental Concentration ($\mu g/m^3$) – Worst Case**	**Resultant Concentration ($\mu g/m^3$)**	**AAQ Standards (mg/Nm3)**
PM	31.849	1.17	33.01	100
NOx	51.374	1.89	53.264	80
SOx	28.78	1.06	29.84	80

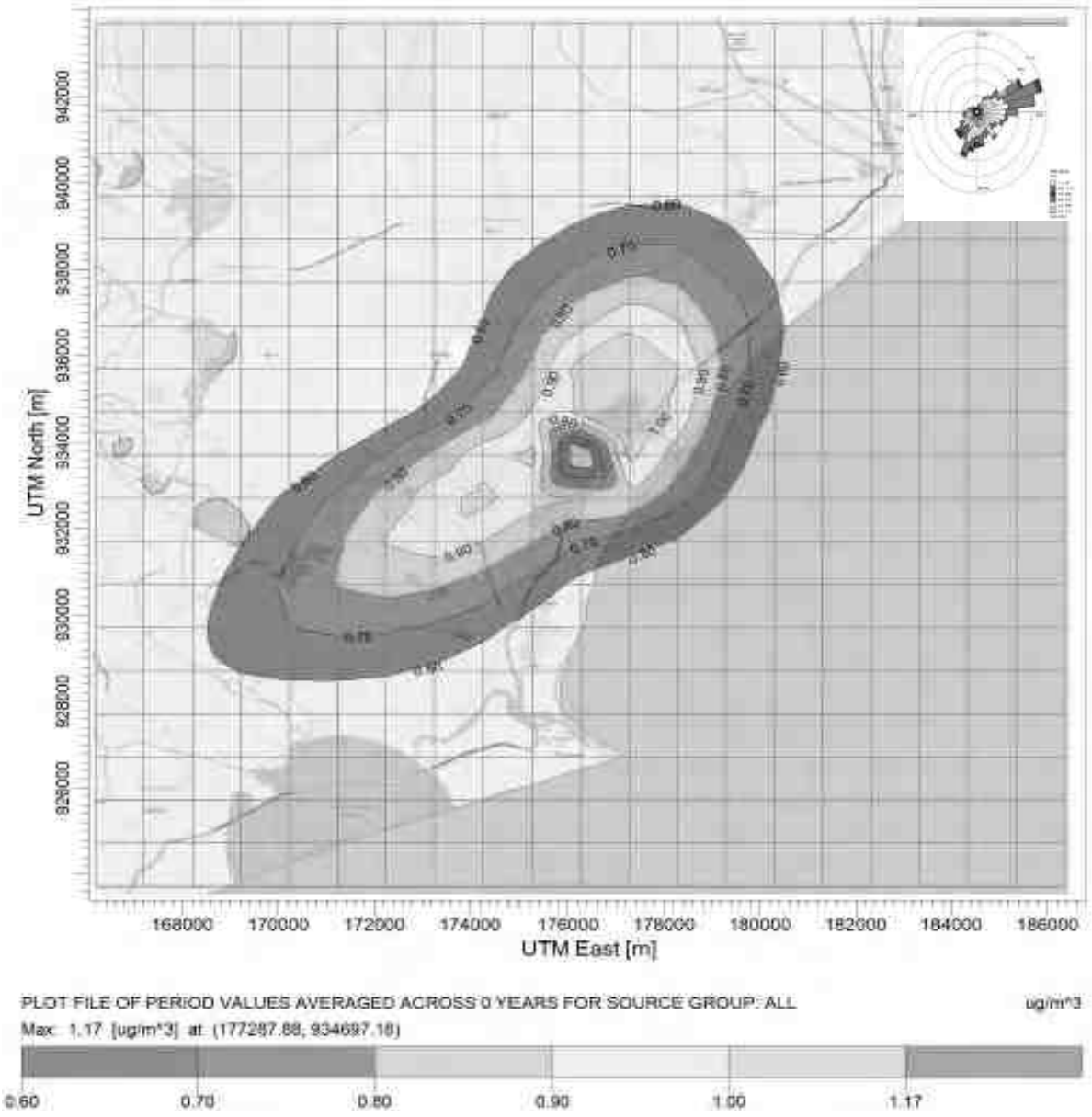


Figure 4-1 Predicted GLC of PM

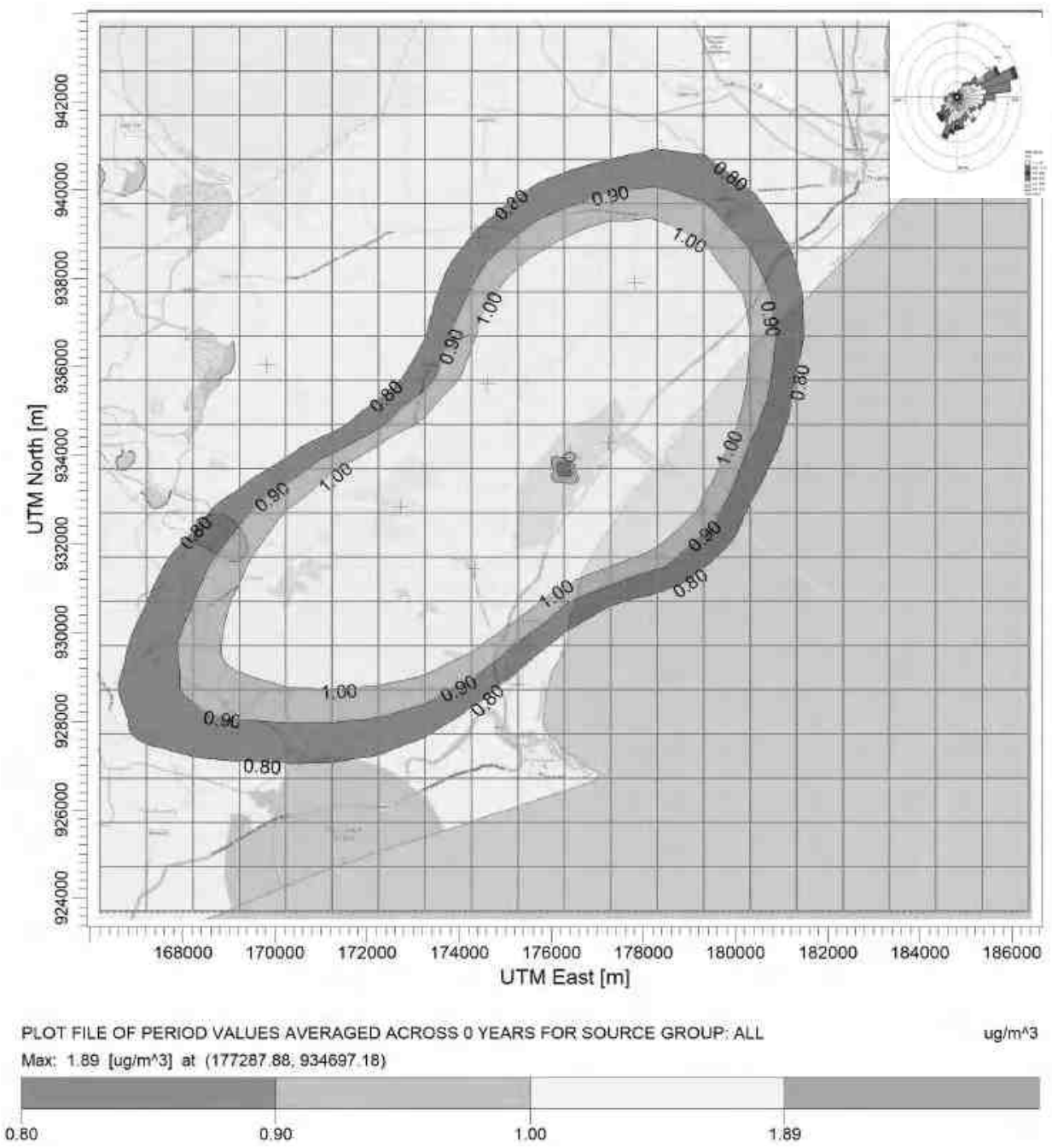


Figure 4-2 Predicted GLC of NOx

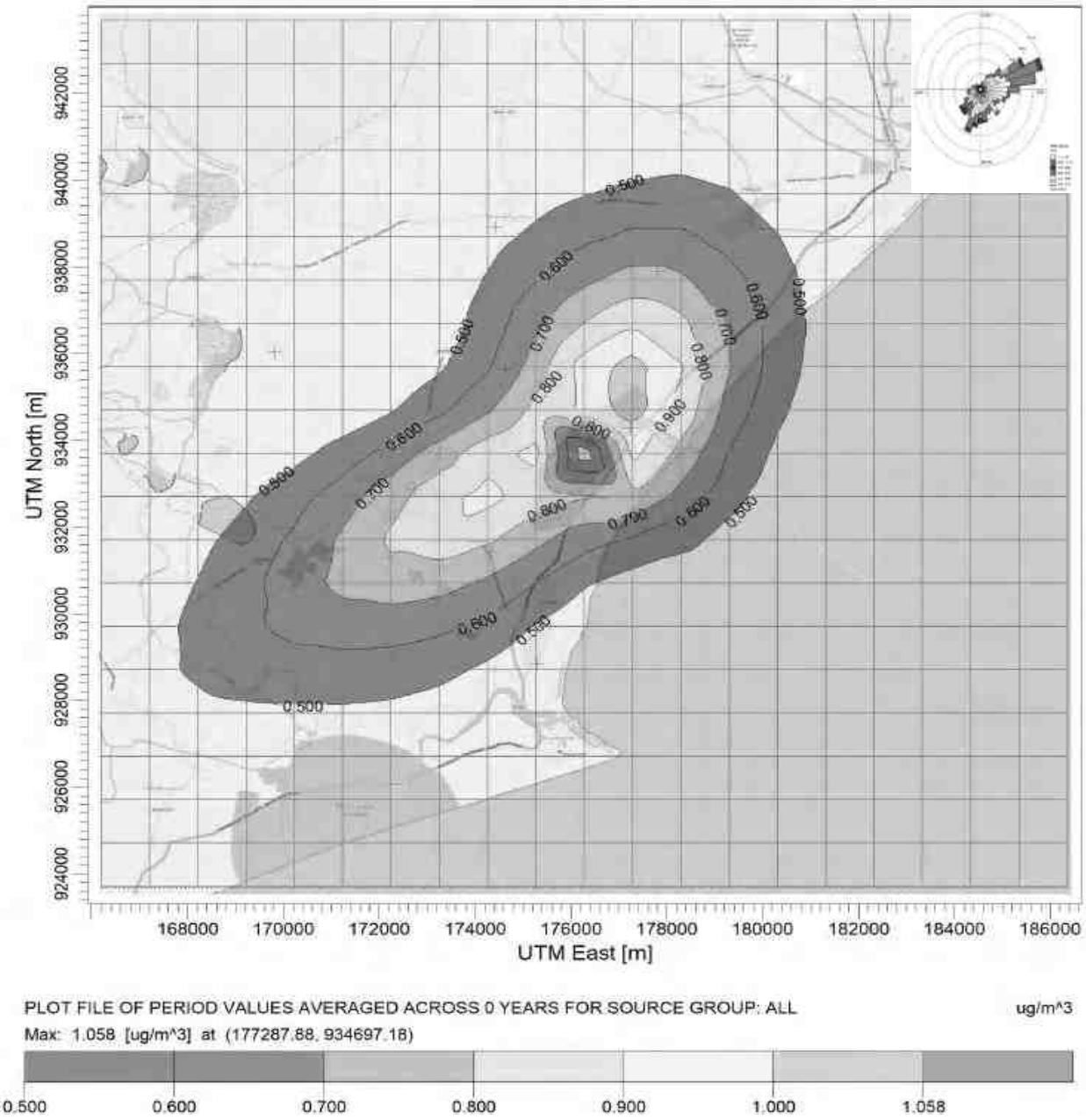


Figure 4-3 Predicted GLC of SOx

Mitigation measures

4.3.1.1.1 Air pollution control devices

Electrostatic Precipitator

It is proposed to install adequately sized electrostatic precipitator having an efficiency that limits the outlet emission to the applicable value of 30 mg/Nm^3. The electrostatic precipitators will have adequate numbers of parallel gas streams, isolated from each other on the electrical as well as gas side and will be provided with gas tight dampers at inlets and outlets of each stream, to allow maintenance to be carried out safely on the faulty stream, while the unit is working. Electrostatic precipitator will be provided with transformer rectifier sets, microprocessor based programmable type rapper control system and ESP management system to ensure safe and optimum operation of ESP. The dust collection hoppers at all strategic locations will have a minimum storage capacity of eight (8) hours. The hoppers will have heating arrangements to prevent ash sticking to the sloping sides and down pipes. Level indicators to indicate ash levels in the hoppers and trip the ESP in case of high ash levels in the ash hoppers are also envisaged to ensure safety of ESP.

In order to meet the environment norms and maintain the sustained efficiency of ESP, it shall be adequately designed with sufficient margins for all operating conditions. The Electrostatic Precipitator Management System (EPMS) in conjunction with opacity monitor shall continuously monitor and maintain the optimum energy level to achieve higher efficiency of ESP. One (1) no. twin-flue chimney of 275 m height has been envisaged. The chimney would be provided with personal access for regular monitoring of stack emissions.

For the control of fugitive dust emission within and around the Coal handling plant, dust extraction and suppression systems be provided. Dust suppression system like dry fog will be installed at all the transfer points in Coal Handling Plant and at Coal stockyard. Dust extraction system would be provided in crusher house, and at Coal stockyard. Further in order to arrest the coal dust generation, all conveyers will be provided with enclosed galleries. The bottom portion of all the conveyors will be provided with seal plates within the power plant area and above roads.

Flue Gas Desulphurization (FGD)

Wet Limestone based Flue Gas Desulphurization system

The wet limestone based FGD system adopts limestone slurry for the removal of the SOx present in the flue gas and the flue gas after treatment will be saturated. Gas to gas heat exchangers will be required to raise the temperature of the flue gas entering the chimney. The system will have efficiency of 95% or more. The arrangement of flue gas system will allow complete isolation of the absorber from gas side, with the unit in operation. For this purpose, Motorized/Pneumatic Guillotine type gates will be provided at hot gas inlet to gas-gas heater, cold gas outlet from gas-gas heater and the flue gas bypass duct.

Considering that the limestone-based system is being adopted for the proposed plant, sources & mode of transport already being identified and also considering the advantages of higher efficiency, wet limestone-based Flue gas desulphurization system is proposed

for 2 x 660 MW units. It is expected that about 2,10,000 TPA of gypsum would be generated and treated as a byproduct due to installation of FGD. The above quantity of gypsum will be sold in the market as per the requirement.

NOX Control System

At present, advanced Low NOx combustion technology is used in all steam generator combustion system with Low NOx burner and over fire air system. This will reduce the NOx emission to a large extent. However, cost effective post combustion NOx control technology such as SCR / SNCR will be required to limit the NOx level to 100 mg/Nm^3 as stipulated by 2015 amendment.

4.3.2 Noise environment

The proposed project related activities will lead to generation of noise that may have minor impact on the surrounding communities in terms of minor increase in noise levels. The potential impacts on noise level may arise out of the following:

Noise from Vehicle /Traffic

Vehicle movement for transportation of materials and work force to the site will cause minor noise emission as the frequency of vehicular movement is few times in a week.

Noise from DG Set, Boiler, Cooling tower, etc.

Noise generated from DG set, boiler, cooling tower, etc. will have a permanent effect to the workers working in the nearby vicinity, if they will work for more hours in a day.

Impacts

The machinery envisaged for the plant operation is a source of noise. Generally, this noise is generated due to continuous operation of machineries like coal mills, turbine, boilers, generators, pumps and cooling towers etc.

The noise levels likely to be generated by these sources are presented in **Table 4.7.** It is all likely that equipment manufacturers are to adhere the noise norms in design stage which may further reduce the noise levels. Most of the machines will be working continuously round the clock during operation of the proposed facilities. However, these machines would be housed in acoustic enclosures/buildings in such a way that they would not be contributing any additional noise levels in the surrounding environment.

Noise levels are mainly generated from coal mills, turbine, boilers, generators, pumps and cooling towers in the proposed power plant. Various equipments like Turbine, Generator, Boilers feed pump, Condensate, Coal mill, Cooling Tower and ID & FD Fans would be designed to 85 dB (A). The Input Noise Levels considered for modeling are in the event of failure of protections systems are as follows.

Table 4-7 Main sources of noise from different equipment & their noise levels

Sr. No	Name Of The Source	Distance from noise source (m)	Noise Levels, dB(A)
1	Crusher Unit	1	85
2	ID & FD Fans	1	85

3	Boilers feed pump	1	85
4	Turbine	1	85
5	Generator	1	85
6	Cooling Tower	1	80

During operation phase, noise is generated from the above sources. Hence, with increasing distance from the source the noise level decreases due to wave divergence. Additional decrease also occurs due to atmospheric effects and interaction with objects in the transmission paths.

In view of this, the propagation modeling considered for operation and the predicted noise level at source during operation is 85 dB(A).

The results of the noise modelling reveal that the maximum noise level will be 23.4 dB(A) at 1.5km distance due to the proposed plant. The results are predicted without any attenuation factors. It is expected with attenuation factors as given in mitigation measures will reduce the noise level to the extent possible/within the permissible norms. The noise contours are shown in **Figure 4.4**.

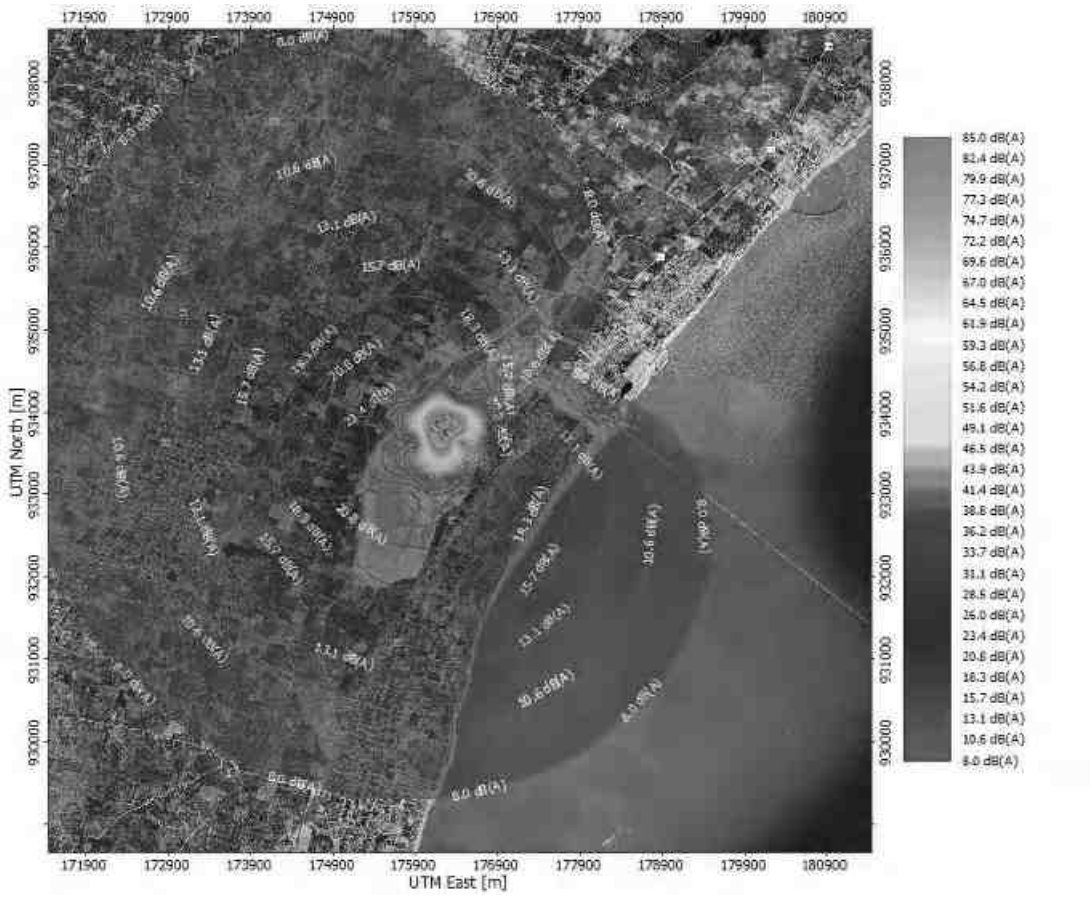


Figure 4-4 Noise contours

Mitigation Measures

The ambient noise levels in the region are within permissible limits and are proposed to be within the permissible limits even after commissioning of the proposed facilities.

The noise levels stipulated by MoEF&CC and/or Pollution Control Board at any point of time will not exceed the stipulated standards. The equipments will have inbuilt noise control devices. The measured noise level produced by any equipment will not exceed 85 dB(A) at a distance of 1.0-m from its boundary in any direction under any load condition. The noise produced in valves and piping associated with handling compressible and incompressible fluids will be attenuated to 75 dB(A) at a distance of 1.0 m from the source by the use of low noise trims, baffle plate silencers/line silencers, acoustic lagging (insulation), thick-walled pipe work as and where necessary. The general mitigation for the attenuation of the noise is given below:

Noise Attenuation Measures

Noise level can be reduced by stopping leakages from various steam lines, compressed air lines and other high-pressure equipment

- By providing padding at various locations to avoid rattling due to vibration
- By adopting new technologies for control of noise in various units
- Encasement of noise generating equipment where otherwise noise cannot be controlled
- Providing noise proof cabins to operators where remote control for operating noise generating equipment is feasible.
- The air compressor, process air blower, pneumatic valves should be provided with acoustic enclosure;
- In all the design/installation precautions are taken as specified by the manufacturers with respect to noise control shall be strictly adhered to;
- High noise generating sources shall be insulated adequately by providing suitable enclosures;
- Design and layout of building to minimize transmission of noise, segregation of particular items of plant and to avoid reverberant areas;
- Use of lagging with attenuation properties on plant components / installation of sound attenuation panels around the equipment
- Other than the regular maintenance of the various equipment, ear plugs/muffs are recommended for the personnel working close to the noise generating units;
- All the openings like covers, partitions are designed properly; and Inlet and outlet mufflers will be provided which are easy to design and construct.
- All rotating items will be well lubricated and provided with enclosures as far as possible to reduce noise transmission. Extensive vibration monitoring system is being provided to check and reduce vibrations. Vibration isolators are being provided to reduce vibration and noise wherever possible;
- The insulation provided for prevention of loss of heat and personnel safety will also act as noise reducers.

4.3.3 Impact on water quality

The estimated water requirement for the proposed power plant is about 3,13,512 m^3/day (13,063 m^3/h) Water drawn from the Bay of Bengal is subjected to Desalination and used for various systems. To produce 87,168 m^3/day of desalinated water about 36,840 m^3/day of brine water will be discharged into sea along with cooling tower blowdown water. The

desalination water quantity of about 24,525 m^3/day will be used for domestic purpose which will be treated through 40 KLD STP. The wastwe water generated from DM plant, Transformer yard, TG hall, floor wash, fuel oil handling area, etc. of about 720 KLD will br treated through 720 KLD ETP. In addition, about 1,59,624 m^3/day of cooling tower makeup water and 15,314.4 m^3/day of ash water recovery will be discharged into sea.

Impacts

The source of wastewater generation from the project is as follows:

- Sewage
- Cooling tower blowdown
- Floor washings,
- DM Plant reject
- Transformer yard, TG hall, fuel oil handling area, Coal handling area wash water etc.

Mitigation Measures

Various mitigation measures are proposed to minimize the impact on the water environment due to the wastewater generation during the operation phase of the project.

The effluent generated from the plant is treated in Sequential Batch Reactor (SBR) based ETP capacity of 720 KLD. The treated water will meet the requirement of TNPCB norms viz. BOD <30 mg/l, TSS <20 mg/l and pH 5.5-8.5. The SBR plant consists of clarifier, oil and grease removal, closed aeration followed by pressure sand filter and activated carbon filter. The treated water is fed into ultra-filtration and the UF treated water will be passed through Two stage RO. The RO treated water will be used for plantation and greenbelt.

About 40 KLD of sewage will be generated and the same will be treated in SBR based STP of capacity 40 KLD. The treated water from STP will be reused for plantation and green belt to reduce the fresh water consumption. In addition, the efficient rainwater management plan is also adopted for entire plant area according to the topography. Groundwater recharge, storm water management also considered as mitigation measures.

Specific water consumption

The specific water consumption of TANGEDCO Limited is estimated to be 3.05 m^3/MWh against specific water consumption of 3 m^3/MWh as per G.S.R 593 dated 28th June, 2018. The extraction of the notification is reproduced below.

Quote “III. Specific water consumption shall not exceed maximum of 3m^3/Mwh for new plants installed after the 1st January, 2017 and these plants shall also achieve zero waste water discharge” – Un Quote

The proposed TPP using sea water for internal consumption as well as for desalination plant. Further, the above specific water norms are not applicable if the plant consumes sea water as a raw water source. However, the specific water consumption exceeding marginally and it is comparable with fresh water consuming power plant. The recent amendment as enclosed as **Annexure XVI**.

Mathematical Modeling Study for Intake and Outfall of Water

Mathematical modeling study of the intake and outfall of cooling water system of Udangudi Super Critical Thermal Power Plant at Udangudi, Tuticorin dist., Tamilnadu has been carried out by National Institute of Oceanography (Council of Scientific & Industrial Research) Dona Paula - 403 004 Goa.

The outfall/intake pipeline corridor considered for this study extends to the sea up to 2.05 km offshore to the coast line. The pipeline travels offshore along the sea bed and the impacts if any is associated with laying of the pipelines onshore and offshore areas only. Though the temperature of the discharge will be same as the ambient sea water temperature, as an extreme case an outfall temperature of +5^{o}C above ambient temperature is considered with a source salinity of 50 PSU and maximum flow rate of 13500 m^3/h.

The warm/saline water discharge reached ambient temperature within 200m from the chosen discharge location. Hence, there will not be any change in the water quality in the coastal environment. Model results suggest that there is no re-circulation of warm water discharged from the outfall area into the intake point during the entire simulation period which represents spring and neap tides and calm periods as well as high salinity and high temperature events. The model results show that the average increase in temperature is 1.46^{o}C at the outfall point situated at about 1.06 km from shore, and under the prevailing currents, the plume advects northeast ward and the temperature increase is confined to an area of 200 sq.m around the outfall location. Also, salinity plume advects northeastwards under the prevailing currents, and average increase in salinity is about of 4.82 PSU around the outfall point. Therefore, the outfall location situated at 1.06 km from the shore is recommended for release of the warm water discharge. Also, the intake point which is located at 2.05 km will be suitable as there is no recirculation of the warm water from the outfall and this location has sufficient depth of -5.40m. The details of the study are attached as **Annexure II**.

4.3.4 Land environment

Impacts

Dumping of municipal solid waste & industrial waste on the land will affect the soil quality. Poor garbage management would lead to unsanitary conditions including vermin and fly infestation and odors as well as unsightly aesthetic conditions. A solid waste collection and disposal will be practiced in efficient manner. The impact on the soil will be insignificant as an organized solid waste collection and disposal practices are planned to be followed.

Mitigation Measures

Solid waste

Municipal solid waste management

The estimated Municipal solid waste is about 109 kg/day. Out of this, 40% that is about 43.6 kg/day is Bio-degradable waste. The Non Bio-degradable waste 60% is estimated to be 65.4 kg/day. As the plastic waste recirculation is maximized and usage of plastic is reduced the expected plastic waste is about 20% of 65.4 kg/day that is 13.08 kg/day will

be collected, segregated and disposed through Udangudi town panchayat as per Solid Waste Management Rules, 2016 and we plan organic waste converter of the capacity of 50 kg/day.

Industrial solid waste management

Ash will be the major solid waste generated from the power project. An ash management scheme will be implemented consisting of dry collection of ash and supply of ash to entrepreneurs for utilization and promoting ash utilization to maximum extent and safe disposal of unused ash. The expected ash generation is 175.2 t/h. The details of ash generation shown in **Table.4.8.**

Table 4-8 Details of ash generation

Description	Ash generation
Total Ash generation for two units	175.2 t/h
Annual ash generated for two units	1.31 million TPA
Annual Bottom ash generated for two units	0.26 million TPA
Annual Fly ash generated for two units	1.054 million TPA

A robust fly ash handling system is planned as a part of power plant equipment consist of ESP ash handling sytem, duct and stack hoppers. The fly ash handling system will be of vacuum-cum-pressure type. The fly ash collected in several sets of ESP hoppers located in the flue gas path will be evacuated pneumatically.

The fly ash is sequentially extracted from these hoppers by creating vacuum in extraction piping. In this system, the vacuum will be created using vacuum pumps. The total ash removal system will be divided into parallel paths (4 Nos). In each path, clearance of ash from hoppers connected to common fly ash header will be done one after another.

Shifting of ash clearance cycle from one hopper to the next will be automatic and based on vacuum level. The evacuation will be done once in eight (8) hours shift. Fly ash will be conveyed in dry mode through bag filter to buffer hopper. There will be 4W Nos. of buffer hoppers for each unit.

Dry fly ash evacuation System:

The fly ash system will be designed to collect fly ash in dry form in RCC silos. Fly ash lines from Buffer Hoppers will be provided with pneumatically operated isolation valves for diverting fly ash to any of the silos.

For collecting fly ash in dry form, the system will be designed such that the fly ash and conveying air mixture from fly ash hoppers is passed through buffer hoppers, where ash will get separated and air will flow to the vacuum pumps through Bag filters. The bag filters will be pneumatic pulse jet type. The fly ash from the buffer hoppers will be transported to RCC silo by using air from conveying air compressors. Adequately sized vent filter will be mounted on top of the silos to filter the air and let it out to atmosphere.

Disposal of Fly Ash from Silo

Each storage silo will be provided with a dedicated aeration system. Each silo will have the following connections with rotary feeder to offer the unloading of ash in different form as below.

- no. opening common for unloading of ash in dry form to closed tank carriers through Telescopic chute.
- no. opening for Wet disposal using jet pump.
- 1 Opening common for Unloading of ash through Dust conditioner into open truck.
- 1 One blind flange opening.

Silo area will be provided with compound wall and gate.

Ash Slurry Disposal

Common ash slurry pumps will be provided for bottom and eco ash of two units. (2W+1S) will be provided for two units. Ash slurry will be discharged into common channel of ash slurry sumps from where it will be disposed to Ash Pond by means of slurry pumps and associated piping. Number of slurry pumps in series will be selected based on the total disposal distance. One pipeline will be provided with each series of pumps. Slurry discharge line will be flushed with water in order to prevent settling of ash inside the slurry pipe lines at the end of each operation.

Common ash slurry pumps will be provided for fly ash of two units. (1W+1S) will be provided for two units. Ash slurry will be discharged into common channel of ash slurry sumps from where it will be disposed to Ash Pond by means of slurry pumps and associated piping. Number of slurry pumps in series will be selected based on the total disposal distance. One pipeline will be provided with each series of pumps. Slurry discharge line will be flushed with water in order to prevent settling of ash inside the slurry pipe lines at the end of each operation.

Ash Pond

Ash will be transported to ash pond in the land identified near the main plant. Ash slurry will be dumped into the ash pond would be contained in the ash pond by constructing bunds around the periphery of the ash pond. HDPE liner thickness of the ash pond will be established to limit permeability to the required level and as required to resist tears and punctures due to placement of the top soil on it. Recovery water system will be provided near the ash pond. The required area of the land will be about 48.562 Ha considering the bund height of 25m for both fly and bottom ash.

Hazardous waste management

The expected hazardous waste generation and the mode of disposal from the plant is shown in **Table.4.9.**

Table 4-9 Hazardous waste generation

Name of the waste	Source	Qty (TPA)	Mode of disposal	Mode of transport
Resin	DM Plant	2	TSDF site	Road
Glass Wool	Overhauling	1.3	TSDF site	Road
Waste oil	Maintenance	1.6	TSDF site	Road
ETP sludge	ETP plant	0.2	Sludge pit	-

4.3.5 Soil environment

Impacts

Soil contamination takes place due to movement of vehicles and deposition of fly ash from the solid waste generated.

Mitigation measures

State-of- the- art ESP is provided with the efficiency of 99.9%. Hence, deposition of fly ash is not anticipated. Good housekeeping and best practices of waste handling is adopted to eliminate/minimize the risks of soil contamination. Hazardous waste generated due to the proposed project is sludge from waste-water treatment plant and wastes like oil and grease from machinery which will be disposed of as per hazardous waste (management and handling) Amendment rule 2000. The wastes generated are stored in temporary storage facility and disposed through TNPCB Authorized vendor for safe disposal.

4.3.6 Biological environment

Impacts

High efficiency ESPs are proposed to control particulate emissions. ETP with recycling arrangement is provided to control water pollution. Cooling Towers will be proposed to prevent thermal pollution. Adequate greenbelt will be developed. Hence impact on ecology will be limited. The impact of the thermal discharge on the marine ecology for the proposed plants has been studied by National Institute of Oceanography (NIO), GOA and it is recommended that there will not be any adverse impact on the marine biology.

Based on the NIO, Goa results report it is proposed to draw sea water for condenser cooling purposes from deep sea directly (Bay of Bengal) by sinking a gravity pipeline for the proposed plant under gravity up to the fore bay. The coolant water from the proposed plant will be returned to sea through submarine Conduit. The total intake length is located at 2.68 km (onshore – 1 km & offshore – 1.68 km) and the total outfall length is located at 2.39 km (onshore – 1.51 km & offshore – 0.88 km). The model studies were already conducted by NIO, Goa considering the impact of the discharge into sea and recommended the above location in their report. Increased water temperatures may change the biodiversity of an ecosystem, and may also lead to increased microbial growth, which may decrease dissolved oxygen. As per NIO report the temperature increase is confined to an area of 200m^2 around the outfall location and hence there will not be any impact due to the released hot water. In addition, a study of impact on marine ecology has been carried out by Institute of Ocean Management of Anna University and Centre for Advance Study (CAS) of Annamalai University. As per CAS report the outfall area is not seems to be neither spawning ground nor breeding ground of fishes. Based

on the reports MoEF&CC has accorded Environmental Clearance and CRZ clearance for establishing captive coal jetty, including out fall and intake points for the cooling water system, coal conveyor system, for the project vide Lr. No. - EC22A004TN156490, 10-66/2020-IA.III dt. 03.08.2022.

Brine discharge

As stated in project description of about RO reject (reject concentrate or Brine) from the desalination plant will be about 36840 m^3/day. This reject will be diluted by discharging the same into the large quantity of cooling tower blow down water let into the sea. Thereby the impact of RO reject over the marine ecology is expected to be negligible. The detailed modelling was carried out by NIO, Goa to observe the brine concentration and the details are as follows:

Seawater and seabed water quality: The sea water quality and sea bed studied have been carried out due to construction of 7.91 km offshore structure and discharge of cooling tower water along with brine generated from the desalination plant. Significant elements of marine pollution include excavation of seabed sediments or laying of intake and outfall pipelines, piling for trestle & jetty and construction of the breakwater and discharge of outfall along with brine.

Initial mathematical modelling studies for the intake and outfall pipelines were carried out. Their findings were verified by CMSRSL using in-house mathematical modelling softwares.

Due to breakwater construction, impacts on the hydrodynamics have been studied using the mathematical model Delft 3D for four seasons (Northeast monsoon, Southeast monsoon, summer, and winter). Due to the construction of the breakwater structure, alternations in current speed and direction are negligible. The predicted current speed and direction during NE monsoon shown in **Fig.4.5.** which is used for brine dispersion studies.

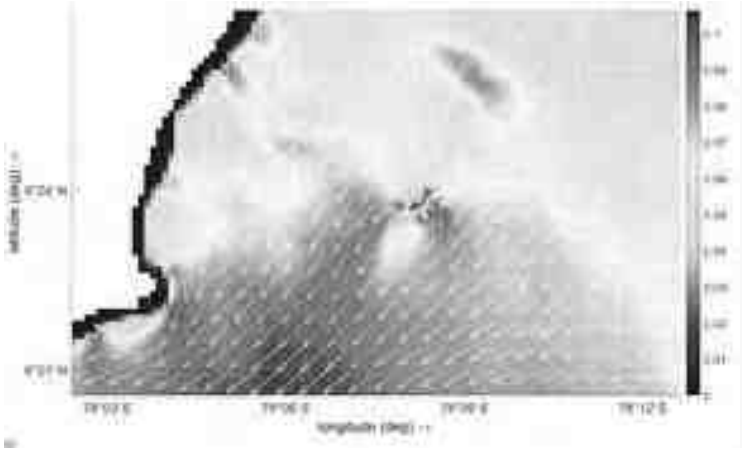


Figure 4-5 Predicted current speed and direction – Scenario – NE Monsoon (Spring Ebb) (Delft 3D model study)

Advection Dispersion modelling (AD)

Modelling study was undertaken to assess the characteristics of the combined discharge such as salinity. Physical oceanographic parameters such as tidal elevation, current speed, current direction, wind speed and wind direction were used to establish a numerical model depicting the replica of the proposed project activities. The model was then simulated for various seasons such as South-West Monsoon, North East Monsoon, Summer and Winter to understand the behavior of the combined discharge. The intake and outfall parameters considered for various seasons are given in **Table.4.10.**

Table 4-10 Combined Intake and Outfall parameters considered for model study

S.No.	Parameter	Unit	South-West Monsoon	North – East Monsoon	Summer	Winter
1.	Intake quantity	M^3/hr	30000	30000	30000	30000
2.	Outfall	M^3/hr	22500	22500	22500	22500
3.	Ambient salinity	PPT	32	32	35	32
4.	Combined reject salinity	PPT	43	43	47	43

*Discahrge salinity of 47.25 PPT (approx. 47 PPT) has been considered as worst case (Summer)

Based on the study findings, the impact due to the proposed discharge activities on the marine organisms such as phytoplankton, zooplankton and benthos are discussed in the subsequent sections. In this section, the impact on the marine water quality due to increase in the salinity is discussed.

Salinity Dispersion

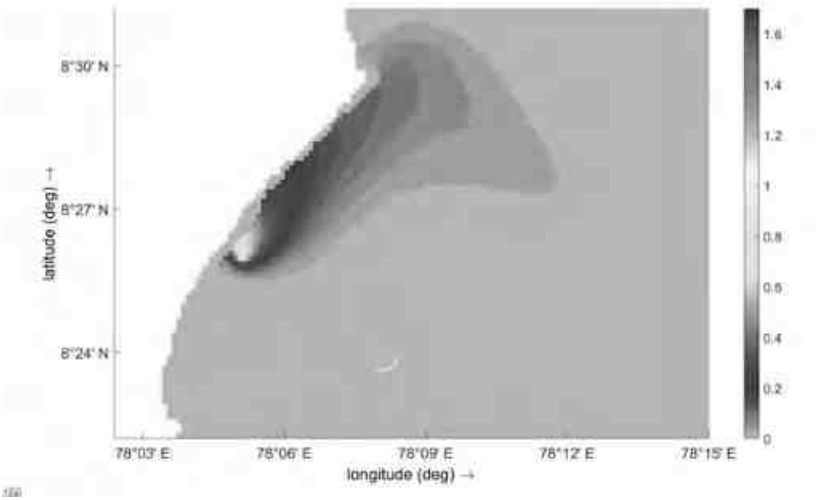
The maximum salinity was observed at the point of disposal (i.e. the outfall location). The peak salinity was observed during the summer season of 1.7 PPT above ambient condition during spring-ebb tide conditions. It takes 2.9 km in the in the NE direction for the discharged reject to attain near ambient conditions (Δ 0.5 PPT above baseline condition).

The peak salinity of the other seasons was also observed during the spring-ebb tide conditions and the salinity observed at the outfall location during south-west monsoon, north-east monsoon and winter season are 1.4, 1.4 and 1.6 PPT above ambient conditions, respectively. Recirculation of reject water near the intake point is observed from the model studies during south-west monsoon and summer seasons. The observed concentration of salinity near the intake point during these seasons are in the order of Δ 0.2 PPT above baseline conditions. Salinity observed near the shore is also in the range of Δ 0.2 PPT above baseline conditions which is insignificant and can have no impact on the coastal ecosystem and intake quality. The peak salinity observed at different tidal conditions for various seasons are given in **Table 4.11**.

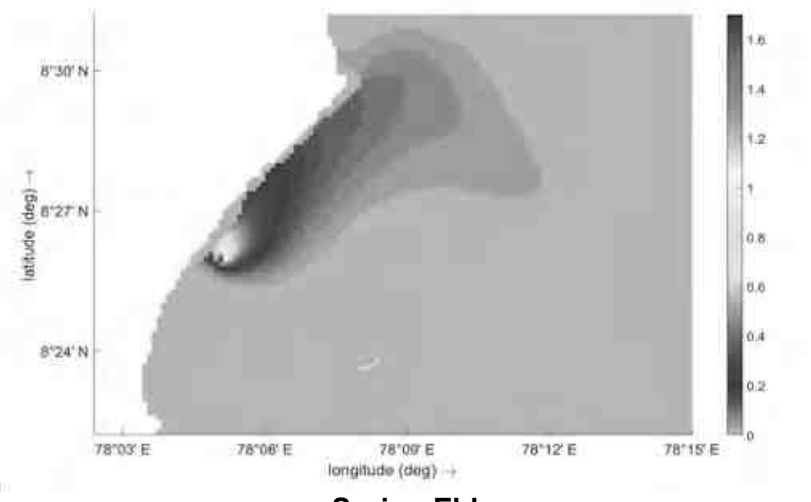
The spatial plot of the salinity distribution for different tidal conditions of various seasons are presented in **Figure 4.6 to Figure 4.9.**

Table 4-11 Peak salinity observed during different tidal conditions of various seasons

Season	Tide	At the point of disposal (Δ ppt)	Distance to reach near Ambience – Δ 0.5 PPT above baseline (km)	Direction of dispersion
South-West Monsoon	Spring Flood	1.1	1.7	NE
	Spring Ebb	1.4	2.2	NE
	Neap Flood	1.2	1.8	NE
	Neap Ebb	1.3	2	NE
North-East Monsoon	Spring Flood	0.7	0.5	SW
	Spring Ebb	1.4	0.9	SW
	Neap Flood	0.9	0.6	SW
	Neap Ebb	1.3	0.7	SW
Summer	Spring flood	1.1	2.4	NE
	Spring Ebb	1.7	2.9	NE
	Neap Flood	1.2	2.5	NE
	Neap Ebb	1.6	2.7	NE
Winter	Spring flood	1.1	0.8	SW
	Spring Ebb	1.6	1.2	SW
	Neap Flood	1.2	0.9	SW
	Neap Ebb	1.5	1	SW

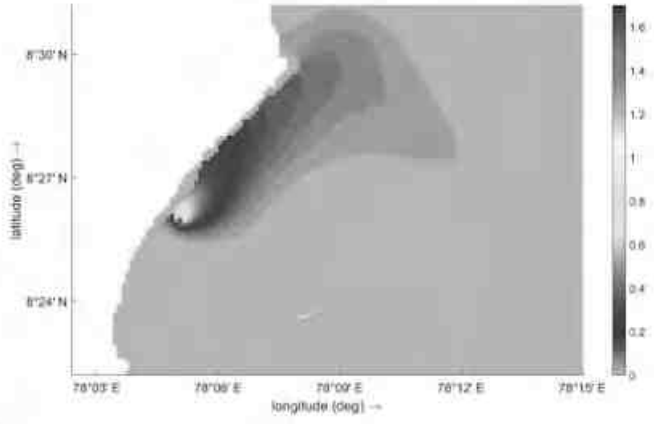


Spring flood



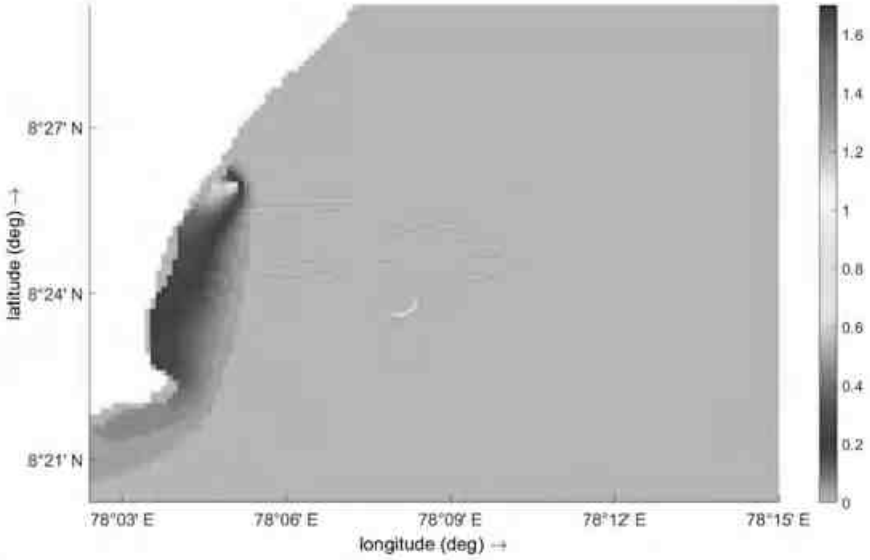
Spring Ebb

Neap Flood

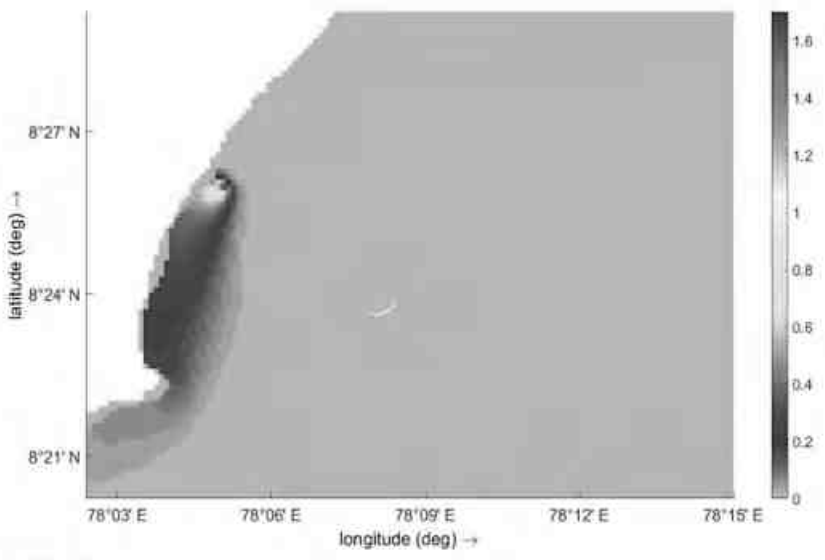


Neap Ebb

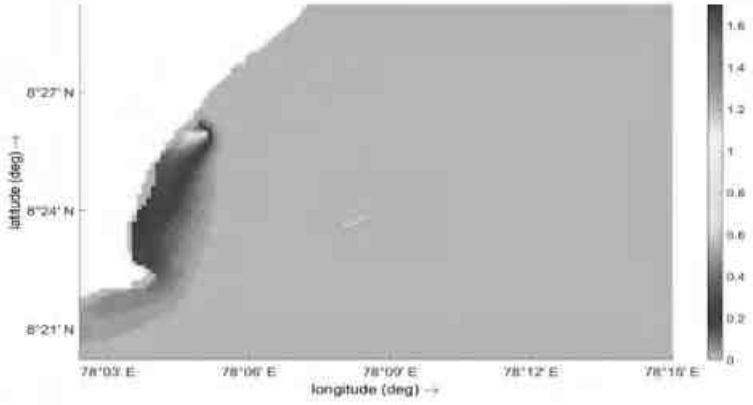
Figure 4-6 Salinity Dispersion during South-West Monsoon



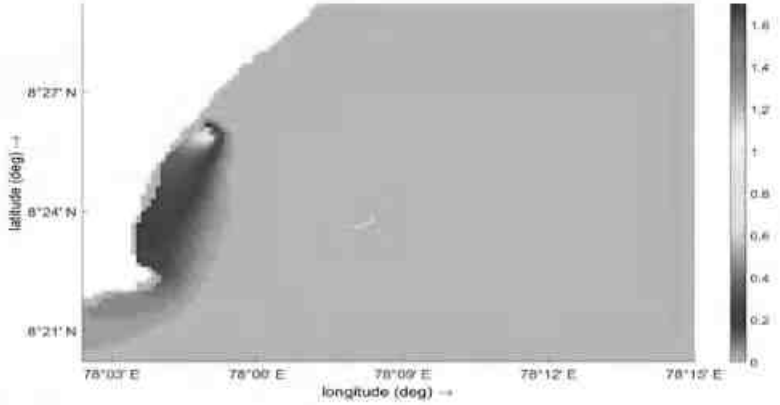
Spring flood



Spring Ebb

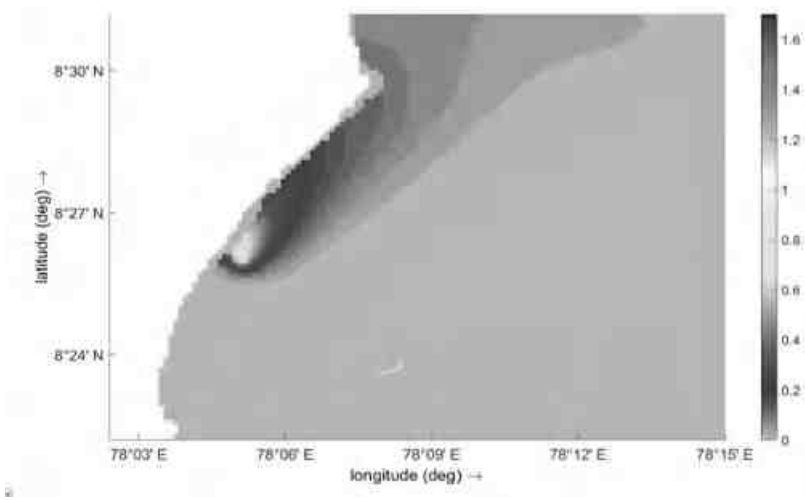


Neap Flood

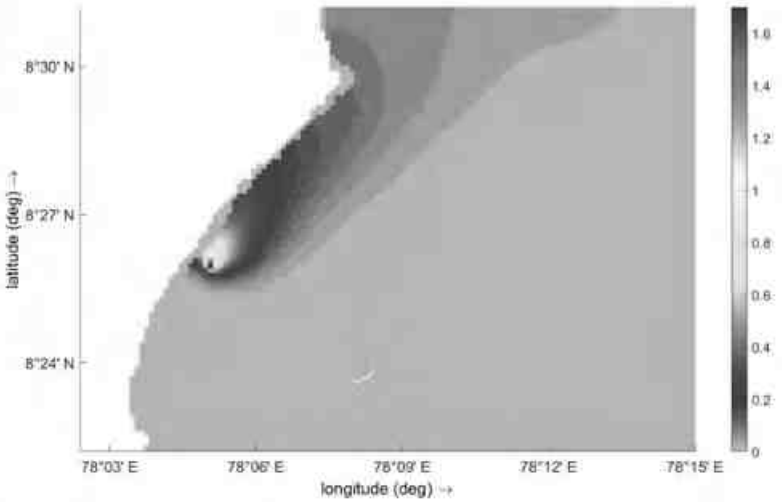


Neap Ebb

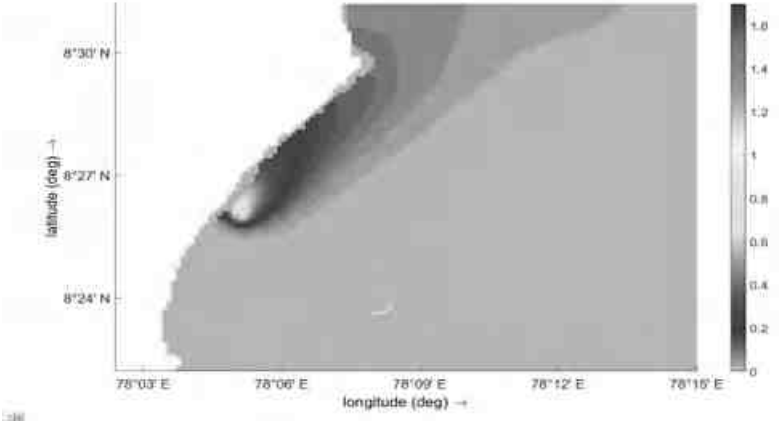
Figure 4-7 Salinity Dispersion during North-East Monsoon



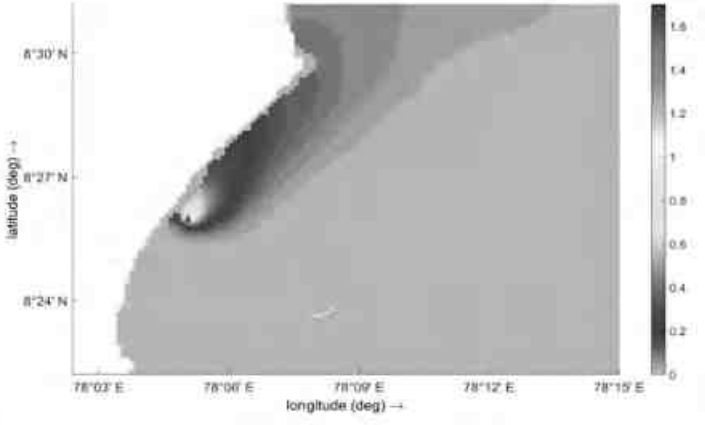
Spring flood



Spring Ebb

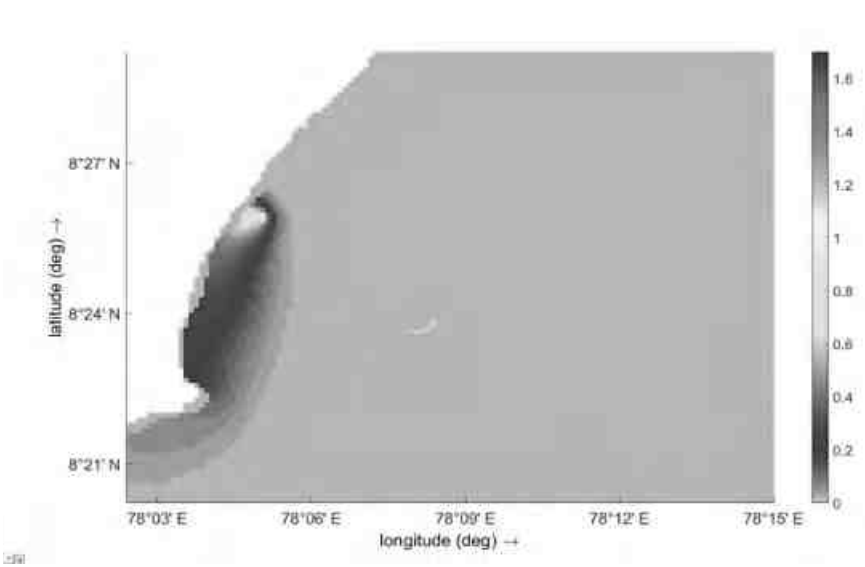


Neap Flood

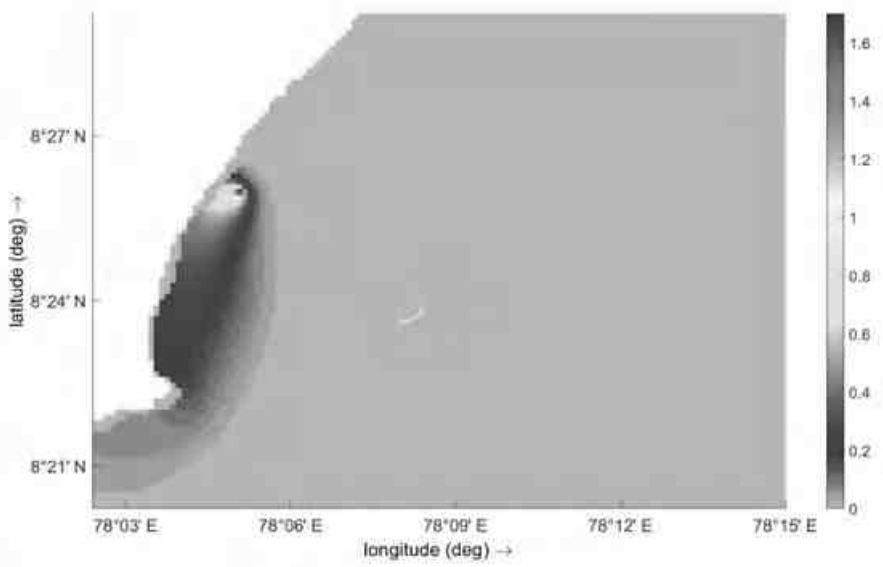


Neap Ebb

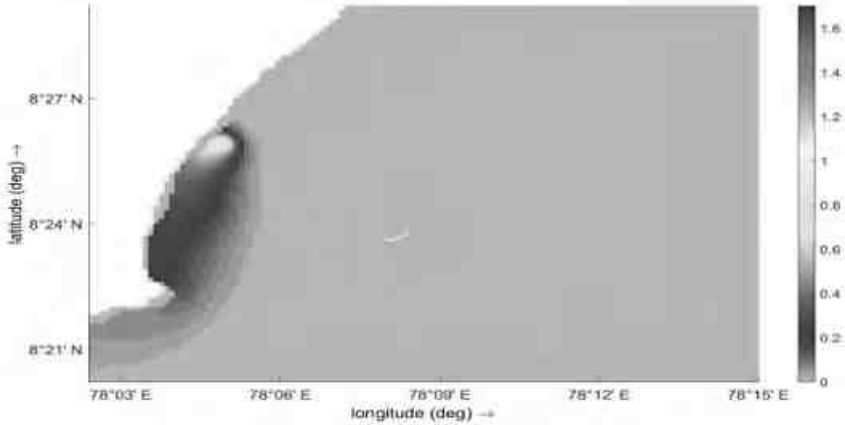
Figure 4-8 Salinity dispersion during summer



Spring flood



Spring Ebb



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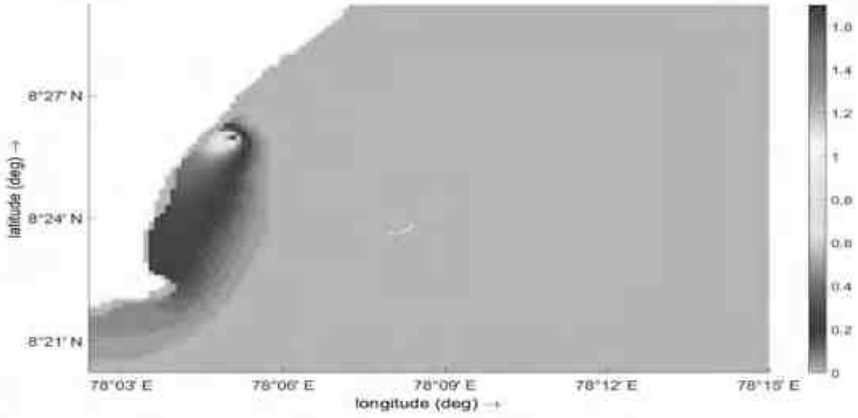


Neap Ebb

Figure 4-9 Salinity dispersion during winter

Conclusion

Delft 3D salinity dispersion modelling study was conducted to understand the salinity dispersion pattern near the point of brine cum cooling water disposal. The peak salinity was observed during the summer season of 1.7 PPT above ambient conditions during spring-ebb tide conditions. It takes 2.9 km in the NE direction for the discharged reject to attain near ambient conditions (Δ 0.5 PPT above baseline condition). However, as predicted from the model study, this influence is limited due to good brine dispersion.

4.3.7 Socio economic environment

Around 1500 trucks per month are anticipated for the disposal of fly ash, which will be an additional traffic load on the existing Tiruchendur – Kulshekharapattinam road. The impacts of the proposed power plant during operational phase on demography and socio-economic condition of the study area is as follows.

- Increase in direct employment opportunities of about 545 and indirect opportunity of more than 1000 and reduction in migration outside for employment
- Improved education and health services will enhance technical services which can attract more doctors and teachers to the area, which can improve health and education services.
- Availability of Electricity improve the living condition of the people.
- Increase in literacy rate
- Growth in service sectors
- Improvement in socio cultural environment of the study area
- Improvement in transport, communication, health and educational services
- The overall impact on the socio-economic environment will be beneficial
- The CER and CSR activity will improve the living condition of the people in the surroundings.

4.3.8 Occupational health and risk

Impacts

The plant is handling and storing flammable substances like HSD and Coal thereby increasing potential risks due to storage of flammables. The exposure of hazardous chemicals and work floor hazards may affect occupational health and safety of the workers. However, TNPGCL (TANGEDCO) will adopt necessary control measures through implementation of mitigation measures and provision of proper PPEs to workers operating in aforesaid area to prevent and/or mitigate adverse health related impacts. Hence, any possible occupational health impact from exposure to such fugitive dust is not likely to be of major significance.

General safety Measures

Considering the various chemicals handled and stored at site; following safety measures are provided at the site.

- Requisite personnel protective equipment is provided. Instruction/Notice to wear the same is displayed. Further, it is insisted to use the same while at work.
- Provision of safety shower with eye washer.

- MSDS of all hazardous chemicals is available at office and with responsible persons.
- Antidotes for all chemicals being used as per MSDS is available at the site.
- Regular training programme for safety awareness.
- The possible occupational safety hazards and activities are electrical hazards at the construction activity, falling from heights, slips and fall of equipment such as cranes etc. proper precaution will be taken care by TNPGCL (TANGEDCO), to mitigate this.
- Provisions of First Aid Box and trained person in first aid.
- Prohibition on eating, drinking or smoking at work-area.
- Any leakage/spillage of liquid chemical will be immediately attended.
- Work area is monitored to maintain work environment free from any dust/chemicals fumes/vapors and to keep well within below permissible limit.
- Provision of adequate Fire Extinguishers at site and training will be imparted to the workers also.
- Ring-main pipeline systems will be provided to cater to the fire hydrant requirements across the facility. Fire house reels will be provided as per the National Building Code requirements.
- Maintaining the Fire-Protection System adequately as per PESO/OSID norms.
- Availability of Self Breathing Apparatus at site.
- Provisions of immediate accident/incident reporting and investigation.
- Instructions on Emergency/Disaster will be displayed.
- Safety Posters and slogans will be exhibited at conspicuous places.
- Arrangement of Periodical Training to workers and supervisors.

Mitigation Measures

- Plant operation is carried out in closed atmosphere.
- Medical checkup would be carried out at a regular interval
- During operation, proper care would be taken by TNPGCL (TANGEDCO), appropriate PPEs will be provided to site workers and staff members
- Appropriate personnel protective clothing to be used to prevent skin contact.
- Safety Goggles will be used to prevent eye contact.
- Hand gloves of natural rubber, neoprene, and polyvinyl chloride will be used as and when required
- Acoustic enclosures will be provided to DG sets and other noise generating equipment
- TNPGCL (TANGEDCO) will develop and implement a skill management plan to prevent risk of spill which may cause health problem.

4.3.9 Impact of traffic and transportation

TNPGCL (TANGEDCO) is located near to Udangudi village about 4.85 km in the West direction on SH-176 (Thoothukudi – Tiruchendur – Kanyakumari Road) - 0.12 km East which is leading to Udangudi. Since, the plant is located on the isolated path major traffic is not expected. The LOS study shows that the existing traffic scenario is “Excellent” and the free flow of vehicles is observed during the study period February 2024. Out of the

total traffic vehicles, 2 wheelers are very high followed by Trucks& Bus, 4-wheeler light and medium vehicles. Due to the proposed 2 x 660 MW supercritical thermal power plant, the traffic density will have negligible increase and traffic scenario is “High” and stable flow.

5 ANALYSIS OF ALTERNATIVES (TECHNOLOGY & SITES)

5.1 General

The ongoing plant is already in construction and about 85% of the work is completed and it is planned to obtain a fresh EC as the validity is expired in the month October, 2024. Hence, alternative site and technology consideration is not applicable for this project at this stage. However, the other criteria with respect to environment is considered for site selection during the time of site selection. They are discussed below:

- Availability of suitable and adequate land with least Resettlement & Rehabilitation issue
- Availability of suitable land for the plant from topography and geological aspects.
- Availability of Water and Proximity to source
- Availability of adequate jetty for coal unloading
- Feasibility of transportation of fuel from the jetty
- Road and railway access
- Proximity to the grid for evacuation of power
- Acceptability from the environmental consideration
- Availability of infrastructural facilities

Considering the above-mentioned points and by detailed study of the ongoing site at Udangudi village was selected for 2x660 MW Supercritical thermal power project. The following features also aid the proposed site selection

- Availability of the land with the Govt. of Tamil Nadu to the maximum extent so as to reduce land acquisition issues.
- There is no notified wildlife sanctuaries, Elephant/Tiger Reserve within the study area.
- Distance away from thickly populated town.
- The plant is away from the coastal regulation zone.
- Transportation of coal from the jetty to the site through a pipe conveyor system.
- Minimal issues for Right of way for seawater pipeline and coal conveyor system.
- Other advantages of the selected site is, well developed infrastructure facilities are readily available in the near proximity to the site because of the existing railway lines and highway.

The location being close to the sea, make-up water for cooling-water system is perennially available at the site for the power project. Well-developed infrastructure facilities are readily available in the near proximity to the site. Taking all these into consideration, the selected site is well suited for placing up a thermal power project.

6 ENVIRONMENTAL MONITORING PROGRAM

6.1 General

An Environmental Monitoring Program provides feedback about the difference between actual environmental scenario and the impacts of the project on the environment and helps to judge the adequacy of the mitigation measures in protecting the environment. The purpose of environmental monitoring is to evaluate the effectiveness of implementation of Environmental Management Plan (EMP) by periodically monitoring the important environmental parameters within the impact area, so that any adverse effects are detected and timely action can be taken.

The sampling and analysis of the environmental attributes will be as per the guidelines of Central Pollution Control Board / Tamil Nadu State Pollution Control Board (TNPCB). The frequency of sampling and location of sampling will be as per the directives of CPCB/TNPCB.

Environmental monitoring will be conducted on regular basis by TNPGCL (TANGEDCO). To assess the pollution level in the area. Usually, as in the case of the environmental monitoring, an impact assessment study was carried over a period of three months and the data cannot bring out all variations induced by the natural or human activities throughout the year. Therefore, regular monitoring programme of the environmental parameters is essential to take into account the changes in the environment. This chapter presents the details of environmental monitoring, schedule, arrangements for pollution control, cost for environmental protection measures and details of greenbelt development for the proposed project.

6.2 Objectives of the Environmental Monitoring Program

The basic objective of the environmental monitoring program is as follows.

- To ensure implementation of mitigation measures during project implementation
- To provide feedback to the decision makers about the effectiveness of their actions
- To determine the project's actual environmental impacts so that modifications can be made to mitigate the impacts
- To identify the need for enforcement action before irreversible environmental damage occurs
- To provide scientific information about the response of an ecosystem to a given set of human activities and mitigation measures
- To ensure that new parameters, other than those identified in the impact assessment study, do not become critical through commissioning of Supercritical thermal power plant.
- To check assumptions made with regard to the development and to detect deviations in order to initiate necessary measures
- To establish a database for future Impact Assessment Studies for projects.

6.3 Types of environmental monitoring

The key issues associated with the life cycle of a project are the monitoring of environmental parameters. Three types of environmental monitoring are associated with the project, which includes.

- Baseline monitoring
- Effects/Impacts monitoring and
- Compliance monitoring

6.4 Environmental monitoring plan

The environmental monitoring plan for the ongoing project has been developed in view of the institutional, scientific and fiscal issues pertaining to the project. For developing the monitoring plan, appropriate Value Ecosystem Components (VEC's) which are likely to be affected have been identified. For each component, suitable measurable environmental indicators, which are appropriate to the impact mechanism and scale of disturbance and have a low natural variability, broad applicability and an existing data series have been defined.

As per the guidelines of MoEF&CC, environmental monitoring shall be required during construction and operational phases. The schedule for monitoring ambient air quality, ambient noise quality, source emission monitoring, ground water quality and wastewater quality both during the construction and operation phases of the project is given in **Table 6.1.**

Table 6-1 Environmental monitoring plan construction phase

Sl. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
1	Air Emissions	All equipment's are operated within specified design parameters	Random checks of equipment logs/ manuals	Periodic checks on the online monitoring results
		Vehicle trips to be optimized to the extent possible	Vehicle logs	Periodic check during site clearance & construction activities
		Maintenance of boiler emissions to meet stipulated standards in the process ESP and other bag filters installed at transfer points	Particulate and Gaseous emissions (SO_x, CO, NO_x)	Periodic emission check during monitoring period
		Ambient air quality within the premises of the proposed unit to be monitored.	The ambient air quality shall conform to the standards for PM_{10}, $PM_{2.5}$, SO_2, NO_x, CO	As per CPCB / TNPCB requirement or on monthly basis whichever is earlier.
2	Noise	List of all noise generating machinery is to be prepared. Equipment to be maintained in good working order	Equipment logs, noise level reading	Regular check during construction and operation period
		Night workings will be minimized.	Working hour records	Daily records
		Generation of vehicular noise.	Maintenance of records of vehicles	Daily records
		Noise to be monitored in ambient air within the plant premises.	Spot noise recording	As per CPCB/ TNPCB requirement or on quarterly basis whichever is earlier

Sl. No.	Potential Impact	Action to be Followed	Parameters for Monitoring	Frequency of Monitoring
3	Waste Water Discharge	No discharge to be made to surface water, groundwater or soil.	Temperature, pH, TSS, Oil & Grease, BOD & COD	Periodic check during construction activities and operation period
4	Drainage and wastewater Management	Ensure drainage system and specific Design measures are working effectively for rainwater harvesting system. The design to incorporate existing drainage pattern and avoid disturbing the same.	Temperature, pH, TSS, Oil & Grease, BOD & COD	Periodic check during construction activities and operation period
6	Waste Management	Implement waste management plan that identifies and characterizes every waste arising associated with proposed activities and which identifies the procedures for collection, handling & disposal of each waste arising.	Comprehensive Waste Management Plan should be in place and available for inspection on-site. Compliance with MSW Rules, 2016 and Hazardous Wastes (Management, handling and Trans boundary Movement) Rules, 2016	Periodic check during construction activities and operation period
7	Health	Employees and migrant labor health check ups	All relevant vital parameters including HIV	Regular check ups
8	Loss of flora and fauna	Re-vegetation as per Forest guidelines	No. of plants, species	During site clearance and monitoring existing and proposed green belt for the survival rate.

Table 6-2 Environmental monitoring plan operational phase

Sl. No.	Component	Parameter	No. of Locations	Frequency/ Duration
1	Ambient Air Quality	PM_{10}, $PM_{2.5}$, SO_x, NO_x, CO	8	Two at on site and 6 nos. of AAQ from outside the plant by regular monitoring / Once in a month
2	Fugitive Emission	PM_{10}, $PM_{2.5}$,	4	Once in a month
3	Stack Emission Monitoring	PM, SO_2, NO_2, CO & HC	-	Continuous monitoring for PM, SO_x, NO_x / Physical stack monitoring for CO & HC for once in a month.
4	Source Noise	Instantaneous Noise level in dB(A)	8	Once in a month
5	Ambient Noise Quality	Ambient noise level (Leq, Leq_{day} & Leq_{night})	8	Once in a month
6	Ground water Quality	Parameters specified under IS:10500, 1991	8	Once in 3 months
7	Soil Quality	Parameter for soil quality: pH, texture, EC, Organic Matter, N, P, K, Na, Ca & Mg	5	Once in 6 months

6.5 Data analysis

The monitored data will be analyzed and compared with the baseline levels as established in the EIA study and the regulatory standards specified by different government agencies. The standards against which the different environment components will be compared are as per **Table 6.3**.

Table 6-3 Applicable environmental standards

Sl. No.	Component	Applicable Standards
1	Ambient Air Quality	National Ambient Air Quality standards, CPCB
2	Source Noise Quality	Standards for workers, Insp. of Factories / OSHA
3	Ambient Noise Quality	Ambient Noise Standards, CPCB
4	Ground water quality	IS: 10500 Standards, BIS
5	Soil quality	Standard Soil Classification, ICAR

6.6 Environmental management cell

A separate environmental management cell will be established to implement the management plan. The group will be headed by a Chief Engineer (O & M). The group will ensure the suitability, adequacy and effectiveness of the Environment Management Program. The functions of Environmental Management Cell will be as follows:

- Obtaining consent order from State Pollution Control Board.
- Environmental monitoring, like collection and analysis of air, water and soil samples.
- Analysis of environmental data, reports, preparations and transmission of report to statutory authorities, Corporate Centre etc.
- Implementing the control and protective measures.
- Collecting statistics of health of workers and population of the surrounding villages.
- Green belt development.
- Co-ordinate with statutory bodies, functional groups of the station, head office etc.
- Interactions for evolving and implementation of modification programs to improve the availability/ efficiency of pollution control devices / systems.
- Environmental Appraisal (Internal) and Environmental Audit.

Divisional Engineer (Environment) will be directly responsible for Environmental Management of the proposed station and report to the Chief Engineer (O&M), head of the plant. The Divisional Engineer (Environment) should have at least 10 years of experience in the Environmental Management will be entrusted the Environmental Management of the station.

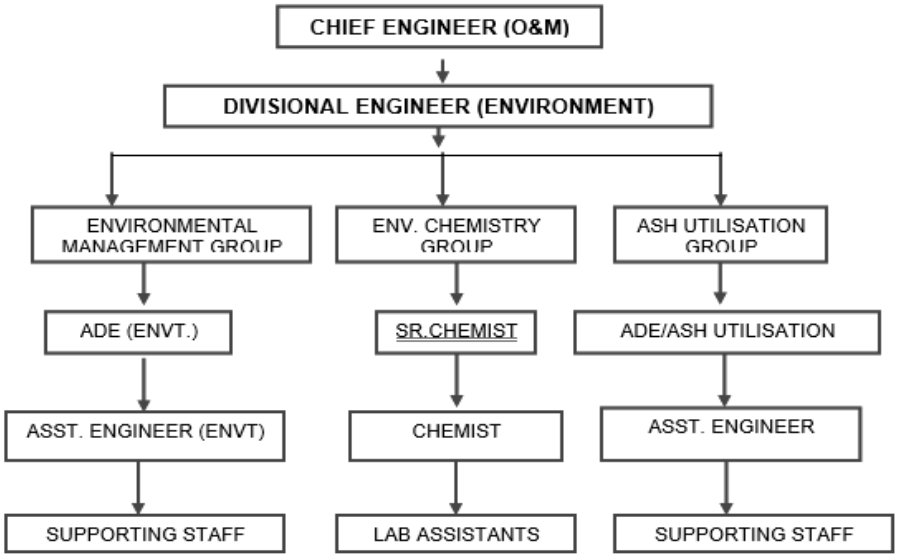


Figure 6-1 Organizational setup for Environmental management

6.7 Compliance reports

As a part of environmental monitoring programme, following compliance report will be submitted to TNPCB and Regional Office of MoEF&CC.

- Half yearly compliance reports of Environmental Clearance terms and conditions on 1stJune and 1st December every calendar year.

6.8 On-site mock drills requirements

On-site mock drills are very important as it helps employees to be aware of the safety procedures and how to react during the time of crisis. Conducting mock drills at regular intervals enhances preparedness and checks the viability of environmental/disaster management plan. Mock drills are essential for the following reasons:

- Helps in revising/improving the environmental/disaster management plan
- Helps to evaluate whether the responsible officials are trained efficiently for the unforeseen event
- Helps in evaluating whether the emergency equipment is being maintained at plant premises

To ensure efficient environmental/disaster management, EHS department/EMP cell shall conduct periodic on-site mock drills in case of occurrence of the following activities:

- Fire, Natural calamities (cyclones, floods, earthquakes)
- Power break down
- Bomb threats; War alerts/terrorist attacks

Mock drills should also involve fire department, police, municipal authorities, hospitals and other department/agencies that are mandated to provide emergency support. Documenting the outcome of mock drills is an important aspect as this helps in revising the existing plan more efficiently. In all safety programmes the right personnel need to be employed and this is of utmost importance.

7 ADDITIONAL STUDIES

In order to support the environment impact assessment and environment management plan, following additional studies have been included in the report.

- Risk assessment
- Disaster Management Plan
- On-site emergency action plan
- Occupational Health and Safety Management System
- Social Impact Assessment
- R&R Action Plans

7.1 Risk assessment

Risk is defined as the unwanted consequences of a particular activity. The magnitude of risk varies with the total impact area for different scenarios. The risk assessment is basically carried out all the hazardous storages that are present in the premises. The larger the storage, greater is the risk posed by the storage. Risk assessment is a tool that is used to analyze the risk posed by different project activities vis-à-vis the area. The consequence analysis forms part of this assessment and helps in evaluation of different hazards that are to be considered for conducting consequence analysis.

The risk assessment basically involves the prediction of the consequence in case there is a fire, explosion or toxic gas release that might occur due to handling, storage or processing of any of the hazardous materials by the industry. The site of Udangudi Supercritical Thermal Power Project stage-I is located at Udangudi Village, Tiruchendur Taluk, Tuticorin District, Tamil Nadu.

7.1.1 Need for quantitative risk analysis

The main objective of quantitative risk analysis studies is to identify the potential hazards, assess the consequence of probable accidental hazards and developing mitigating measures to reduce hazards during storage and handling of Heavy Fuel Oil (HFO) and High-Speed Diesel (HSD). The objective of risk assessment includes:

- Identify potential hazards at the thermal power plant due to Heavy Fuel Oil (HFO) and High-Speed Diesel (HSD) storage.
- Assess the consequence of probable accidental hazards from fuel oils storage to men and material in and around thermal power plant,
- Recommend necessary mitigating measures based on risk analysis

7.1.2 Scope of study of risk analysis

The quantitative risk analysis study involves the following steps:

I. Identification of Hazards and Selection of Scenarios
II. Release – consequence analysis
III. Likelihood estimation
IV. Estimation of risk
V. Comparison against risk acceptance criteria
VI. Recommendations for risk reduction

7.1.3 Approach and methodology

Risk involves the occurrence or potential occurrence of some accidents consisting of an event or sequence of events. The risk assessment study covers the following:

- Identification of hazards and selection of scenarios
- Effects and consequence calculations
- Likelihood estimation
- Risk summation
- Measures for risk mitigation

(i) Identification of Hazards and Selection of Scenarios

Hazard Identification is essentially the first step in quantitative risk analysis. It is also an important step in various safety studies and many techniques are available for hazard identification. Identification of hazards has been carried out by HAZAN approaches. The most relevant to risk analysis is the review of release sources. For each release scenario a set of consequence chain is developed showing escalation of events.

(ii) Effects & Consequence Estimation

Effects & consequence estimation is done to determine the potential for damage or injury from selected scenarios. The incident outcomes are analyzed using release rate, pool fire, and dispersion and explosion models. PHAST/SAFETI software of DNV has been used to perform the consequence calculations.

(iii) Likelihood Estimation

Likelihood estimation is required to estimate the frequency or probability of occurrence of an incident. The estimates have been obtained from historical incident data on failure frequencies.

(iv) Risk Summation

Risk summation is done by combining the consequences and likelihood of all incident outcomes from all selected incidents to provide a measure of Risk. The risk to people from the facilities is presented in the form of individual risk of fatality.

(v) Risk Mitigation Measures

The risk mitigation measures are suggested to reduce risk and enhance safety at the thermal power plant based on hazard identification and consequence analysis.

7.1.4 Hazard identification & scenarios selection

Hazard is defined as a chemical or physical condition that has the potential for causing damage to people, property or the environment. Hazard identification is the first step in the quantitative risk analysis and entails the process of collecting information on:

- The types and quantities of hazardous substances stored, handled and disposed in the location;
- The location of storage tanks & other facilities;
- Potential hazards associated with the spillage and release.

The starting point of the quantitative risk analysis study is the identification of hazards and selection of scenarios that are then addressed for further analysis.

It is essential to have comprehensive information on the hazardous chemicals handled by thermal power plant. An understanding of their physico-chemical properties of hazardous chemicals is also essential for hazard identification. Heavy fuel oil (HFO) and high-speed diesel (HSD) will be stored at thermal power plant.

7.1.4.1 Hazards associated with hazardous materials

(i) Hazards Associated with High-Speed Diesel

High speed diesel is a mixture of straight run product (150 °C and 350 °C) with varying amount of selected cracked distillates and is composed of saturated hydrocarbons (primarily paraffins including n, iso, and cycloparaffins), and aromatic hydrocarbons (including napthalenes and alkylbenzenes). Its exact composition depends on the source of crude oil from which it is produced and the refining methods used.

Physical properties of high-speed diesel are as given below:

Boiling point/Range	: 215 – 376^{o}C
Physical state	: Liquid
Appearance	: yellowish brown
Vapour pressure	: 2.12 to 26mm Hg at 21 deg C
Odour	: Perceptible odour
Solubility in water @ 30 deg.C	: Insoluble
Specific gravity	: 0.86 - 0.90 at 20 °C
Pour Point	: 6 - 18 °C
Flammability	: Yes
LEL	: 0.6%
UEL	: 6%
Flash point (deg C)	: 32 (°C)
TDG Flammability	: Class 3
Auto Ignition Temp	: 225 °C

HSD presents a moderate fire hazard. On heating, it can cause pressure rise with risk of bursting and subsequent explosion. It also forms explosive mixture with air particularly in an empty container.

(ii) Hazards Associated with Heavy Fuel Oil

Heavy fuel oil (HFO) is a thick, viscous, tar-like substance used as fuel. It's a residual fuel, or heavier fraction, produced during the distillation of crude oil. HFO is combustible liquid.

Physical properties of Heavy Fuel Oil are as given below:

Boiling point/Range	: > 204.4^{o}C
Physical state	: Oily liquid
Colour	: Black. Opaque
Appearance	: Black viscous liquid, may be coloured
Vapour pressure	: Negligible
Odour	: Diesel fuel, Kerosene

Solubility in water @ 30 deg.C	: Very slightly soluble in water
Density	: 960 kg/m³ (0.96 g/cm³)
Specific Gravity	: 0.92 to 0.98 at 20 °C
Pour Point	: < 10 °C
Flammability	: Yes
LEL	: 0.7%
UEL	: 5%
Flash point (deg C)	: Closed cup: >61°C
TDG Flammability	: Class 3
Auto Ignition Temp	: 250 °C

In case of fire, use water fog, foam, dry chemical or carbon dioxide extinguisher or spray to extinguish fire.

7.1.4.2 Hazardous conditions

An accidental release of HFO and HSD from tanks or piping would result in formation of fixed or spreading pool. In case of immediate ignition, a pool fire will result. Delayed ignition may result in explosion or flash fire, if quantity of explosive mass is sufficient and some confinement is present.

(i.) Pool Fire

A leak or spill of sufficient quantities of petroleum product will result in an accumulation of petroleum product on the ground. If ignited, the resulting fire is known as spreading or fixed pool fire. In case any object comes in contact with the flame above the pool, it will be severely damaged or destroyed and personnel exposed to flame will suffer extensive burn injuries. Objects and personnel outside the actual flame volume may also be affected or injured by radiant heat. The extent of damage or injury depends on the heat flux and duration of fire and exposure. If a large area of the body receives second- and third-degree burns, it can result in fatalities.

The extent of injury to people depends on the heat flux and duration of exposure. The extent of damage to personnel and property depends on the size of the pool and the duration of fire.

(ii) Thermal Effects

In case of fire, thermal effect is likely to cause injury or damage to people and objects. A substantial body of experimental data exists and forms the basis for thermal effect estimation. The consequence caused by exposure to heat radiation is a function of:

- Radiation energy onto the human body [kW/m2];
- Exposure duration [sec];
- Protection of the skin tissue (clothed or naked body).

The following damage distances for thermal radiation have been used:

37.5 kW/m^2	:	Damage to process equipment. 100% fatality in 1min. 1% fatality in 10sec.
12.5 kW/m^2	:	First degree burn for 10 sec exposure

4.0 kW/m^2	:	First degree burn for 30 sec exposure

(iii) Vapour Cloud Explosion/Flash fire

Vapour cloud explosion scenarios have been considered for confined (Over Pressure Scenario) as well as non-confined scenario (Flash Fire).

If a released HFO/HSD is not ignited directly, the vapour cloud will spread in the surrounding area towards wind direction. The drifting cloud will mix with air. As long as the vapour concentration is between the lower and upper explosion limits, the vapour cloud may be set on fire by an ignition source. In case of delayed ignition of a vapour cloud, two physical effects may occur: a flash fire (non-confined) over the whole length of the flammable vapour cloud; a vapour cloud explosion (confined) which results in blast wave, with typical peak overpressures circular around the ignition source. For generation of overpressure effects, some degree of confinement of the flammable cloud is required. The extent of injury to people & damage to property or environment depends on the cloud size, explosive mass in the cloud and the degree of confinement at the time of ignition.

Delayed Ignition & Explosion

In case of delayed ignition of a natural vapour cloud, two physical effects may occur:

- A flash fire (non confined explosion) over the whole length of the explosive vapour cloud;
- A vapour cloud explosion (confined explosion) that results in blast wave, with typical peak overpressures circular around the ignition source. For generation of overpressure effects, some degree of confinement of the flammable cloud within UEL and LEL is required.

The following **Table.7.1** gives damage criteria with respect to the peak overpressures resulting from a blast wave:

Table 7-1 Damage effects due to overpressures

Peak Overpressure	Damage Type
0.830 bar	Total Destruction
0.350 bar	Heavy Damage
0.170 bar	Moderate Damage
0.100 bar	Minor Damage

The **Table 7.2** below gives an illustrative listing of damage effects caused by peak overpressure.

Table 7-2 damage effects caused by peak overpressure

Peak Overpressure (Bar)	Failure
0.005	5 % Window Shattering
0.02	50 % Window Shattering
0.07	Collapse of a roof of a tank
0.07-0.14	Connection failure of panelling
0.08-0.1	Minor Damage to Steel Framework

Peak Overpressure (Bar)	Failure
0.15-0.2	Concrete block wall shattered
0.2	Collapse of Steel Framework
0.2-0.3	Collapse of self framing Steel panel building
0.2-0.3	Ripping of empty oil tanks
0.2-0.3	Deformation of a pipe bridge
0.2-0.4	Big trees topple over
0.3	Panelling torn off
0.35-0.4	Piping failure
0.35-0.8	Damage to Distillation Column
0.4-0.85	Collapse of pipe bridge
0.5	Loaded Train Wagon overturned
0.5	Brick walls shattered
0.5-1.0	Movement of round tank, failure of connecting piping

(Source: TNO)

7.1.4.3 Selection of scenarios for consequence analysis

At the thermal power plant, inventory of HFO and HSD may be released due to loss of containment. A leak can range in size from a hole leak to a catastrophic failure. In general, smaller leaks have higher accident likelihood but lower consequence distances. On the other hand, larger releases have lower accident likelihood but longer consequence distance.

At the thermal power plant, following scenarios have been considered for consequence analysis:

- Rupture (Nozzle Failure) in tanks
- Failure of transfer piping

The selected scenarios for consequence calculations area are given in **Table 7.3.**

Table 7-3 List of Selected Scenarios for Consequence Analysis

Scenario No.	Description	Outcomes
1.	Rupture of Heavy Fuel Oil (HFO) Tank followed by Immediate/Delayed ignition	Pool Fire/ Vapour Cloud Explosion/ Flash Fire
2.	Rupture of High-Speed Diesel (HSD) Tank followed by immediate/ delayed ignition	Pool Fire/ Vapour Cloud Explosion/ Flash Fire
3.	Leakage of HSD from Pump Seal followed by immediate/ Delayed Ignition	Pool Fire/ Vapour Cloud Explosion/ Flash Fire
4.	Catastrophic Rupture of HSD Piping from Pump House to HSD Tank followed by Immediate/ Delayed Ignition	Pool Fire/ Vapour Cloud Explosion/ Flash Fire

Note: Vapour Cloud Explosion (Confined) and Flash Fire (Non-confined)

7.1.5 Consequences analysis

The subsequent to the accidental release of HFO and HSD, the consequence of an accidental release depends on various factors e.g. type and quantity of release, presence

and location of an ignition source, meteorological conditions, etc. Any loss of containment at thermal power plant will lead to a release of HFO/HSD. The released quantity will depend on failure size and the duration of release. HFO and HSD storage tanks will be provided with bund (dyke) for full containment. A fixed pool may be formed on release of containment from tanks, which may or may not ignite. If immediate or delayed ignition takes place a pool fire will result. Delayed ignition may also lead to vapour cloud explosion/flash fire, if release quantities/surface areas are significant. In the event of release from transfer piping, spreading pool will be formed followed by spreading pool fire on getting source of ignition.

The following effects are distinguished for consequence analyses, immediate ignition followed by pool fire, or evaporation and delayed ignition of a vapour cloud resulting in a fire and/or explosion. Representative consequences distances up to where 1% fatality-occurs among those exposed, have been calculated.

The following damage distances for thermal radiation have been used:

37.5 kW/m^2	Damage to process equipment. 100% lethality in 1min. 1% lethality in 10sec.
12.5 kW/m^2	First degree burn for 10 sec exposure
4 kW/m^2	First degree burn for 30 sec exposure

The 0.1 bar overpressure due to explosion at 1% fatality has been considered for computations.

7.1.5.1 Model used for consequence analysis

The consequence analysis studies involve a large number of calculations for which established computing aids are essential. PHAST/SAFETI software of DNV has been used to perform the consequence calculations. PHAST/SAFETI is a consequence and risk assessment software for calculation of physical effects (fire, explosion, atmospheric dispersion) of the escape of hazardous materials. PHAST/SAFETI software allows detailed modelling and quantitative assessment of release of pure and mixtures of liquid and gaseous chemicals.

7.1.5.2 Consequence analysis for release scenarios

(i) Scenario - 1: Rupture of 3000 Kl HFO Tank Followed by Immediate/ Delayed Ignition

On release of HFO from 3000 kl tank, HFO will be contained in bund and fixed pool of HFO will be formed. On early or delayed ignition, fixed pool fire will be observed. Consequence calculations for rupture of HFO tank followed by fire have been carried out as per the details given below:

- Pool Fire Heat Radiation

On ignition of fixed pool, thermal radiation distances will be as given:

Radiation Level	Thermal Radiation Level Distances (m)			
	3 m/s - B	3 m/s – D	2 m/s - E	2 m/s - F
37.5 kW/m^2	Not Reached	Not Reached	Not Reached	Not Reached

12.5 kW/m^2	28.7	31.1	30.3	33.7
4 kW/m^2	71.6	73.9	68.8	73.1

Thermal radiation radii for pool fire are shown in **Figure 7.1.**

Vapour Cloud Explosion: In the event of delayed ignition after release of HFO, vapours of HFO will be generated from the surface of fixed pool and dispersed into the atmosphere towards prevailing wind directions. Due to less degree of confinement, HFO vapours cloud on getting source of ignition vapour cloud will not be exploded.

Overpressure	**Distances (m)**			
	3 m/s - B	**3 m/s - D**	**2 m/s - E**	**2 m/s - F**
0.1 bar	No Hazard	No Hazard	No Hazard	No Hazard

Flash Fire

In the event of delayed ignition, vapours of HFO will be generated from the surface of fixed pool and dispersed into the atmosphere towards prevailing wind directions. The distances of HFO vapours within the UFL and LFL are given below:

Concentrations	**Distances (m)**			
	3 m/s - B	**3 m/s – D**	**2 m/s - E**	**2 m/s - F**
UFL	161.1	164.4	154.8	146.8
LFL	415.9	455.9	481.3	471.5

Flash fire envelope distances will be as given below:

Concentrations	**Flash Fire Envelope Distances (m)**			
	3 m/s - B	**3 m/s - D**	**2 m/s - E**	**2 m/s - F**
Furthest Extent	415.9	455.9	481.3	471.5

Flash fire envelope distances under various stability classes are shown in **Figure 7.2.**

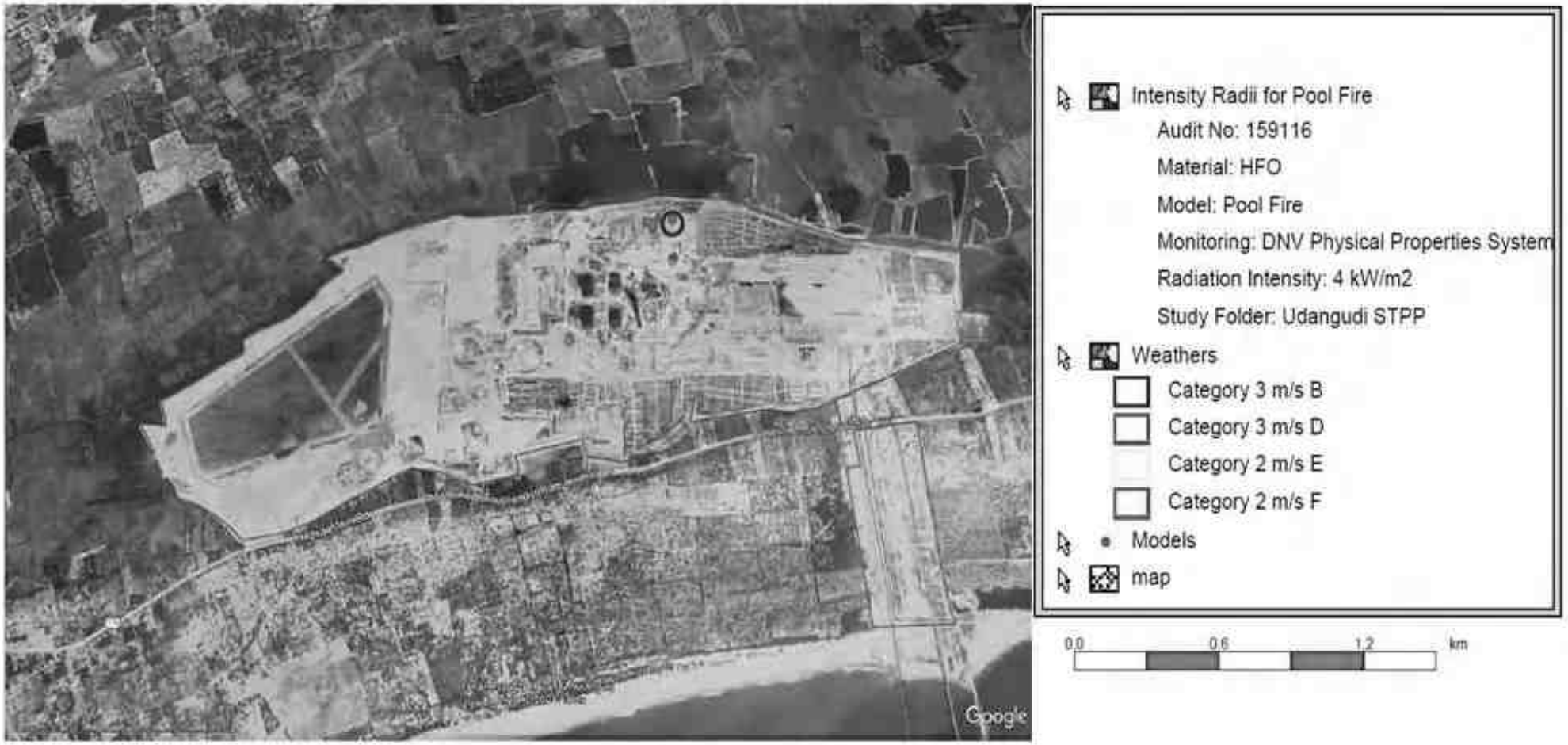


Figure 7-1 Thermal Radiation Radii for Late Pool Fire due to Rupture of HFO Tank

Figure 7-2 Flash Fire Envelope Concentration of HFO Vapours due to Rupture of HFO Tank

(ii) Scenario - 2: Rupture of High-Speed Diesel Tank followed by Immediate/ Delayed ignition

On release of high-speed diesel from the 1000 kl tank, high speed diesel will be contained in bund and fixed pool will be formed. On early or delayed ignition, fixed pool fire will be observed. Consequence calculations for rupture of high-speed diesel tank followed by fire have been carried out as per the details given below:

Pool Fire Heat Radiation

On ignition of fixed pool, thermal radiation distances will be as given:

Radiation Level	Thermal Radiation Level Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s - E	2 m/s - E
37.5 kW/m^2	Not Reached	Not Reached	Not Reached	Not Reached
12.5 kW/m^2	21.7	23.1	22.2	23.9
4 kW/m^2	57.6	58.9	54.4	56.4

Thermal radiation radii for pool fire are shown in **Figure 7.3.**

Vapour Cloud Explosion: In the event of delayed ignition after release of high-speed diesel, vapours of high-speed diesel will be generated from the surface of fixed pool and dispersed into the atmosphere towards prevailing wind directions. Vapour cloud explosion will not be occurred on ignition of high-speed diesel vapours due less degree of confinement.

Overpressure	Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s - E	2 m/s - F
0.1 bar	No Hazard	No Hazard	No Hazard	No Hazard

Flash Fire

In the event of delayed ignition, vapours of high-speed diesel will be generated from the surface of fixed pool and dispersed into the atmosphere towards prevailing wind directions. The distances of high-speed diesel vapours within the UFL and LFL are given below:

Concentrations	Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s - E	2 m/s - F
UFL	103.9	113.2	112.6	106.7
LFL	257.9	276.1	293.3	285.6

Flash fire envelope distances on ignition of HSD vapours will be as given below:

Concentrations	**Flash Fire Envelope Distances (m)**			
	3 m/s - B	**3 m/s - D**	**2 m/s - E**	**2 m/s - F**
Furthest Extent	257.9	276.1	293.3	285.6

Flash fire envelope distances are shown in **Figure 7.4.**

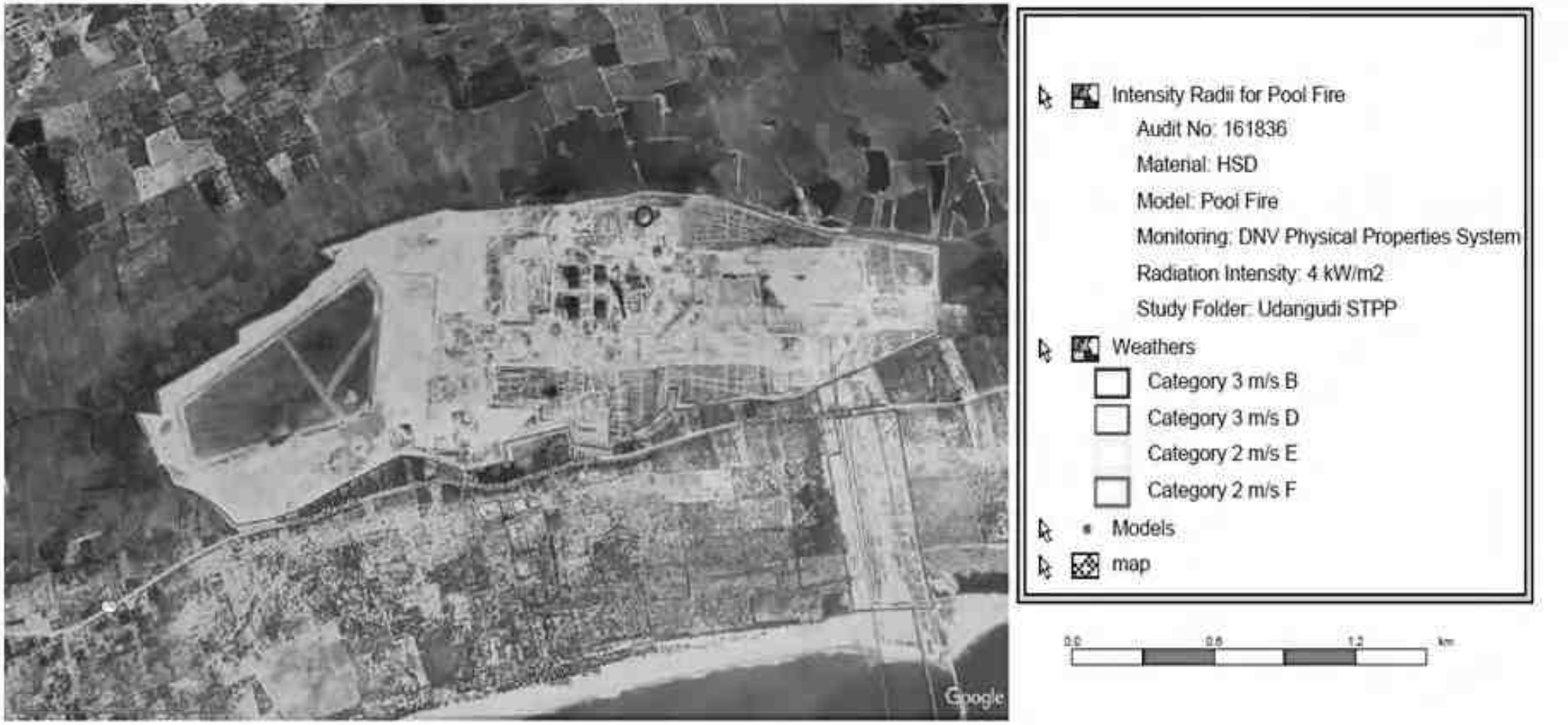


Figure 7-3 Thermal Radiation Radii for late Pool Fire Due to Rupture of HSD Tank

Figure 7-4 Flash Fire Envelope Concentration of Due to Rupture of HSD Tank

(iii) Scenario - 3: Leakage of HSD from Pump Seal followed by immediate/ Delayed Ignition

On leakage of HSD from pump seal will be spread on ground and spread pool of HSD will be formed. On early or delayed ignition, spreading pool fire will be observed. Consequence calculations for leakage of HSD from pump seal followed by fire have been carried out as per the details given below:

Pool Fire Heat Radiation

On ignition of spreading pool due to leakage of HSD from pump seal, thermal radiation distances will be as given:

Radiation Level	Thermal Radiation Level Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s - E	2 m/s - E
37.5 kW/m^2	No Hazard	No Hazard	No Hazard	No Hazard
12.5 kW/m^2	16.7	16.9	16.5	16.8
4 kW/m^2	27.8	27.8	27.4	27.9

Thermal radiation radii for pool fire of HSD are shown in **Figure 7.5.**

Vapour Cloud Explosion: In the event of delayed ignition after release of HSD due to leakage from pump seal, HSD vapours from spreading pool will be generated dispersed into the atmosphere towards prevailing wind directions. On ignition HSD vapours vapour cloud explosion will not be occurred due to less degree of confinement:

Overpressure	Distances (m)			
	3 m/s – B	3 m/s - D	2 m/s - E	2 m/s - F
0.1 bar	No Hazard	No Hazard	No Hazard	No Hazard

Flash Fire

In the event of delayed ignition, vapours of HSD will be generated from the surface of spreading pool and dispersed into the atmosphere towards prevailing wind directions. The distances of HSD vapours within the UFL and LFL are given below:

Concentrations	Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s - E	2 m/s - F
UFL	0.40	0.42	0.42	0.36
LFL	4.28	4.99	4.84	4.79

Flash Fire Envelope distances will be as given below:

Concentrations	Flash Fire Envelope Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s - E	2 m/s - F
Furthest Extent	4.28	4.99	4.84	4.79

Flash fire envelope distances are shown in **Figure 7.6**

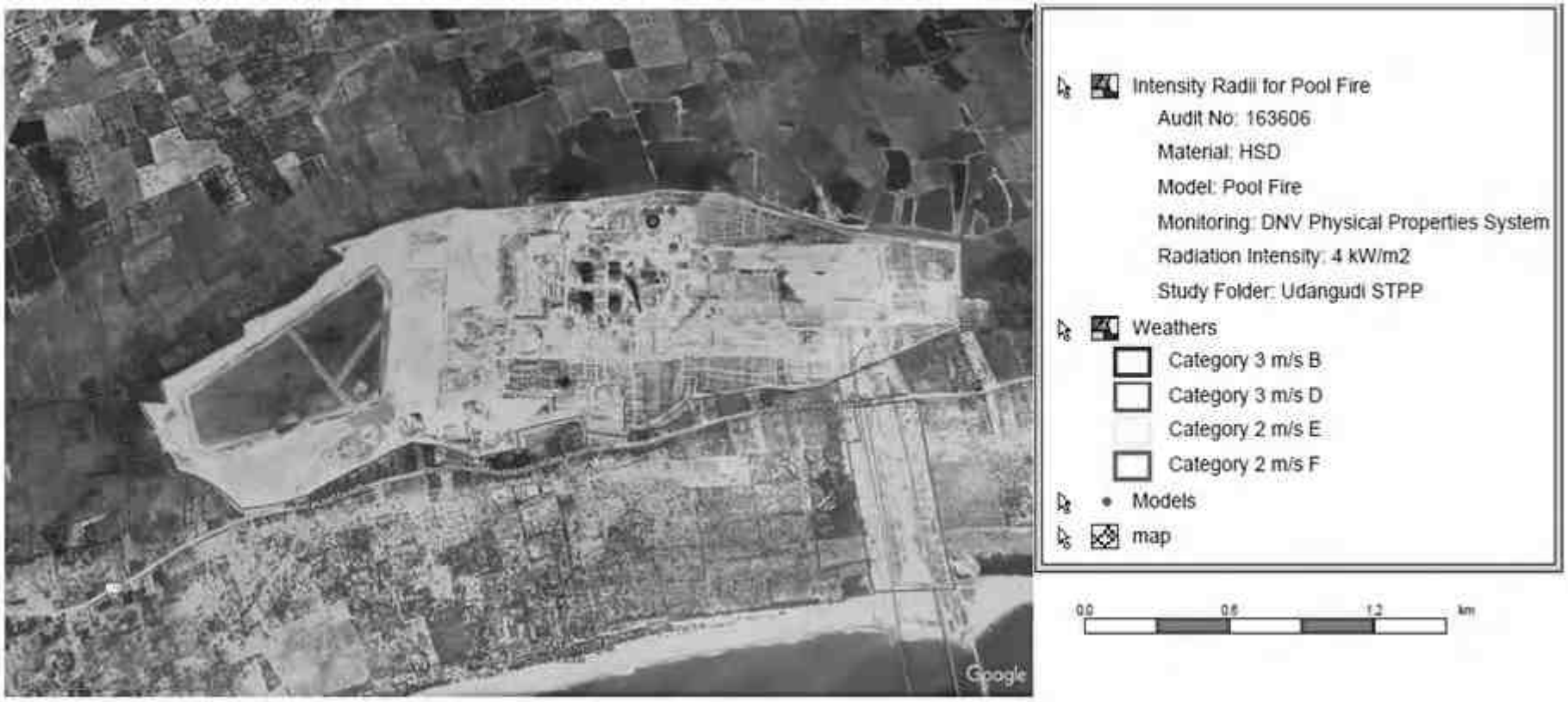


Figure 7-5 Thermal Radiation Radii from Pool Fire due to Leakage of HSD from Pump Seal

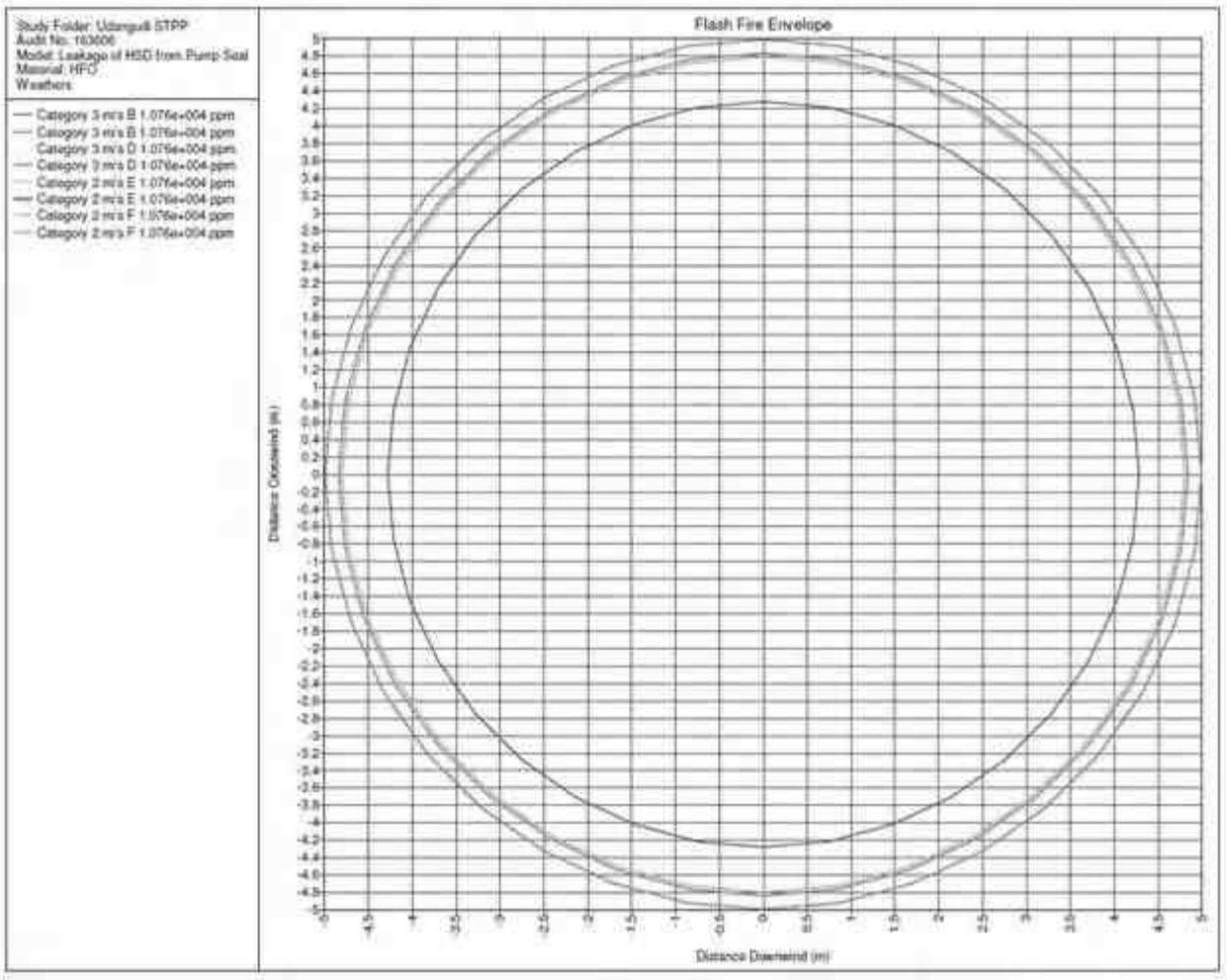


Figure 7-6 Flash Fire Envelope Concentration of HSD Vapours due to Leakage of HSD from Pump Seal

(iv) Scenario - 4: Catastrophic Rupture of HSD Piping from Pump House to HSD Tank followed by Immediate/ Delayed Ignition

On catastrophic rupture of HSD piping from pump house to storage tank, HSD will be spread on ground and spread pool of HSD will be formed. On early or delayed ignition, spreading pool fire will be observed. Consequence calculations for rupture of HSD piping followed by fire have been carried out as per the details given below:

Pool Fire Heat Radiation

On ignition of spreading pool due to rupture of HSD piping from pump house to HSD tank, thermal radiation distances will be as given:

Radiation Level	Thermal Radiation Level Distances (m)			
	2 m/s - B	3 m/s - D	2 m/s - E	2 m/s - E
37.5 kW/m^2	No Hazard	No Hazard	No Hazard	No Hazard
12.5 kW/m^2	22.6929	22.2905	19.2293	19.6147
4 kW/m^2	45.647	45.2446	40.8285	40.4664

Thermal radiation radii for pool fire of HSD are shown in **Figure 7.7.**

Vapour Cloud Explosion: In the event of delayed ignition after release of HSD due to rupture of HSD piping from pump house to HSD tank, vapours of HSD will be generated from the surface of pool and dispersed into the atmosphere towards prevailing wind directions. Vapour cloud explosion will not be occurred on ignition of HSD vapour due to less degree of confinement.

Overpressure	Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s - E	2 m/s - F
0.1 bar	No Hazard	No Hazard	No Hazard	No Hazard

Flash Fire

In the event of delayed ignition, vapours of HSD will be generated from the surface of spreading pool and dispersed into atmosphere towards prevailing wind directions. The distances of HSD vapours within the UFL and LFL are given below:

Concentrations	Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s - E	2 m/s - F
UFL	2.4	2.7	1.8	1.6
LFL	34.3	46.7	53.0	46.5

On ignition of HSD vapours from spreading pool due to rupture of HSD piping from pump house to HSD Tank, flash fire envelope distances will be as given below:

Concentrations	Flash Fire Envelope Distances (m)			
	3 m/s - B	3 m/s - D	2 m/s - E	2 m/s - F
Furthest Extent	34.3	46.7	53.0	46.5

Flash fire envelope distances are shown in **Figure 7.8**.

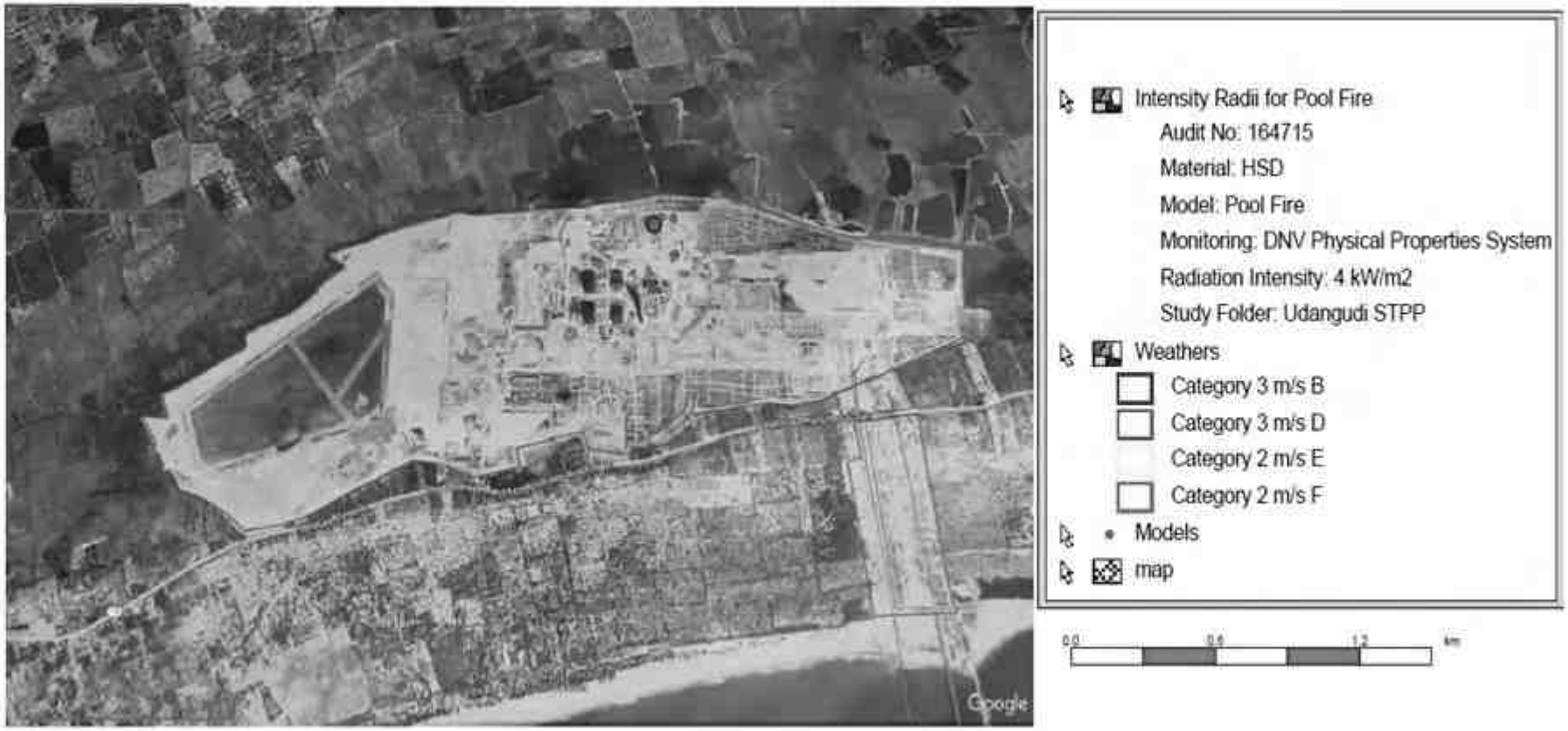


Figure 7-7 Thermal Radiation Radii from Pool Fire due to Rupture of HSD Piping

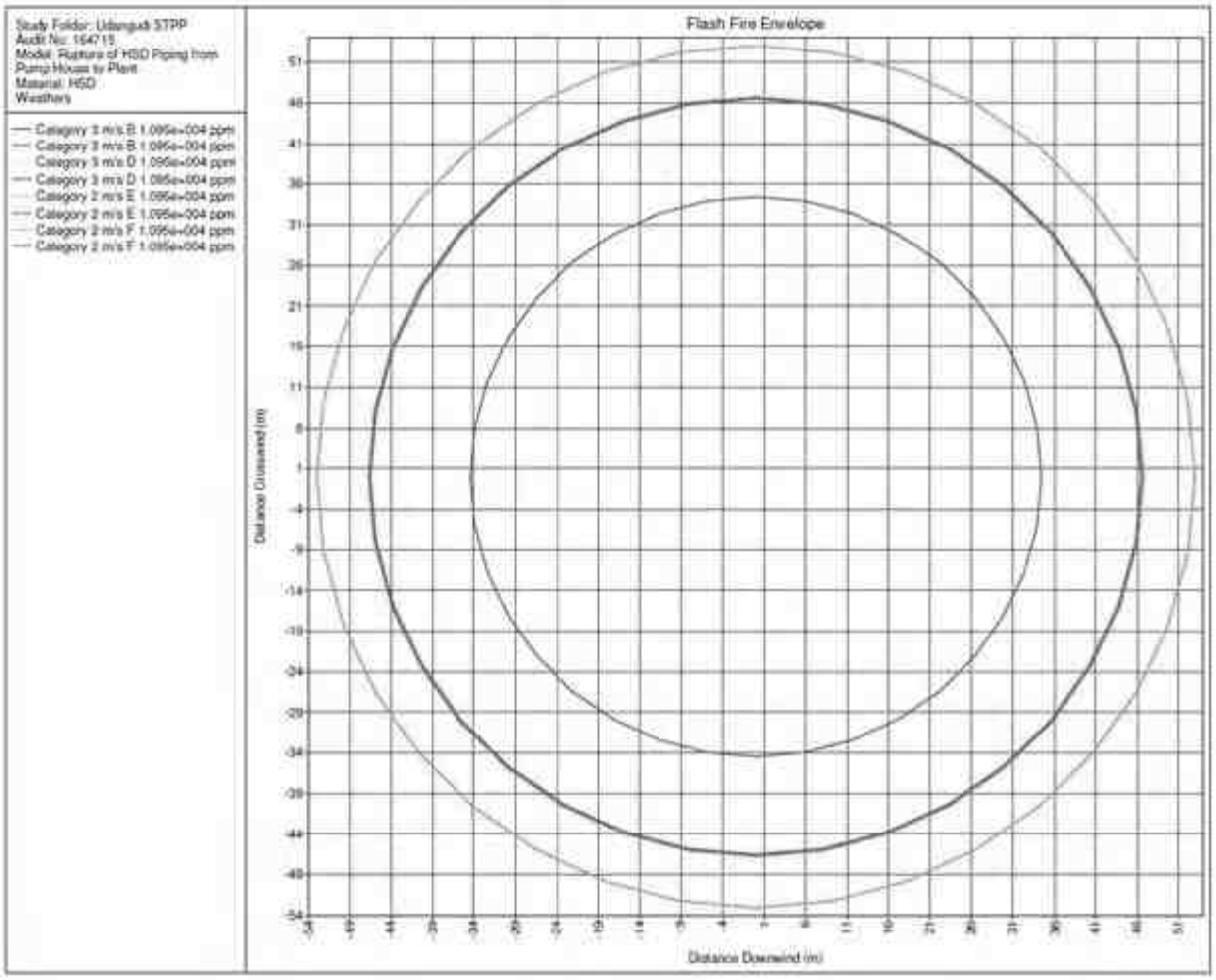


Figure 7-8 Flash Fire Envelope Concentration of HSD Vapours due to Rupture of HSD Piping

7.1.6 Frequency analysis

For frequency analysis, the failure rate has been estimated by counting the different items in the section. The failure rate for a certain item has been broken down into the correct proportions for required release rate bands. Failure modes of all components giving rise to similar release rates have been clustered and all corresponding failure frequencies have been added up, since release could occur due to the failure of any of the components. This then is the occurrence probability for the particular size of release.

7.1.6.1 Generic failure frequencies & Data resources

(i) Equipment Failure Frequency

The data sources referred for failure frequencies are E & P Forum (Oil Industry International Exploration & Production Forum) Frequency database from TNO and Failure frequency data from the Rijnmond Report (COVO Study). The failure frequencies have been distributed for three different failure sizes, rupture, hole (50 mm equivalent hole size) and leak (13 mm equivalent hole size).

Equipment	Rupture	Hole	Leak
Process piping	4.0 x 10^{-6} /m yr	6.0 x 10^{-6} /m yr	1.6 x 10^{-5} /m yr
Storage Tank	1 x 10^{-6} /yr	1 x 10^{-5} /yr.	1 x 10^{-4} /yr.

Equipment	Rupture	Hole	Leak
Valves	9.2 x 10^{-6} /yr	1.8 x 10^{-5} /yr.	5.3 x 10^{-5}/yr.
Flanges	-	3.52 x 10^{-6} / flange yr	8.5x 10^{-5}/flange yr

(ii) Ignition Probability

Ignition probabilities for this study have been taken from Motor Spirit transport study done by TNO.

Probabilities of Ignition

Type of Ignition	Probability
Immediate	0.065
Delayed	0.065
No Ignition	0.87

(iii) Frequency Analysis

Methodology / Assumptions - The following methodology/ assumptions have been adopted:

- The Release frequency is obtained by adding the failure frequencies of all the valves, flanges, pumps, piping, etc.
- The immediate ignition probability for pool fire has been taken as 0.065 and delayed ignition probability has been taken as 0.065.

Accident Likelihood for storage Tanks

The release frequency for storage tanks at the thermal power is given below:

Storage Tank Catastrophic Failure Frequency	1E-6 tank -1 yr. -1

Accident Likelihood for Piping Failure

Piping failure frequency	3.0E-5/hr

7.1.7 Risk analysis and submission

Risk is defined as the unwanted consequence of a particular activity in relation to the likelihood that this may occur. Risk thus comprises of two variables: magnitude of consequences & the probability of occurrence. The Risk analysis and summation are most often presented in terms of individual and group or societal risk.

Individual Risk is the probability of death occurring as a result of accidents at a plant, installation or a transport route expressed as a function of the distance from such an activity. Such a risk actually exists only when a person is permanently at that spot (out of doors). The individual risk is well illustrated with the aid of risk - curves or Iso-risk contours. Societal risk is the probability of a certain number of victims per year. In calculating the group risk demographic data relating to the presence of humans is

necessary. The societal risk is represented as an F-N curve, which depicts the frequency of occurrence per year F of a certain number of fatalities, N.

The individual and societal risks from thermal power plant are the result of the cumulating of risks connected with all possible scenarios. From the standpoint of what constitutes acceptable risk levels from a complex, both the Individual as well as Societal risk should be within the acceptance criteria.

The DNV Software model PHAST RISK has been used for plotting the iso-risk contour of individual risk and F-N curves of Societal Risk. The 'PHAST RISK' program package is a very powerful tool to combine the probabilities and consequences of all release scenarios considered into risk and then sum them.

Data input to SAFETI (PHAST RISK) comprises of results of effects-consequence and frequency analyses for the scenarios included for risk summation, along with population and meteorological data for the locality in question. The effects-consequence and frequency analyses for the selected releases have been summarised in Section 3 and Section 4, respectively.

7.1.7.1 Risk summation

The results of quantitative risk assessment have been reproduced as Individual and Societal risks and these are defined as below:

(i) Individual Risk

The individual risk at a certain distance from a thermal power plant is the result of the cumulation of risks connected with all possible scenarios. The calculation of individual risk at a geographical location near a thermal power plant assumes that the contributions of all incident outcome cases are additive. Thus, the total individual risk at each point is equal to the sum of the individual risks, at that point, of all incident outcome cases associated with the thermal power plant. The calculation of individual risk requires the application of these equations at every geographical location surrounding the facility.

(ii) Societal Risk

Societal risk is the probability of a certain number of victims per year. In calculating the group risk demographic data relating to the presence of humans is necessary. From the stand point of what constitute acceptable risk levels from a complex, both the Individual as well as societal risk should be within the acceptance criteria.

The need for the societal risk computation arises due to the fact that society views multiple fatalities from the same accident far more seriously than single fatalities from numerous accidents. It may well happen that for HFO and HSD thermal power plant the individual risk criteria is met but the group risk criteria is not, due to a high population density around the thermal power plant. It also follows that if the population growth around the thermal power plant cannot be arrested; further risk reduction becomes necessary to meet the group risk criteria.

7.1.7.2 Risk acceptance criteria

The risk analysis provides a measure of the risk resulting from storage and handling of HFO and HSD at the thermal power plant. The methodology for calculating risk levels has been well defined and consistent results can therefore be expected. However, the assessment of the acceptability or otherwise of that risk is left to the judgement and experience of the people undertaking and/or using the risk assessment study. The normal approach adopted is to relate the risk measures obtained to risk acceptance criteria.

7.1.7.3 Criteria adopted for individual risk

As per "Code of Practices for Emergency Response and Disaster Management Plan Regulation 2010" formulated by Petroleum and Natural Gas Regulatory Board, under Petroleum and Natural Gas Regulatory Board Act 2006, Individual Risk per Annum (IRPA) has been adopted as given below:

- 10-5 per year for tolerable risk
- 10-6 per year for acceptable risk.
- Lower than 10-6 per year for negligible risk.

Individual Risk from 10-3 to 10-5 per Annum is considered tolerable in As Low as Reasonably Practicable (ALARP Zone).

7.1.7.4 Criteria adopted for societal risk criteria

In the assessment of the societal risk, demographic data on the offsite of the thermal power plant have been used. Only the employees working in the thermal power plant are not included in the 'society'. With regard to the risk of people employed in nearby industries with similar risk, it is debatable to consider them as population. Internationally consensus is lacking on this aspect. However, in the present study employees in the adjoining facilities have been considered in the assessment of societal risk.

	FN Curve Slope	Intolerable Intercept With N=1	Negligible Intercept With N=1	Limit on N
Existing and New Plants	-1	10^{-3}	10^{-6}	-

7.1.7.5 Individual risk due to existing facilities

Iso risk contour for HFO and HSD storage and handling at the thermal power plant are presented in **Figure 7.9**. From the figure, it is observed that risk level contour 1.0E-5 is within the boundary of the Udangudi thermal power plant. The risk level 1.0E-6 per year individual risk contour also does not cross the thermal power plant boundary. It is thus clear that individual risk higher than 1.0E-5/yr is within the thermal power plant boundary and does not cover any populated areas and is hence acceptable. The individual risk contours up-to risk level 1.0E-6/avg. yr remain within boundary of the thermal power plant as all tanks have been provided with the dyke (bund) for full containment of release of petroleum products. Therefore, consequence of thermal radiation is confined to short distance around the fixed pool.

The Individual Risk Potential for Loss of Life (Potential Loss of Life- PLL) due to the thermal power plant is 2.3527E-005 per avg. year.

7.1.7.6 Findings of risk analysis

Based on Risk analysis and summation, following conclusions can be made:

1. Individual risk from the thermal power plant is negligible, as it is below the tolerance criterion of individual risk not to exceed 1.0E-5 per year in populated areas,
2. Individual risk contour for 1.0E-5 per year is also within the boundary limit of the Udangudi thermal power plant,
3. The Individual Risk Potential for Loss of Life (Potential Loss of Life- PLL) due to Udangudi thermal power plant is 2.3527E-005 per avg. year.

Figure 7-9 Iso Risk Contours for Udangudi Thermal Power Plant

7.1.8 Risk reduction measures

This section discusses risk mitigation measures for reduction of risk and to enhance safety thermal power plant based on the risk analysis study carried out. For risk reduction attempts should be made to either reduce inventories that could get released in the event of loss of containment or failure likelihood or both as feasible.

7.1.8.1 Implementation of advance risk mitigation measures

- It should ensure that the continued functioning of the instrumentation such as the two independent level instruments, level alarm, etc
- Storage tanks should be provided with at least two numbers of level instruments of which one may be local and the other remote. In addition, high/low level alarms with the independent primary sensing device are also recommended.
- Open vents should be provided of goose neck type, covered with a 4 to 8 mesh screen to discharge the vapours of hydrocarbons from storage tanks.
- Every HFO and HSD storage tank, including its roof and all metal connections, should be electrically continuous and be effectively earthed.
- Check list for operators for checking safety system and equipment should be prepared and check records kept in safe custody.
- All operational valves must be outside dyke area.
- Dyke should be leak proof.
- High level alarm from the radar gauge and High-High level alarm from a separate tap off should be provided.
- Piping design inside tank dyke area should ensure easy accessibility for any operations inside dyke in the tank farm.
- Tank dyke valves should be provided with position indicator (open or close) in control room and necessary hardware and instrumentation should be provided for this.

7.1.8.2 Painting on storage tanks

- Besides tank numbers, safe filling height, reference height, etc. should be painted on the tanks to avoid operating errors.
- Tanks numbers should be painted at three positions, 120 degrees apart, below roof level and should be clearly visible from outside the dyke/roadside. Recommended size of letters for numbering is 150 mm and 12 mm thick.
- For storage tanks luminous paint should be preferred.

7.1.8.3 Earthing and bonding

Every storage tank, including its roof and all metal connections should be electrically continuous and be effectively earthed. The pontoon, ladder and shell of the floating roof tank shall be continuously bonded with copper cable and the shell shall be independently earthed. Best practices of “OISD-RP-110 - Recommended Practices on Static Electricity” for earthing and bonding should be followed.

Site specific “Standard Operating Procedure (SOP)” should be developed.

7.1.8.4 Work permit system

Work permit system for cold work, hot work, working at height, electrical and confined space entry will be followed.

7.1.8.5 Security and surveillance of fuel storage area

- CCTVs should be installed covering tank farm areas and other critical areas. CCTV can provide with an alarm to provide warning in case of deviation from any normal situation. The CCTV monitoring station should be provided both in the control room as well as in the Security cabin/office.
- A board displaying the name, address and phone numbers of the emergency contact points of the company as well as the local authorities shall be provided therein.
- Adequate lighting in operational areas should be ensured.
- Vehicles with spark ignition engine should not be allowed in the fuel storage area.

7.1.8.6 Firefighting facilities

- The fire fighting facilities including fire hydrants system, monitors, hose pipes, fire extinguishers should be provided in fuel tank farm area.
- Fire fighting system should be tested periodically for proper functioning and logged for records and corrective actions.
- Every fire-water pump should be tested run for at least half an hour two times a week.
- All hydrants, monitors and valves should visually inspect every month.
- Fire hoses should be hydraulically tested at least once in six months to a minimum pressure of 7 kg/cm2.
- Personnel from safety department and security services should be trained fully in fire fighting and rescue operations using Personal Protective Equipment (PPE).
- During all operations even after the general shift a dedicated fire fighting team should be present.
- Flame-proof torches should be made available to inspect and keep vigil in the tank farm areas during night.

7.1.8.7 Integrity of tanks and piping

The integrity of the tanks and pipings during its lifetime needs to be maintained by means of condition monitoring.

7.1.8.8 Personal protective equipment

- Personal protective equipment such as safety glasses must be worn while carrying out all operations
- All other PPEs should be available at location and easily identified.
- All PPEs as well as safety equipment required for emergency use such as breathing apparatus, fire suit, fire extinguishers, monitors and sprinklers should be regularly tested in presence of safety officers and records maintained.
- All PPEs required during emergency shall be located in designated safe areas.

7.1.8.9 Preventive and predictive maintenance

Predictive and preventive maintenance practices significantly help in minimizing the likelihood of an accidental release. Therefore, predictive and preventive maintenance schedule should be prepared and followed.

7.1.8.10 Check for Tank Trucks

Before entering the truck tankers engaged in the transportation of HFO and HSD, following documents should be strictly checked on the main gate and trucks having following documents should allowed to enter into plant premises:

- Registration certificate for transportation of HFO and HSD
- Deriver license to drive vehicles carrying petroleum products
- Authorized license to carry the petroleum products.
- Fitness Certificate
- Valid National permit
- TREM Card
- Insurance papers
- Spark arrester with the exhaust
- Restricted item such as match box, cigarette, bidi, etc.

7.1.8.11 Emergency response plan

Emergency response plan should be prepared for an unlikely event of release scenarios. and it should also be updated based on finding of mock drill. Emergency procedures should be written in local language and available to all personnel in the installation outlining the actions to be taken by each during a major incident.

7.1.8.12 Mock Drill Exercises

Mock drill should be conducted once in six months. Based on mock drill findings Emergency response plan should be updated and training to responsible personnels should be given.

7.2 Disaster management plan

As per the ToR condition the Disaster management will be prepared in English and tamil widely circulated to the nearest villages. The copies will be made available in the panchayat office / Public assembly area.

7.2.1 Objective

- To establish a method of systematic, safe and orderly evacuation in the least possible time, to a safe area or by the nearest safe means of way out.
- Control the accidents.
- Rapid control and containment of hazardous situation.
- Rescue and treatment of casualties.
- Safeguard people (both at site and neighborhood).
- Minimize damage to property and environment.
- Identify casualties, notify their relatives and render necessary help to them.
- Proper training of the concerned person.
- Prevent recurrence.
- Be capable of dealing with largest incident that can reasonably be foreseen.
- Have sufficient flexibility with a view to handling the emergency efficiently and avoiding unnecessary calling external agencies like fire brigade services.

7.2.2 Basic forms of emergency

- Fire

- Explosion
- Toxic release
- Natural disaster (earth quake, flooding, tsunami etc.)
- A combination of more than one

7.2.3 Types of emergency

7.2.3.1 On-site emergency

An accident/ incident that take place in a factory, with effects being confined to the factory premises, involving only the persons working in the factory and the property inside the factory is called On-site Emergency. It can further be classified as minor and major emergency based on severity of the incident.

7.2.3.2 Minor emergency (Evacuation is not required)

In the case of minor emergency there is no need for evacuation siren and the respective department personnel will handle the same with assistance of Safety Squad.

7.2.3.3 Major emergency (Evacuation is required)

In case of major emergency, there must be an emergency siren and situation is tackled as per the plan

7.2.3.4 Off-site emergency

If the accident is such that it affects inside the factory uncontrolled and it may spread outside the factory premises, it is called as Off-site Emergency.

7.2.3.5 Natural disaster (Tsunami)

Tsunamis are a series of waves usually generated by movement of the sea floor. These movements are caused by different types of geophysical phenomena such as earthquakes, landslides and volcanic eruptions. Tsunamis are move at a speed equals to the square root of the product of gravity and the depth of the water. The tsunami waves behave very differently in deep water than in shallow water as their speed is related to the water depth. Tsunami waves form only a small hump, barely noticeable and harmless, which generally travels at a very high speed of 500 to 1,000 km/h. Tsunamis are most commonly generated by earthquakes in marine and coastal regions. Major tsunamis are produced by large (greater than 7 on the Richter scale), shallow focus (< 30km depth in the earth) earthquakes associated with the movement of oceanic and continental plates.

The devastation unleashed by the fury of massive Tsunami waves on 26th December 2004 was unprecedented in nature. It also affected around 50 Town Panchayats of six coastal districts namely Kancheepuram, Villupuram, Cuddalore, Nagapattinam, Kanyakumari and Thoothukudi in Tamil Nadu. It was an extraordinary calamity of rare severity. According to the intensity of disaster, the affected Town Panchayats were categorized as “worst damaged” and “partially damaged” Town Panchayats. Out of the 50 coastal Town Panchayats, 19 Town Panchayats were declared as “worst damaged” Town Panchayats with loss of life and property damages.

7.2.4 On Site Emergency Plan in Place with TNPGCL (TANGEDCO)

7.2.4.1 Purpose

The main purpose of preparing “On-Site Emergency plan” is to define responsibility for individuals and teams to control and mitigate emergency situation in a systematic way

without affecting adjacent building, neighboring industry and public of the surrounding vicinity.

7.2.4.2 Emergency organization

The effective control of emergency situations depends upon the way in which the individual and team acting during emergency in an appropriate time. So, this is very essential to identify key individual and teams for fixing specific responsibility as part of emergency organization to avoid confusion.

Duties of Various Personnel

Chief Emergency Controller:

- Site Head (Operations) in his absence HOD- (Operations):
- Beyond General Shift hours and on Holidays Site Shift Manager will act as Chief Emergency Controller until Site Head/HOD-Operations takes over.
- Chief Emergency Controller will be over all controller of the emergency. He will take ultimate decision on the following aspects and execute the same with the assistance of concerned personnel:
- Essential Communication
- Fire Fighting and Rescue Work
- Emergency Plant Shutdown
- Evacuation Actions if required
- Demolition and Repairs
- Transportation
- Investigation
- Public Relation
- Urgent Medical Attention and Actions
- Evacuation and Directive to Vicinity Community through State Agencies.
- Incident Controller
- Concerned HOS until HOD arrives at site, the Shift In charge of the area will function as Incident Controller:
- Assess the emergency
- Disseminate warning
- Direct the fire fighting and rescue operation
- Direct the plant operations/shutdown to control the emergency.
- Liaison with HOD(CES) /HOS (Mech.)
- Ensure constant feed back to C.E.C.

HOS (Production)

- Deploy officers and staff for control room and field for coordinating and direct the work of the fire fighting and rescue operation
- Evaluate the risk and its subsequent effects in consultation with HOS (Safety, Health & Environment).
- Function as Incident Controller in the absence of HOD-Operations
- HOS (Safety, Health & Environment)

- Evaluate the hazard and accordingly direct the Fire Executive and Safety Executive for emergency actions. Arrange for safety equipments.
- Keep constant contact with Incident Controller throughout the emergency.
- Summon help from outside agencies like local Fire Brigade and Mutual Aid Scheme.

HOD (Technical Services)

- Evaluate the operational needs on emergency, anticipation possible risks and suggest suitable measures to Incident Controller.
- Assessment of magnitude and spread of risk to work out remedial actions.
- Deciding the method of disposal of hazardous spillage/leakage.
- HOD (T.S) will take over the function of HOS (Safety, Health & Environment) in his absence.

HOS (Laboratory)

- Collect the information on weather condition, ambient air quality and drain discharge during emergency and give feed back to HOD (T.S.)

Executive (Fire) / Executive (Security)

- Direct the crew members in carrying out fire fighting, rescue operation and control of toxic chemical release.
- Direct the rescue operations in co-ordination with HOS (Safety, Health & Environment).
- Provide stretcher service to ambulance point.
- Arrangement and deployment of additional crew (Off Duty Personnel)
- Ensure adequate supply of fire fighting / rescue equipment, accessories and materials.
- Keep constant touch with HOS (Safety, Health & Environment) and Incident Controller.

HOD (CES):

- Evaluate the emergency requirements in consultation with Incident Controller.
- Arrange and provide necessary equipment like cranes, dozers, pay loaders, forklifts, trucks welding / cutting sets, jacks, chain pulley blocks, water pumps etc. and power to operate these equipments.
- Ensure continuous operation of firewater pumps and regular supply of required water for fire fighting and other emergency operations.
- Arrange and provide required number of contract personnel to do civil, mechanical and electrical jobs like sand bags, bunding, excavation, repairs, structure and debris removal, lighting etc.
- Make arrangement for permanent / temporary lighting/flood lights/emergency lights to the affected area, shelters and other places.
- Direct the operation of above equipment and services in consultation with Incident Controller to minimize loss / damage.
- Keep constant touch with Chief Emergency Controller.

HOS (Mechanical)

- Mobilize necessary equipment like cranes, dozers, pay loaders, forklifts, welding/cutting sets, jacks, chain pulley blocks, tools and tackles etc. to the site of emergency.
- Arrange and depute operators, riggers, welders and technician etc. to operators, riggers, welders and technician etc. to operate the above equipment.
- Keep mechanical workshop open.

HOS (Electrical)

- Arrange to cut off/restore power supply as needed in emergency situations.
- Provide temporary connection for floodlights, and electrical tools.
- Provide power connection for pumps and other equipments.

Engineer (Civil)

- Ensure adequate fire fighting water supply in co-ordination with Manager (Admin.).
- Arrange additional water supply from reservoirs and by diverting process water/treated water in consultation with C.E.C.
- Organize jobs such as excavation, shoring and supporting of civil structures, temporary bunding etc.
- Direct demolishing of structure.

Engineer (Instrumentation)

- Organize instrumentation jobs such as repairs, adjustment of settings, bypassing, switching over the mode of control, repairs, calibration and the like which are needed for effective process control during emergency.
- Restore the functioning of controls, alarms and recorders, indicators etc. for stabilizing the operations.
- Remain in constant touch with Incident Controller.
- Ensure availability of information and data, pre-disaster time and at the time of disaster and store it in proper fashion so that as and when required is available.

HOS (Materials)

- Immediately contact Incident Controller and ascertain the material requirements to control emergency.
- Arrange adequate supply of required material and transport for material
- Procure or hire material, labour and transport to meet urgent requirement from outside parties/industries.

Officer (Stores):

- Keep all the stores open with necessary staff and give instructions for prompt delivery of material on the site of emergency.
- Keep constant touch with HOS (Safety, Health & Environment) and HOD (CES), for their requirement of material and ensure material delivery on the site.
- Give feed back to HOS (Materials).

Officer (Purchase):

- Arrange emergency purchase or hire of material require for meeting the emergency.
- Keep constant touch with HOS (Safety, Health & Environment)
- Give feedback to HOS (Materials).
- HOS (P&A)
- Orange hospitalization, evacuation and relief camps.
- Maintain law and order in factory premises (with the help of security)
- Control entry and exist of personnel and vehicles with the help of security.
- Seek assistance from outside agencies such as police, civil defense, fire brigade and mutual aid scheme.
- Ensure dissemination of authentic information to public and press.
- Keep relatives/family members of involved employees informed from time to time.
- Give constant feed back to CEC [Chief Emergency Controller]

Manager (Security)

- Assess and maintain law and order
- Reinforce security at gates and vital installations.
- Cordon off affected area
- Depute security personnel to help fire fighting, rescue and stretcher service.
- Restrict entries of unauthorized persons.
- Regulate entry and exit of personnel to ensure smooth function of emergency services.
- Ensure smooth entry and exist of fire brigades, ambulances and service vehicles.
- Organize transportation for affected/evacuated employees, their families and public.
- Keep liaison with police, home guards for additional help to control law and order, traffic and evacuation.

Officer (Admin.)

- Report to HOS (P&A) and get instructions.
- Keep liaison with HOS (Safety, Health & Environment) and accordingly organize evacuation.
- Keep liaison with Plant Manager and direct affected/evacuated persons/public to proper shelters.
- Ensure proper and effective functioning of means of communication. Make alternative and stand-by arrangement for prompt communication of messages.
- Give constant feed back to HOD (Services) and CEC.

Officer (Personnel)

- Report to HOS (P&A) and get instructions.
- Arrange canteen services for personnel engaged in emergency duties.
- Arrange canteen services for affected/evacuated public and improvised shelters in community hall, schools nearby etc.

- Keep liaison with Medical Officer. Collect information regarding members/relatives.
- Inform statutory authorities such as Chief Inspector of Factories, Insurance Companies, Controller of Explosives, Labour Commissioner and Pollution Control Board.
- Disseminate authentic information to public.
- Ensure authentic press release in consultation with CEC.
- Arrange for entry, exit, transportation and proper reception of press personnel.
- Keep liaison with Officer (Administration), Medical Officer and Plant people and give feedback to General Manager (P&A).

Medical Officer

- Organize ambulance services, treatment and hospitalization of affected persons.
- If necessary, get help of outside hospitals and medical professionals.
- Pass on information regarding condition and treatment of patients to HOS (P&A) & HOD (Services) from time to time.
- Contact Blood Bank and organize blood supply.
- Get blood donors. Get the help of social service organizations for this purpose.
- Keep liaison with Officer (Admin.) for emergency transportation arrangements.
- Contact HOS (P&A) for welfare arrangements of treated and discharged persons.
- Give feedback to HOD (Services).
- Shift Engineers/ Asst. Manager/ Shift In-charge
- Deploy staff for controlling process and field operation.
- Co-ordinate and direct the work of fire fighting
- Evaluate the risk and effects and take necessary actions like cutting off a section/ whole plant etc.
- Keep in close liaison with Incident Controller.
- Act as Incident Controller in silent hours and also till General Manager takes over as Incident Controller.

Operators/ Technicians

- Report matter to Shift Engineer.
- Take action to stop supply of gas, fuel etc. to the point of fire/ leakage keeping you safe.
- Use first aid fire fighting appliances to fight the fire/leakage etc.
- Stand-by for instructions from shift engineer. Keep ready for evacuation, if needed.

7.2.4.3 Responsibilities of Coordinators/Controllers

Main Incident Controller

- For On-Site Disaster Management Plan (DMP), the site shift manager shall be the Main Incident Controller to coordinate the execution of the plan during an emergency or a mock drill. He is responsible for preparation/ updating of the plan, getting approval from the District Authorities/ Factory Inspectorate; and its implementation in the hour of need. His duties are

- Assess the magnitude of the situation and declare state of emergency. Activate DMP and ensure its implementation.
- Mobilize the Main Coordinators/ Key personnel and exercise direct operational control of area, other than those affected.
- Declare danger zones and activate emergency control center.
- Ensure calling in Mutual aid members and district emergency agencies like Fire Brigade, Police, and medical authorities.
- Maintain a speculative continuous review of possible developments and assess these to determine most probable course of events and appropriate response.
- Inform Area Office, head Quarters, Police, Statutory authorities, District Authorities about the magnitude of the emergency casualties and rescue operation.
- Ensure casualties are receiving required attention and their relatives are informed.
- Ensure accounting of personnel.
- Issue authorized statements to Press, Radio, TV etc., regarding the emergency and its possible impact on the surroundings.
- Authorize procurement of emergency material.
- Log important developments in chronological order and preserve material evidence for investigation. Direct isolation of power supply, plant shutdown and evacuation of personnel inside the premises as deemed necessary.
- Advice Police, District Authorities regarding evacuation of public in the near vicinity/ vulnerable zone. Ensure raising the siren in EMERGENCY mode till All Clear Signal.
- When effects are likely to be felt outside, get in touch with District Authorities, who will take over the management and declare “Off- Site Emergency”.
- Control rehabilitation of affected areas on cessation of emergency.

Administration & Communication Coordinator

- Liaise with Chief and other coordinators.
- Inform and coordinate with External agencies and Mutual aid members for agreed assistance. Direct them on arrival to the respective coordinators.
- In case communication means fail, send messages to Mutual aid members/Emergency departments. Coordinate with Police in controlling the traffic and mob outside the premises.
- Activate the medical center and mobilize medical team. Arrange ambulance and transfer casualties to hospitals. Also coordinate with police in case of fatalities.
- Arrange for head count at the assembly points.
- Arrange procurement of spares for fire fighting and additional medical drugs/ appliances.
- Mobilize Transport as and when required by various coordinators. Arrange to provide spark arrestors to emergency vehicles entering the premises.
- Control and disperse crowds from the emergency site. Regulate traffic inside the location.
- Arrange food, beverages and drinking water for all those involved in execution of DMP in case the emergency prolongs.

- Communicate with relatives of person's injured/ involved in fire fighting activities.
- Arrange evacuation of premises as directed by Main Incident Controller.
- Coordinate with civil authorities for evacuating public from the danger zone and arrange for refreshments at the evacuation center.

Safety Coordinators

- Ensure safe stoppage of the operation; switching off main instruments, shut off valves on product lines; and isolation of affected areas.
- Demarcate danger and safe zones by putting RED and GREEN flags.
- Mobilize the Fire Fighting Crew and direct the Fire Fighting Operation.
- Effectively deploy manpower, both internal and external.
- Direct & utilize the Fire Brigade personnel.
- Arrange the replacement of various Fire Fighting squads with the Mutual and External aid members on need basis.
- Ensure/ maintain sufficient pressure in the Hydrant mains.
- Assess water level in the storage tank/ reservoir and plan replenishment.
- Monitor the requirements of Fire equipment and coordinate for procurement of spares.
- Arrange for flood lighting of the affected areas and dewatering of the Fire Fighting area, if required.
- Arrange to remove and part the tank lorries (Bulk & Packed) to a safer place, as necessary.

7.2.4.4 Internal resources

Communication

Communication includes physical and administrative means by which plant operators can rapidly notify plant management and offsite emergency response agencies and the public. They also include emergency response actions, which must be taken to protect health and safety of the plant personnel and the public. The communication is both software and hardware-oriented systems. Without adequate communication successful emergency planning cannot be exercise.

During disaster, the communication channels are kept open to the emergency control center (ECC) and outside agencies. The communication system is planned as follows:

Voice Communication Channels.

1. ECC to:
   Civilian hospitals
   Civic authorities including police
   Local firefighting brigade
2. ECC to:
   Control room unit
   Industrial medical center (First Aid Station)

3. ECC to:
   Firewater pump house

Offsite operators' station
Security gate

Audio Communication Channels [(ACC)(Alarms):
Fire Warning

If the fire is noticed at any plant or sector the fire warning is to be given and so alert all the sections of the facility. If it is a major fire or a fire at critical sector, the ECC is to be immediately activated.

Warning System

This is done by a Siren, which could be audible at a range. Signal for enforcement and withdrawal of disaster control plan are as follows:

- The disaster control plan is actuated for product leakages, fire and explosion by sounding of the siren as below:
- Sound the siren continuously for 1-minute and then stop for 10 seconds.
- This is repeated five times.
- The disaster control plan is withdrawn on sounding siren continuously for 3 minutes.
- The Siren system is designed to set in operation from the emergency control centre.
- Power Supply for the Communication System
- All types of communication systems should have an independent power back-up system for reliability.
- Walkie-talkies should be given to offsite operations and area in-charges for additional communication facilities.
- Medical Resources
- The medical aspects shall be covered for normal and routine accidents like personnel injury not due to process risks and also for providing quick first aid during the initial phase of disaster. Primary Health Centre (PHC) is already established with general staff and medical officer.
- TANGEDCO shall have a tie-up with nearby Hospital. The hospital shall be equipped by means of donating suitable equipment to deal with at least three injured persons at a time to treat burn injuries, multiple fractures, shock etc., and antidote for toxic.
- Transport
- Adequate transport vehicles are to be provided for transporting affected people/medical staff for medical treatment, evacuation and the movement of emergency staff. The vehicles are to be parked in the area where the medical center is situated. For example the vehicles of following types are stationed:
- One emergency vehicle, which can accommodate two stretcher cases.
- A pick up van with radio communication system (i.e. walkie-talkie).
- General purpose vehicle (Jeeps).

Emergency Control Centre (ECC)

This is a center for emergency works and is a part of the administrative building. The staff can be called at certain level of danger and the emergency crew, as identified in the Organogram, performs the activities. The control entry shall be located outside the area of hazard.

The center should be equipped with emergency power, duplicated means of communication to the plant area and outside the facilities with civic authorities. The control room has the following information/provisions:

- An adequate number of external telephones, one accepts outgoing calls only, in order to bypass jammed switchboards during an emergency.
- A pick-up van with radio communication systems.
- An adequate number of internal telephones.
- Layout of the facilities and detailed telephones.
- Technical documentation of the facilities.
- P & ID, process data, equipment data.
- Safety data sheets.
- Identification hazard zones for the type of scenarios considered.
- Maps marked with escape routes
- Evacuation plans in case of total evacuation of the facilities and surroundings.
- Information regarding the fire fighting and medical services.
- Personnel protective equipment.
- Medical first aid facilities to handle two or three people at a time.
- A muster roll of employees.
- A list of key personnel, with addresses, telephone numbers, etc.,
- The emergency control center is not manned always. During emergency concerned persons move into ECC and direct all activities from here.
- The emergency control center should be located away from the hazardous zone.

7.2.4.5 Action plan

The emergency action plan to be initiated in the event of a product tank on fire is as given below:

- Break the nearest fire alarm field station and /or dial the fire station giving the location and nature of emergency.
- Report the to the superior officer concerned/ control room.
- Isolate the affected tanks and cordon off the area
- Start the sprinkler system on the adjacent tanks, and the affected tank. The radiation intensity level of one tank on fire may heat up the second adjacent tank if the adjacent tanks are not cooled by water sprinkler system.
- Cool the adjacent equipment/structures with water monitors/sprinklers. Care to be taken on not to throw on wires and electrical equipment to avoid short-circuiting and electrocution. The firewater facilities at the plant have been designed as per OISD –117. for fighting prolonged fires, the firewater shall be continuously

replenished into the firewater tanks from underground water source/water supply lines.

- In order to prevent escalation, apply foam blanket on roof of the nearest tank; alternatively, apply adequate water on the rim of the floating roof. In the event of a major tank fire, it is advisable to empty out the adjoining tanks also, if practicable.
- Inject foam into the burning tank through foam equipment.
- Make the decision to pump out or not to pump out oil from the burning tanks depending on the circumstances. If the tanks hold substantial oil, it may be helpful pumping out most of it. It is also to be noted that as the level goes down, greater portion of shell comes in contact with flame weakening it. If the flame cannot be extinguished, sacrifice of the tank by burning out o the residual stock (brought to minimum) may be the strategy to be adopted.
- Inform Ambulance and medical staff to report at eh Scene.
- Remove injured personnel and render medical treatment. Get additional medical help if required. Hospitalize the affected people and inform their families.
- All contract employees to be cleared off from the cordoned off area.
- Arrange for traffic control inside the premises and outside the main gate. Ensure the approach to the main gate is cleared to facilitate movement of essential services.
- Watch for breach of dyke and arrange for blocking if required.
- Arrange for external help if required for additional fire brigades/foam equipment.
- Arrange for refreshments for the fighting personnel.
- Arrange relief crew for the fire fighting personnel.
- Inform the neighboring people about the fire to avoid panic among the people.
- Inform local authorities/ police station.
- Arrange for evacuation of people.
- Inform the press about the nature and seriousness of the fire to avoid false propaganda.
- Intimate concerned authorities about the situation.
- Obtain supplementary equipment/ materials for crisis control from other places if required.

7.3 Mangrove conservation

The project is located on the sea shore the nearest mangrove has been identified at the distance of 8.08 km within the impact zone of the proposed plant. Hence, it is planned to identify the area and density in association with forest department for inter plantation for the mangroves are considered as carbon sink. This goal will be achieved after estimating the carbon foot print of the proposed plant. The inter plantation will be reducing the carbon print to the extent of two times of the source.

7.4 Socio-economic environment

The study area falls in the district Thoothukudi, Tamil Nadu. This section describes the socio-economic environment of the district as well as details of the socio-economic profile of the villages that is falling in the study area based upon the secondary information available for these villages.

District profile

The Thoothukudi district is traditionally known as “Pearl City” on account of the Pearl fishery of this coastal belt. On 20th, October 1986, Thoothukkudi district was carved out of the erstwhile Thirunelveli district and named after V.O. Chidambaranar, a great national leader hailing from Ottapidaram who led the Swadeshi Movement in the south.

Thoothukkudi district lies in the southern part of the Indian subcontinent. According to Census 2011, the district is divided into 3 revenue divisions as Thoothukkudi, Tiruchendur and Kovilpatti. The district has 12 Community Development Blocks consisting of 403 Village Panchayats. There are 8 Taluks and 439 revenue villages (as per census 2011), out of these 432 villages are inhabited. But, as per updated information mentioned on the district official website (https://thoothukudi.nic.in/about-district/district-profile/) and district Statistical Handbook (2016-17), now the district has 10 Taluks comprising of 480 revenue villages.

The district constitutes urban units with one Municipal Corporation, two Municipalities (Kovilpatti and Kayalpattinam), 19 Town Panchayats and 13 Census Towns in the district. Total population of the district is 17,50,176 with a share of 49.90% rural and 50.10% urban population. Out of the total population in the district, 49.42% are males and 50.58% are females. The population density in terms of person per sq. km in the district is 369 with the sex ratio of 1023 females per 1000 males which is higher than the state sex ratio i.e., 996.

The share of ST and SC population in the Thoothukudi district is only 0.28% and 19.88%, respectively of the total population in the district. The literacy rate in the district is 86.16% which is higher as compared to state’s 80.09% literacy rate. There is a gap of 9.81% between male and female literacy rate in the district while in the state overall gender gap in literacy rate is 13.33%. The gender gap of male literacy to female literacy has come down from 13.2 in 2001 to 9.81 in 2011, revealing the narrowing of gender inequality in the district.

Narrowing the gender gap in education at the high school and higher secondary levels calls for a multipronged strategy that includes: (a) educating parents about the economic and social benefits of girls’ education, (b) lowering the opportunity cost of girls’ education, (c) free education, (d) providing scholarships to girls to encourage them to continue in secondary school, (e) provision of school uniforms, (f) providing day care facilities to look after the young ones, (g) involving the community in planning and development of education, (h) making the curriculum more gender sensitive and (i) recruiting more female teachers.

The per capita income (Rs.74,933) of the district is high comparable with that of the state (Rs.63,996) during 2011-12 at constant prices. A majority of the people of the district are dependent on agriculture, textiles, industries and fishing for their survival.

The district also occupies the first place in salt production in the State. It is proposed to establish cottage-based industries since the district has Palmyra and coconut trees to promote rural economies. Another major uniqueness of the district is having major port “Thoothukudi port”.

The district also has a large number of textile units to provide employment opportunities for rural and urban population. According to the recent data, 367387 (69.74%) of the households are employed under MGNREGS in Thoothukudi district.

The district's average below poverty line families are 18.33% during 2013-14. Thus, about 4,65,845 households are entitled to make use of ration cards to buy essential commodities at subsidized prices. Thoothukudi district had a lower life expectancy when compared to the Tamil Nadu and currently it stands at 71.8 for females against 68.6 for males during 2013-1440.

As on 01/04/2021, almost 77.98% rural habitations are fully covered in the district with drinking water supply, however about 20.99% rural habitations are partially covered, as per Tamil Nadu Water Supply and Drainage Board.

The Government of India is assisting the States in providing Water Supply to the rural areas through the Centrally Sponsored Scheme of National Rural Drinking Water Programme from 2009 onwards.

Prior to 2009, the Assistance to States was through Accelerated Rural Water Supply Programme. In 12th plan period, the Government of India enhanced the rural drinking water supply per capita norms from 40 LPCD to 55 LPCD with a view to increase house hold tap connections.

The Newly formed Ministry of Jal Shakthi is committed to provide piped water supply to all rural households with a focus on community managed ground water schemes wherever possible with emphasis on source sustainability through ground water recharge and waste water reuse. **A comparison between district profile and state profile is given in Table.7.4.**

Table 7-4 District profile of Tuticorin District

No.	Indicator/Parameter	Thoothukudi	Tamil Nadu
1	Total Population	17,50,176	72,147,030
1 (a)	Rural Population (%)	49.90	51.60
1 (b)	Urban Population (%)	50.10	48.40
1 (c)	Male (%)	49.42	50.09
1 (d)	Female (%)	50.58	49.91
1 (e)	Sex ratio	1023	996
2	SC Population (%)	19.88	20.01
3	ST Population (%)	0.28	1.10
4	Literacy rate (%)	86.16	80.09
4 (a)	Male Literacy Rate (%)	91.14	86.77
4 (b)	Female Literacy rate (%)	81.33	73.44
4 (c)	Gender Gap in Literacy rate (%)	9.81	13.33
5	Infant Mortality Rate (per 1000); (2016-17)	7.6	16
6	Maternal Mortality rate	105.8	68
7	Life Expectancy Rate at Birth (2013-14)	71.8	70.6

8	Per Capita Income at Constant Price (in Rs).	74933	63996
9	% BPL HH (2013-14)	18.33	-
10	Work Participation Rate	42.74	45.6
10 (a)	Work Participation Rate (Male)	58.23	59.3
10 (b)	Work Participation Rate (Female)	27.61	31.8
11	Total workers (Main + Marginal)	7,48,095	3,28,84,681
11 (a)	Main Workers (% to the Total Workers)	87.88	84.97
11 (b)	Marginal Workers (% to the Total Workers)	12.12	15.03
11 (c)	Cultivators (% to the Total Workers)	6.49	12.92
11 (d)	Agricultural Labourers (% to the Total Workers)	26.82	29.92
11 (e)	Household Industrial Workers (% to the Total Workers)	3.06	4.15
11 (f)	Other workers (% to the total workers)	63.64	53.72
12	Drinking Water Supply- as per TWAD Board (as on 01/04/21) Fully Covered Rural Habitation (%) Partially Covered Rural Habitation (%)		77.98 20.99%

7.4.1 Socio-Economic profile of study area

The socio-economic profile of the study area is based upon the Census of India 2011 as well as the primary sample survey conducted in the sample villages. For the baseline socio-economic study, the study area considered is 10 km radius around the proposed project site location. The villages/habitations within the periphery of 10 km radius from the project site were considered for the study.

The study area comprises of 86 villages/habitations including two urban areas Udangudi and Tiruchendur as town panchayats spread across Tiruchendur Taluk of Thoothukudi district. The project area villages/habitations are given in the **Table.7.5.**

Table 7-5 Villages/habitations in the study area

District: Thoothukudi Taluk: Tiruchendur			
S. No.	**Village /Habitation**	**S. No.**	**Village/Habitation**
1.	Kallamoli	45.	Jerusalem
2.	Kulasekarapattinam	46.	Kandasamypuram
3.	Athiyakurichi	47.	Nathan kinaru
4.	Manaduthandupathu/ Thandupathu	48.	Kayamozhi
5.	Nainarpathu	49.	Therikudiyiruppu
6.	Ammanpuram	50.	Elluvilai
7.	Shirgaj/Sirkatchi	51.	Seerudaiyarpuram
8.	Arnaghudi	52.	Gurunathapuram
9.	Theyagarajapuram	53.	Sundarapuram
10.	Chidambarapuram	54.	Mannadu/Manadi

11.	Udangudi (Town Panchayat)	55.	Megnanapuram
12.	Manapad	56.	Valliammalpuram
13.	Sirunadarkudieruppu	57.	Pudukudiyeatru
14.	Alanthali	58.	Moolaipozhi
15.	Pitchivilai	59.	Alagappuram
16.	Perumal puram	60.	Suganagaram
17.	Vellalanvilai	61.	Marakkudi
18.	Semmarikulam	62.	Veppankadu
19.	Pllilari	63.	Uthiramadankudiyiruppu
20.	Thazhaivilai	64.	Piraikudiyeruppu
21.	Vathiyarkudieruppu	65.	Venkatramanujapuram
22.	Paramankurichi	66.	Sathyanahar
23.	Ambedkar nagar	67.	Elanganathapuram
24.	Nadunalumoolaikinaru	68.	Nangaimozhi
25.	Mela Thiruchendur	69.	Lakshmipuram
26.	Kottankadu	70.	Anaiyur
27.	Thethapuram	71.	Yellur
28.	Periyakandanvadali	72.	Kuthiraimozhi
29.	Chettiyapathu	73.	Kathapuram
30.	Chivulur	74.	Philominagar
31.	Satharakonevilai	75.	Koilvilai
32.	Subramanipuram	76.	Ranimaharajapuram
33.	Anddasinpuram	77.	Vannimanagaram
34.	Kanthasamypuram	78.	Villavalli
35.	Ganeshapuram	79.	Nadaner
36.	Soosaikudiyruppu	80.	Adaikkalapuram
37.	Tiruchendur (Town panchayat)	81.	Mardutkarai
38.	Amlipuram	82.	Pallakuruchi
39.	Thoppur	83.	Sundankottai
40.	Kumarapuram	84.	Plimanthan
41.	Virapandianpattinam	85.	Azhagamman puram
42.	Pallipathu	86.	Padakpatti
43.	Manakkadu		
44.	Anaithalai		

7.4.1.1 Study area

The total population of the study area is 1,22,038 belonging to 30,866 households with an average family size of four. About 20.18% households are headed by women. Out of total population in the study area, 48.93% are males and 51.07% are females. The overall sex ratio in the study area is 1044 females per 1,000 males. Child Population (0-6 age group) in the study area has been worked out to 10.06% of the total population of study area. Of the total child population, 50.61% are boys and 49.39% are girl child. The child sex ratio in this age group is 976 girls per 1,000 boys. The total Scheduled Tribes population in the study area is worked out to be only 0.20% of the total population. Out of these, 50.61% are male and 49.39% are female. The sex ratio among the Scheduled

Tribe population is 976. The share of Scheduled Castes population to the total population is estimated about 15.24%. Out of this, 49.17% are male and remaining 50.83% are female. The sex ratio among the Scheduled Caste population is 1034 females per 1,000 males.

Table 7-6 Study area

S. No.	Indicator	Value	Respective %
1	No. of Household	30866	-
	Average household size	4	-
2	Male	59715	48.93
	Female	62323	51.07
	Sex ratio	1044	
3	Child population (0-6 Age Group)	12280	10.06
4	SC	18595	15.24
	Sex ratio in SC Community	1034	
5	ST	247	0.20
	Sex ratio in ST Community	976	
6	No. of Households < Rs. 5000 monthly income (%)	77.20	
7	Female headed households (%)	20.18	

7.4.1.2 Literacy

Literacy is an important demographic element and it is a good measure of human progress. It is essential for social reconstruction, improvement in quality of life and preparation of manpower for rapid development.

Literacy is also a foundation for individual and societal development and plays an important role in poverty reduction. In this regard, literacy promotion is not only at the heart of Education for All movement (EFA) and United Nations Literacy Decade (UNLD), but also supports the achievement of other related international initiatives including United Nations Education for Sustainable Development (UNESD) and Sustainable Development Goals (SDG-4).

In the study area 81.67% of population is literate, out of that 50.20% are male literates and 49.80% are female literates. The overall literacy rate in the study area has been worked out to 90.81% which is more than the district literacy rate (86.16%). The male literacy rate in the study area is 93.52% and female literacy rate is 88.23%, creating a gender gap in literacy rate of 5.29%.

7.4.1.3 Workers and work participation rate

The total working population constitutes 36.90% of the total population of the study area. Out of the total working population, 75.46% are males and 24.54% are females. The gender gap in work participation rate is significantly high with 50.92%. Similarly, this gap is also very significant in all segments of work force like agricultural, household industrial or any other works which is indicating that female work participation needs to be improved.

Of the total working population in the area, 90.56% are main workers and remaining 9.44% are marginal workers. Of the total main workers, 77.96% are male and 22.04% are female which creates a gender gap in work participation of 55.92% among the main work force.

In the case of marginal workers, 51.51% are male and 48.49% are female that creates a very nominal gender gap of 3.02% in this segment of work participation.

Out of the total work force in the study area, only 18.72% workers are engaged in Agricultural activities. Out of this, 21.55% are cultivators and 78.45% are agricultural labours, Household Industrial Workers are 4.89% and remaining 76.39% are 'Other Workers'.

Table 7-7 Work force distribution in the study area

Description	Number	Respective %	Description	Number	Respective %
Total Workers	45032	-	Cultivators	1817	21.55
Male	33982	75.46	Male	1514	83.32
Female	11050	24.54	Female	303	16.68
Main workers	40780	90.56	Agricultural Labors	6613	78.45
Male	31792	77.96	Male	4339	65.61
Female	8988	22.04	Female	2274	34.39
Marginal workers	4252	9.44	Others	34402	76.39
Male	2190	51.51	Male	27414	79.69
Female	2062	48.49	Female	6988	20.31
Agricultural workers	8430	18.72			
Male	5853	69.43			
Female	2577	30.57			

The people of study area are mostly engaged in agriculture & allied activities, construction activities and other industries outside of Thoothukudi. In the coastal zone villages, the main source of livelihood is fishing & allied activities. Details of fishermen community in the study area is presented in **Table.7.8 & Table.7.9.**

Table 7-8 Population details of fisher folk in the study area

S.No.	Name of Village	Fishermen Families	Traditional Fishermen Families	Below Poverty line Families (BPL Families)	Fisher-folk Population
1.	Alanthalai	616	615	286	2576
2.	Amalinagar	464	464	464	2106
3.	Kallamoli	-	-	-	-
4.	Kulasekharapatnam	198	153	198	818

5.	Manapad	1125	1125	665	4536
6.	Veerapandipatnam	502	462	42	2023

Table 7-9 Active fisher folk in different sections of employment in fishing and allied activities

S. No.	Name of Village	Active fisher folk	Fish Marketing	Making/ Repairing Nets	Curing/ Processing	Peeling	Labourer	Others	Other than fishing	Total occupied
1.	Alanthalai	639	88	24	23	0	3	10	3	790
2.	Amalinagar	535	58	14	0	1	21	8	3	640
3.	Kallamoli	-								
4.	Kulasekharapatnam	216	11	1	0	0	0	0	5	233
5.	Manapad	1333	57	0	3	0	2	80	0	1475
6.	Veerapandipatnam	451	40	5	110	9	16	28	13	672

7.4.1.4 Amenities and Infrastructure

Educational Institutions: Expanding access to education, especially at lower levels, is a common objective of governments in developing countries, and it has met with considerable success over the last two decades. As per census 2011 record, in the study area there are numerous educational institutions functioning including Pre-Primary Schools, Primary Schools, Middle Schools, Secondary Schools, Senior Secondary Schools. The Degree Colleges for pursuing higher education in Art, Science & Commerce subjects, Engineering College and Management Institute are available at Tiruchendur.

Table 7-10 Educational Institutions in the study area

S.No.	Educational Institutions	Number
1	Pre-primary school	73
2	Primary school	132
3	Middle school	53
4	Secondary school	22
5	Senior Secondary School	14
6	Degree College- Arts & Science	01
7	Degree College- Art, Science & Commerce	01
8	Engineering College	01
9	Management Institute	01

Health Institutions: For the access to health services in the study area, there are various health institutions functioning as given in the **Table.7.11.**

Table 7-11 Health Institutions

S. No.	Health facilities & Institutions
1	Community Health Centre
2	Primary Health Centre
3	Primary Health Sub-Centre
4	Maternity and Child Welfare Centre
5	Maternity Home
6	TB Clinic
7	Hospital (Allopathic)
8	Hospital (Alternative Medicine)
9	Dispensary
10	Hospital (Veterinary)
11	Family Welfare Centre
12	Mobile Medical Unit

In the study area Mobile Medical Units have been provided under the control of the PHC Patient Welfare Societies. Services rendered by Mobile Medical Units; especially routine immunization/dropout immunization are being strictly monitored. The other routine services (Ante Natal Care, Post Natal Care, Family Welfare Services, Lab Services, Adolescent Care, Referral Services and Counselling Services) rendered by the MMU team are linked with the Village Health and Nutrition (VHN). For drinking water tube well/bore well, tap water and hand pumps are the main sources in the area. Most of the villages use treated water supply. For enhancement in water supply to enhancing the Sustainability of the drinking water sources, recharge structures like Check Dam, Percolation Pond, Defunct Bore Well Recharge, Recharge Shaft, etc., are being implemented in the district and study area as well by the Tamil Nadu Water Supply and Drainage Board (TWAD Board) under various State and Central Government assistance. The majority of the villages/habitations have the power supply for domestic uses with sufficient amount. The study area is facilitated with a good network of approach roads like black topped road as well as reinforced cement concrete road, gravel and all-weather Road.

Projected population till 2024

The district population growth rate is 3% Which is used for projecting the population within the study area of 10 km radius. The projected population for 2024 study area is 1,40,279 (13%).

8 PROJECT BENEFITS

8.1 General

The ongoing 2 X 660 MW Power plant will result in improvement of infrastructure as well as up-liftment of social infrastructure in the area. The people residing in the nearby areas will be benefited directly and indirectly through employment opportunities likely to arise due to the project. It will also help in sustainable development of this area including development of physical Infrastructural facilities such as road transport facilities, educational facilities and water supply and sanitation. It is anticipated that the ongoing power plant will provide benefits to the locals in two phases i.e. during construction phase as well as during the operational stage of the plant.

8.2 Community services

TNPGCL (TANGEDCO) will employ local people to the extent possible to avoid creation of additional infrastructure. TNPGCL (TANGEDCO) had developed medical facilities for catering to the needs of the project personnel. These facilities are extended to the local community in due course. It is proposed to realign the Ellappanaikan tank surplus course which will benefit the local people to store the water.

8.3 Improvement in Social Infrastructure

The ongoing project will lead to indirect employment opportunities. Employment is expected during civil construction period, in trade, garbage lifting, sanitation, afforestation works and other ancillary services. Employment in these sectors will be primarily temporary or contractual and involvement of unskilled labour will be more. A major part of this labour force will be mainly from local villagers who are expected to engage themselves both in Fishing, Agriculture and project activities. This will enhance their income and lead to overall economic growth of the area. The project will have a strong positive employment and income effect, both direct as well as indirect because of better indirect employment opportunities due to this project. The project will have a positive impact on consumption behaviour by way of raising average consumption and income through multiplier effect. People perceive that the project will help in the development of social infrastructures such as.

- Education facilities
- Banking facilities
- Post offices and Communication facilities
- Medical facilities
- Recreation facilities
- Business establishments
- Community facilities
- Transportation

There will also be a small increase in the vehicular traffic due to passenger transport. This increase in traffic will not have any consequence to warrant special mention. One should expect that the increased passenger load in the sector would prompt the state government to start new and frequent public transport services to this area, bringing upliftment to the whole locality.

The ongoing project is planned to identify the area and density in association with forest department for inter plantation for the mangroves are considered as carbon sink. This

goal will be achieved after estimating the carbon foot print of the proposed plant. The inter plantation will be reducing the carbon print to the extent of two times of the source.

8.4 Other tangible benefits

The capital cost of the project is estimated to be Rs. 13076.705 Crore. As the project is a greenfield project about 0.25% of the cost is to be spent towards CER activity as per OM F.No. 22-65/2017-IA. III dated. 1st May,2018. Accordingly, the ongoing project authority planned to spend Rs.32.694 Crore. This amount will be spent for the development of local people within the impact area of 10 km radius from the project site. During 2018 to 2020, Rs. 10.843 Crore was spent on equipment purchase/ repair/ alteration in government hospitals, construction of fish landing center and temporary protection of sea erosion, etc.

The CER initiatives of TANGEDCO have been prioritized on local needs, which focus on Health, Education, Sustainable Livelihood, Social Mobilization, Infrastructure Development, Water Harvesting, Agriculture and Environment Conservation.

Table 8-1 CER Expenditure

Sl. No	Activities under CER	Total Projection 2024-27 (Rs in Crore)	Cash Flow- Half Yearly Plan in Crore		
			FY 2024-25	FY 2025-26	FY 2026-27
1	Education in Government Schools in nearby villages	10.925	3.64	3.64	3.64
2	Solar power to nearby villages	5	2	2	1
3	Health in Government hospitals in nearby villages	2	0.5	0.5	1
4	provisions OM No. 22-65/2017-IA.III dated 30.09.2020 for public hearing related issues including Fishermen welfare fund	3.92	-	-	-
CER amount spent till date			Rs. 10.843 crore		

9 Environmental Cost Benefit Analysis

9.1 General

Environmental Cost Benefit analysis is not applicable for this project. However, this chapter provides the information regarding the capital cost of the project and expenditure for the implementation of environmental mitigation measures. The cost envisaged for pollution control is included in the capital cost. Cost towards environmental monitoring facilities additionally included. In the analysis of capital cost, recurring cost is also included to know the yearly expenditure. Other features like bag filters, ETP, STP are included in the analysis. Expenditure towards environmental monitoring and environmental monitoring plan is detailed in **Table 9.1.**

9.2 Project cost

The estimated project cost is Rs. 13,076.705 Crore. A good fraction of project cost is earmarked towards pollution control measures. **Table 9.1** gives the breakup of the cost for various control measures.

- Likewise, the costs of fire protection and physical protection measures are not considered, although there may be secondary environmental consequences due to fire or security lapses
- The estimate of recurring cost includes only the revenue expenses for operating the respective facilities. The salary of staff and capital depreciation are not included.

9.3 Budgetary provisions for environmental control

The updated capital cost for the environmental facilities for ongoing project works out to Rs.1287 Crore including CER amount of 32.694 Crore.

Table 9-1 Cost of Environmental Management Plan

Sl. No	Particulars	Capital Cost (Rs. in Crores)	Recurring Cost (Rs. in Crores)
1	Air i) ESP ii) Dust Suppression system for coal handling area iii) Dry fog system iv) Crushing and Transfer tower areas	 60.00 3.00 1.0 0.5	 12.00 0.60 0.2 0.2
	FGD	900.00	2.0
2	RCC Chimney	60.00	6.00
3	Cooling towers	60.00	6.00
4	Bottom ash and fly ash collection, storage and disposal system	160.00	16.00
5	ETP & STP	3.00	0.30
6	Greenbelt development	1.00	0.50
7	Pollution monitoring instrument / equipment	3.00	0.20
8	Outfall arrangements	120	2

9	Energy conservation measures i) Solar panel	3.6	0.5
10	Solid waste management (including OWC)	0.2	0.05
10	Others (Socioeconomic development) i. Occupational health & services (for establishment of PHC at site) ii. To address public hearing issues (to be decided after consultation)	37.00 2.00	7.30 1
11	CER cost	32.694	-
	Total	**1287**	**54.85**

10 ENVIRONMENTAL MANAGEMENT PLAN

10.1 General

M/s. TNPGCL (TANGEDCO) is committed to act as a responsible corporate and is steadfast towards protection of environment and the community. TNPGCL (TANGEDCO) has consecrate to employ best environmental management practices, regular maintenance and keep track record consistent in operation of pollution control systems, effluent treatment plants, recycling of solid wastes and adoption of cleaner and environment friendly technologies etc. The concerted efforts implemented earlier and also proposed through an Environmental Management System (EMS) are expected to result in resource conservation, waste reduction as well as to increase in the green cover.

The Corporate Environmental Policy of TNPGCL (TANGEDCO) emphasizes "adopting environmental management system and continual improvement in environmental quality by applying best available practices".

The importance of environmental control has been recognized by of TNPGCL (TANGEDCO) and it has taken necessary steps to identify and control pollution in the plant, and also in the peripheral areas. TNPGCL (TANGEDCO) has also implemented Environmental Management System (EMS).

Environment management has been considered as one of thrust areas of operation. A three-tier strategy has been adopted and they are as follows:

- Developing a well-organized monitoring/analysis and inspection setup
- Adopting best environmental management practices in all its operation
- Contributing to regional development in terms of social capital building, infrastructural development, catering to immediate and long terms primary needs of local inhabitants (medical, secondary and direct employment, boosting local activities and protecting ethnic culture)

In line with TNPGCL (TANGEDCO) commitment for environmental protection, the project strives
to:

- Conduct processing operation in compliance with relevant environmental legislations and regulations.
- Employ best management practices and environment control for sustainable development of the region
- Consider regional carrying capacity in resource and pollution discharge related decisions and give emphasis to conserve energy and other natural resources and minimize waste generation
- Periodic pollution monitoring to review performance of pollution abatement measures and reporting the same to statutory agencies
- Modernization of occupational health set up facility including regular health monitoring of employees and villagers in the vicinity of the project.
- Strengthen the safety management strategy. Prepare emergency/disaster control plan and a properly trained group to meet the emergency situations
- Green belt development in and around the project site.

- Involvement in area development activities and inviting people's participation in area development projects. Increase awareness in employees and villagers towards environmental preservation
- R & D activities with regard to specific pollution problems.
- Periodical review of the system for continual improvement.

10.2 Organizational setup

10.2.1 Environmental monitoring cell

A separate environmental management cell will be established to implement the management plan. The group will be headed by a Chief Engineer (O & M). The group will ensure the suitability, adequacy and effectiveness of the Environment Management Program. The functions of Environmental Management Cell will be as follows:

- Obtaining consent order from State Pollution Control Board.
- Environmental monitoring, like collection and analysis of air, water and soil samples.
- Analysis of environmental data, reports, preparations and transmission of report to statutory authorities, Corporate Centre etc.
- Implementing the control and protective measures.
- Collecting statistics of health of workers and population of the surrounding villages.
- Green belt development.
- Co-ordinate with statutory bodies, functional groups of the station, head office etc.
- Interactions for evolving and implementation of modification programs to improve the availability/ efficiency of pollution control devices / systems.
- Environmental Appraisal (Internal) and Environmental Audit.

Divisional Engineer (Environment) will be directly responsible for Environmental Management of the proposed station and report to the Chief Engineer (O&M), head of the plant. The Divisional Engineer (Environment) should have at least 10 years of experience in the Environmental Management will be entrusted the Environmental Management of the station.

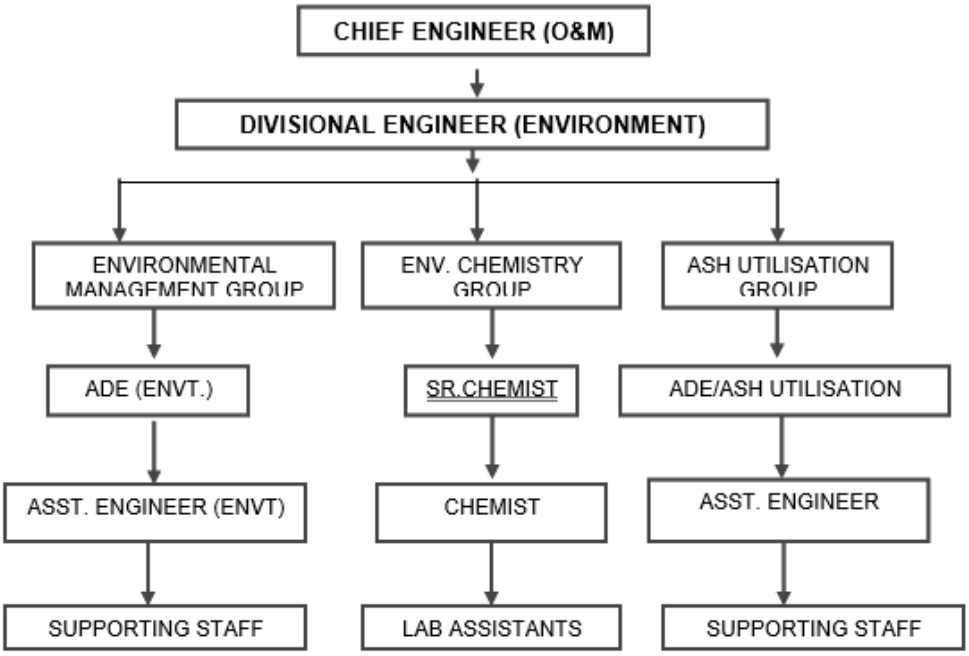


Figure 10-1 Organizational Setup of Environmental Management

10.2.2 Quality control department

Quality Control Department is responsible for quality assessment for product and raw materials. Quality assessment of raw water and waste water is carried out by quality control office in association with EMC. In addition to above, services of external agencies are also taken on periodical basis to carry out the necessary monitoring work. Casual laborers etc. are employed for plantation, drain cleaning etc. as and when required. Services of recognized laboratories for sampling and monitoring the effluent quality and emission are availed.

Environmental impact register has been prepared for various activities of processing plant. Operation Control Procedure (OCP) is available for various environmental aspects to control the pollution.

The various Standard Operating Procedures (SOPs) are:

1. Dust control procedure
2. Noise control procedure
3. Sewage treatment procedure, Effluent treatment procedure
4. Solid waste management
5. Procedure for e- waste, hazardous waste.
6. Fire-fighting procedure

10.2.3 Plant safety committee

Dedicated safety committee for plant will be joined at TNPGCL (TANGEDCO). The safety committee looks after and reviews the safety aspect of the operations involved in production. The safety committee comprises of engineers, medical officer, environmental engineer, workmen, occupational health in- charge etc. The committee reviews the safety aspect of the operations periodically and the minutes of the meeting is communicated to

higher management. The recommendations of the committee as well as corrective actions are implemented.

10.2.4 Activities under EMS

A surveillance for environmental parameters is carried out under EMC in TNPGCL (TANGEDCO). Guidelines of TNSPCB, MOEF&CC, are being followed. EMC carry out monitoring of all relevant parameters of industrial hygiene significance for in-plant, and for surrounding natural environment. The monitoring data generated on routine basis serve as tools for assessment and control of in-plant operations impact; and to ensure environmental protection and to demonstrate the regulatory compliance as and when required. The basis of control measures to be adopted is inline with recommendations of national agencies.

Activities of environmental management cell are:

1. Emission from the stack-online monitoring
2. Water quality monitoring for WTP, ETP and STP
3. Ambient Air Quality monitoring
4. Soil quality monitoring
5. Rainwater harvesting monitoring
6. Groundwater monitoring
7. Plantation and greenbelt development
8. Occupational health & safety surveillance
9. Socio-economic development
10. Implementation of various regulatory guidelines

The details of monitoring programme are covered in Chapter -06

10.2.5 Reporting procedure

A built-in mechanism for reporting on compliance of the environmental and other related aspects has been evolved. As per guidelines of MoEF &CC, all the Environment Clearances and status of their compliances are shown on the website of the company regularly. Periodic auditing and performance measurement is also taken up to look for improvement.

The EMC is headed by a Plant Head. In his day to day work, the plant head is assisted by chemists, laboratory assistants and other staff. Services of forest officials are also taken for effective implementation of plantation schemes. For development and maintenance of jobs like drainage, clearing settling pits etc. assistance from the plant's civil engineering department is taken. The officers of the department meet frequently to assess the progress and analyses the data collected during the preceding fortnight/month. Total manpower of EMC is shown in **Table 10.1.**

Table 10-1 Manpower of EMC

Description	Nos.
Deputy Chemist	1
Chemists for Sample analysis	16
Technicians	18
Assistants	6
Total	41

10.2.6 Duties of EMC

In order to carry out environmental monitoring, EMC performs following functions:

- The EMC oversees the implementation of environmental control measures as per approved EC and consent.
- Plan for conservation of water and energy
- Identify and record the constraints in respect of environmental planning and implementation
- Systematically document and maintain records w.r.t environmental issues
- Working of environmental engineering laboratory
- Field monitoring and laboratory analysis
- Monitoring of green belt and plantation development
- Compliance of environmental regulations and specific stipulations of regulatory authorities
- Communication with concerned department (of the plant) on environmental issues. The same are also discussed with the top management of the company.
- Interaction and liaison with State/Central government departments / agencies.

The EMC has also a well-equipped laboratory to undertake routine environmental monitoring. Environmental Survey Laboratory of TNPGCL (TANGEDCO) is in charge of carrying out all surrounding monitoring covering background levels in air, water, soil, agricultural produce. The data of EMC will be shared with plant head for corrective measures if any.

10.2.7 Occupational health center

Functions of the Occupational Health Centre, M/S. TNPGCL (TANGEDCO)

- Daily OPD (outdoor patient Department) cases of company employees as well as contractual workers.
- IPD (indoor patient department) cases of company employees and contractual workers as and when required.
- Emergency treatment of patients in case of chemical burns, gas inhalation, ingestion of chemical, mechanical injuries like head injury and fracture.
- First aid treatment in case of minor abrasion, contused lacerated wound, etc. Referral services to higher centre as and when required.
- Pre-employment medical examination of all the employees before their joining to decide their fitness and to decide their placement in various plants.
- Periodical medical examination every 6 monthly for all the employees.
- Maintenance of form no. 33 after pre-employment medical examination.
- Maintenance of form no. 32 after periodical medical examination
- Placement and maintenance of first aid boxes to the various departments in the company. First aid boxes are checked twice in a month and replenished with the materials needed.
- Preparation of injury report on daily basis.
- First aid training to the company employees.
- Preparations of monthly report and annual reports describing injuries and sickness.
- Oxygen cylinder refilling and maintenance.
- Ambulance daily test round and daily checking as per our check list.

- Canteen worker's personal hygiene checkup twice in a month.
- Contractual worker's pre-employment physical check-up on daily basis.
- Medicine consumption and keeping record of the same, daily basis and monthly.
- OHC equipment check list as per our SOP.
- Autoclaving of dressing material to sterilize it.
- Segregation and proper disposal of biomedical waste with Globe bio care institute.
- Instrument calibration once yearly.
- Maintenance of clean OHC and beds and linen washing.
- Division of all the work among all four full time medical assistants.
- Blood donation camp, eye checkup camp arrangements at OHC.

Pre-Medical/Periodical Medical Examination

Pre-Medical/Periodical medical examination of worker exposed and other staff members is being carried out at regular intervals.

Pre-Employment Screening / Examinations - All employees will be subjected to pre-placement medical examinations to determine their fitness for the jobs on site. Potential exposures to the work environment will be considered before placing an employee on the job.

Periodic Medical Examinations - Periodic medical examination is the same as the pre-employment screening and may be modified according to current conditions, such as changes in the employee's symptoms, site hazards or exposures. However, List of tests is proposed to done during half yearly employee check-up: -

a. Height
b. Weight
c. Audiometry
d. ECG
e. Eye Vision
f. Complete Blood Count (26 parameters)
g. Pulmonary function testing
h. Blood Sugar
i. Blood pressure
j. Urine Routine & Microscopy

TANGEDCO will allocate Rs.5.0 Lakhs per month for the purpose of occupational, health and safety for the employees.

First aid Boxes

A first aid kit is a collection of supplies and equipment for use in giving first aid. First Aid boxes will be kept available in Admin Block and Production area etc. First Aid items will be issued to injure only by authorized persons.

Following are the contents of First Aid Box,

- Dettol – Antiseptic solution
- Ciplox – Eye Drops
- Soframycin – Skin ointment

- Silverex – Burn ointment
- Betadine – Microbicidal solution
- Iodex – Pain reliever
- Sterilized Cotton Wool
- Surgical Paper Tape
- Small Sterilized Dressings
- Medium Sterilized Dressings
- Roller Bandage – 5 cm wide
- Roller Bandage – 10cm wide
- Band Aid
- Crocin / Paracetamol Tablet

10.2.8 Occupational health monitoring

Medical Surveillance Program: Medical surveillance program is essential to assess and monitor employees' health and fitness both prior to employment and during the course of work; to determine fitness for duty and to provide emergency and other treatment as needed. Effectiveness of a medical program depends on active involvement of employees. TNPGCL (TANGEDCO)Limited medical surveillance program will include the following major elements;

- Developing an OH-IH Medical Surveillance Program.
- Pre-Employment Examination and Periodic Medical Examinations
- Determination of Fitness for Duty.
- Communications.
- Emergency Medical Treatment.
- Medical Records.

Implementation of OHS Standards as per OSHAS

The overall objective of the company is to provide a system that is capable of delivering healthy and safe workplace. Following measures have been adopted for implementation of OHS standards:

- Well-equipped Occupational Health Centre with adequate paramedical staff.
- Routine and special investigation related to occupational health.
- Health surveillance and maintenance of health record.
- Rules and procedure for effective implementation of Safety Health and Environment policy and made to know all employees.
- Round the clock Ambulance facility.
- Sufficient number of First aid boxes.
- Implementation of OHSAS 18001 for Occupational Health and Safety Management System.
- Implementation of ISO 14001 for Environment Management System.
- Risk assessment of each and every activity.
- Implementation of OHS management program.
- Training, awareness program and work place talk.

Personnel Protective Equipment

M/s. TNPGCL (TANGEDCO) will provide full range of Personnel Protective equipments to its workers for their safety. A complete list of Personnel Protective equipments has been listed below:

List of Personnel Protective Equipments

Boiler operation: Cotton type retardant suit, IR resistant goggles, helmet, safety shoes and cotton gloves.

Electrical Work Area (MCC and PCC):433 V to 22 kVA electrical resistance gloves, Electrical safety shoes (without metal toe guard) and helmet and electrical gloves. Tested date and due dates should be marked legibly.

Working at Height: Personal fall protection (i.e. Full body harness), helmet and Safety shoes.

Safety Equipment

- Safety Helmets
- Safety Hand Gloves – PVC, Rubber Cotton, Cum, Leather Asbestos
- Safety Goggles - Spectacle Type, Panoramic Type
- Face Shield
- Aprons – PVC, Cotton
- PVC Suits
- Safety Gum Boots
- Self-Contained Breathing Apparatus
- Gas mask with canister
- Safety emergency
- Fire extinguishers
- Fire hoses with branches
- Explosive meter
- Gas detection devices
- Resuscitator
- Portable mike
- First aid box
- Emergency siren switch
- Telephone- P&T intercom Personal protective equipment (PPE) will be provided during operation as per norms Spill Emergency Mitigation Procedure
- Spill Kit is kept in all Emergency cupboards.
- Once the spill is observed, Spill Kit shall be collected from the nearest area/emergency cupboard installed and neutralizing agent (if required) based on the nature of the spill.

In case if the spill is not controlled, immediately declare the emergency as per emergency response procedure.

- While handling the spill, use most appropriate PPE's like SCBA, chemical suit, acid/ alkali proof hand gloves, face shield, safety goggles, gum boots or even respiratory masks with suitable cartridges.

- Once the spill is controlled using Sorbent pad/Boom collect in a double polythene bag and secure with the plastic ties. Dispose it as per applicable disposal procedure.
- Report the incident of spill to EHS department through online incident reporting System.
- Once in a month, the items of the Spill Kit shall be inspected and recorded by EHS representatives of the individual area.

10.2.9 Industrial/Occupational Health Monitoring

- The workers exposed to noisy sources will be provided with ear muffs/plugs.
- Adequate facilities for drinking water and toilets will be provided to the employees.
- The health of the workers will be regularly checked by a qualified Doctor and proper records will be kept for each worker.
- Isolated storage for all hazardous chemicals with adequate safety measures, sign board outside storage etc.
- Good Air circulation will be ensured within the plant area.
- Hand wash will be provided in vicinity of work area with ample quantity of water available.
- Proper First Aid centre and medical facilities will be provided.

10.2.10 Work Zone Monitoring Equipment

The unit will install the ambient air monitoring kit all over the facility for regular monitoring and these will provide the alarm once the set level is crossed. Same will be connected to TNPCB online Monitoring Server (CAC).

10.2.11 Proposed safety system

Fire protection system

The design and installation of complete fire protection system will comply with regulations of Tariff Advisory Committee (TAC) of India. In the absence of TAC regulations, the National Fire Protection Association (NFPA) standard will be adopted. All equipment, special purpose fittings, couplings or accessories will be approved and certified for use in fire fighting system application by TAC / UL / FM.

The Power Plant is classified as Ordinary Hazard Occupancy as per TAC. Hence the entire system will be designed accordingly.

The different types of fire protection/detection system envisaged for the entire power plant are described below.

Fire water pumping system combined for Hydrant system and MVWS system – The fire hydrant and MVW spray system will have a dedicated adequate number of electrical motor driven main fire water pumps (minimum 3 Nos.) and 50%

standby diesel engine driven pumps (minimum 2 Nos.).

Fire water pumping system for HVW Spray system – The spray system will be provided with dedicated pumping system comprising of adequate number of electric motor driven pumps and 100% standby diesel engine driven pumps.

The common pressurization unit will be provided for hydrant and spray water system network. Pressurization unit will consist of Two (2) nos. of electric motor driven fire water jockey pumps (one working + one standby), One (1) no. hydro-pneumatic tank and Two (2) nos. air compressors (one working + one standby) of adequate rating for pressurization of hydro-pneumatic tank will be provided.

Fire water booster pumping system - Dedicated fire water booster pumps comprising of adequate number of electric motor driven main pumps and 100% diesel engine driven standby pumps will be provided for higher elevation of boiler units/transfer towers/bunker floors.

The seawater intake pump house will be provided with one (1) no of Diesel Engine driven vertical turbine pump of capacity 410 m^3/hr for supplying fire water to the coal stockpile area ring main header for fighting large coal stockpile fire. The material of construction for the pumps, piping and isolation gate valves (Duplex stainless steel) will be rated for seawater duty. The sea water fire water pump outlet will be connected to the main fire hydrant network near the coal stockpile through a normally closed isolation (Duplex stainless steel) gate valve.

Hydrant system will be provided for all the buildings, equipments and entire area of inside the power plant boundary including Boiler and ESP Areas, Mill Reject Handling System compressor house, ESP Control Building, Fly ash equipment building, HFO & HSD Pump House Area, HFO & HSD storage tanks and dyke area, Compressor House, Diesel Generator Area, Generator, Station, Unit transformers and all auxiliary Transformers, CW Pump House, Electro chlorination building (CW), Water Pretreatment Plant, Sludge Pump House, Filtered Water Reservoir and Pump House, Sea Water Intake Pump House, DM Plant with acid and alkali bulk storage tanks, Chemical House, Coal Handling Plant and Coal Storage Yards including all transfer points, bunker bay conveyors, sub-stations and control room, office building(Coal handling will include complete ECHS & ICHS) Crusher House, Coal Handling Control Building, Ash Handling Plant Area including Ash Slurry Pump House, Ash Water Pump House, FA Conveying Blower Room, MCC rooms, All storage areas including O & M Store, Effluent treatment Plant, Open Storage Yard, Transformer Yard, GIS Switchyard & Grid Control Room Building, Service Building, Administrative building, CPU Regeneration building, All gate houses, Canteen, Workshop, Chimney area, Diesel filling station, Fire water pump house, Cooling Tower Area, Fire Station, Ash silo area and any other building equipments inside power plant boundary.

High Velocity Water Spray System (HVWS) for Generator transformers, Unit Auxiliary Transformers, Unit Transformers, Station Auxiliary Transformers, Standby/ Maintenance transformers, Bus reactors, CHP auxiliary transformers, AHP auxiliary transformers and Station transformers (All oil filled transformer of rating 10 MVA and above), turbine oil canal pipe lines in main plant, Boiler feed pumps lube oil tanks, coolers, consoles etc, Boiler burner front, main lube oil tank, clean and dirty lube oil tanks, and Generator seal oil system tanks and its coolers.

Water spray system for steam turbine bearing housing and air pre-heaters or any other fire protection system as recommended by equipment supplier.

Nitrogen injection-based fire protection system in addition to automatic high velocity spray system will be provided for transformers of 220Kv or higher voltage.

Medium Velocity Water spray system – Cable gallery/Cable spreader rooms in the whole plant such as main plant area, ESP, AHP, CHP, WTP, CW, Sea water intake, FOPH and Switchyard control building etc, All Coal conveyor gallery in tunnels/underground and above ground, Transfer points, Junction tower and crusher house entire coal handling system of inside the plant boundary, Fuel oil pump house (Unloading and Forwarding pump house), Fuel oil storage tanks and Emergency DG building.

Foam system will comprise of SS foam tank, foam pumps foam inductors, balance proportioners, foam makers with discharge outlets, associated interconnection (SS and GI) piping, valves, fittings, instrumentation etc. for Fuel oil storage tanks.

Portable and mobile fire extinguishers for entire plant buildings, equipment area, entire area.

Fire tenders (One no. water type fire tender and One no. foam tender) with all equipments as per TAC norms with bay to station all fire vehicles.

Two (2 nos.) numbers of fully equipped ambulance (Ventilators, oxygen cylinder, first aid kid, etc.) with all fittings and Fire Jeep.

Fire tenders, Ambulance and Fire Jeep, All the vehicles (5 Nos.) will be registered, permit and tax paid before handing over to TANGEDCO with name transfer.

Clean agent (Automatic inert gas) gas flooding system for Central Control Room, Control Equipment Room, Computer Room and UPS & inverters Room in the TG building.

Fire Detection and Alarm system for all Central Control rooms, Control Equipment Room, battery rooms, all switchgear rooms / MCC rooms, Computer rooms, Cable spreader rooms in whole plant such as main plant area, ESP, AHP, CHP, WTP, CW, Sea water intake, FOPH and Switchyard control building etc, Detection system for various equipments and in other auxiliary buildings cable spreader, MCC room and Control room.

All necessary instruction and warning plates.

All necessary facemasks, fire jackets, breathing and resuscitation apparatus and/or other protection devices for optimal protection of the personnel of fire station equipments. Fire service station with all equipments as per TAC norms with bay to station all fire vehicles

Passive fire protection measures such as fire barriers for cable galleries and shafts etc., fire retardant coatings, fire resistant penetration sealing for all openings in floors, ceilings, walls etc., fire proof doors etc., will be provided to prevent spreading and for containment of fire.

Hydrant System

Hydrant system will consist of a fire water ring main network of piping along with Isolation gate valves installed above ground (on RCC pedestals) around areas to be protected, hydrant valves (external / internal), hoses (15M/7.5M long hoses), hose cabinets, couplings, branch pipe, nozzles and water monitors along with all accessories. All accessories such as MS painted hose boxes etc. will be provided as per TAC. External

hydrants 'Hose houses or hose boxes' will be located all around the periphery of buildings and internal hydrants 'Hose boxes' will be provided at each landing floor of staircases through above ground main. Outdoor type fixed water monitors will be provided for ESP areas, Boiler house, tall buildings, Coal stock pile area, bunker building, junction towers/transfer towers and other areas in the coal conveyors at locations where water cannot reach from hydrant system. When height of structure, tower exceeds 15M, the concerned hydrants will be replaced by water monitors.

High Velocity Water Spray (HVWS) System

HVWS system will be designed as per TAC regulations. HVWS will consist of above ground piping, along with relevant fittings, Deluge valves, Strainers, isolation gate valves, spray nozzles, quartzoid bulb detector and pressure switches. HVWS system will automatically detect, control and extinguish any out-break or fire and simultaneously give audible alarm. This will hydraulically open the deluge valve thus allowing water to be sprayed on to the equipment/area through projector nozzles in the form of a solid conical emulsifying spray. Local audible alarm will be produced by water motor alarm gong. The operation of the Deluge Valve will be annunciated in the Local Zonal Fire Alarm Panel as well as in the Central Fire Detection and Alarm Panel. The system will also have a manual over riding facility along with regular testing facility.

Isolation gate valve and y-type strainer will be provided on upstream and downstream side of deluge valve. Fast acting butterfly vales will be provided as a bypass to deluge valve, so that this valve can be kept closed and can be operated manually, if there is any malfunction of deluge valves.

Medium Velocity Water Spray (MVWS) System

MVWS system will be designed as per TAC regulations. The medium velocity spray system will consist of a network of open spray nozzles fitted with a special deflector to give required angle of discharge for the water around the area to be provided. The sprayers will discharge a cone of water spray consisting of medium size droplets of water. The water supply to the MVWS system will be controlled by a deluge valve which will operate electrically actuated solenoid valve on release of water pressure.

Local audible alarm will be produced by water motor alarm gong. The operation of the Deluge Valve will be annunciated in the Local Zonal Fire Alarm Panel as well as in the Central Fire Detection and Alarm Panel. The system will also have a manual over riding facility along with regular testing facility.

In order to avoid total flooding of the entire area of cable gallery / coal conveyor system, the area to be protected by MVWS system will be divided into number of zones. Each zone will have separate water supply network controlled by a deluge valve. A fire detection system provided for the MVWS protected area will sense fire and will actuate the deluge valve. In the event of fire in one zone, the deluge valve of corresponding zone and those of adjacent zones on either side will be opened.

The cable galleries will have number of rows of cable trays and each row will have number of tiers of cable trays. Each of the cable rows will be provided with a network of water distribution piping and nozzles. The distribution network will consist of distribution header

for each row of cable tray and on these headers drop pipes will be provided so as to cover all the tiers. Fire in the cable gallery/cable spreader room, addressable multi-sensor detector supplemented with linear heat sensing cable of digital type will be used for detection of fire. Upon detection of fire MVW spray system will be brought into operation by automatically opening of deluge valve, which will allow the projectors located in that areas to direct water in the form of spray, which will cut off oxygen supply and extinguish the fire.

The MVWS system for coal conveyors will be provided for both top and return conveyors. Junction towers/Transfer towers, Crusher house, and all other area will also be covered. Fire in the coal conveyor will be detected by the linear heat sensing cables and infrared ember detectors which will provide signal for electrical actuation of deluge valve. MVWS system spray nozzles will be provided in row centre of the conveyor belt for top conveyor (The sprayers will be installed in rows at the ceiling level above the centre of each conveyor belt and spaced at not more than 4M) and on either side of the conveyor at 4m intervals. Staggering of sprayers is recommended for bottom conveyors. Conveyor walk way will not be affected by MVWS system pipe routing.

The MVWS system for fuel oil pump house and EDG building will be designed considering the pump house as a single zone. A network of pipes with spray nozzles will be located near the roof of the pump house which will be connected to a deluge valve. The fire in the fuel oil pump house and EDG building will be detected by a detection system comprising of quartzoid bulb detectors which will actuate the deluge valve.

Fixed Foam System

Fixed foam system is provided for fuel oil storage tanks. The water for the foam system will be tapped from the Hydrant system. The system will consist of at least two nos. of AFFF foam concentrate tank (2 x 100% capacity of SS foam tank), foam pumps, foam inductors, balance proportioners, foam makers with discharge outlets, associated interconnection (SS and GI) piping, valves, fittings, instrumentation etc. It will be discharged to the foam inductors through 2x100% capacity foam (One (1) Motor driven and One (1) diesel engine driven) pumps through balancing line, with control valves, flow controllers etc. along with deluge valves, strainers and isolating valves fixed piping valves and other accessories, etc.

Inert Gas System

The system will be manufactured, designed, installed & commissioned in conformance with the stipulations of NFPA-2001.

At least 2 x 100% capacity Inert Gas cylinder batteries with each slave cylinder complete with non-return valve and control valve and each master cylinder having a pilot solenoid valve. Frame work support for cylinders for each area, Discharge manifolds, hoses, nozzles, and pneumatic horn for each area. Seamless pipe work, discharge nozzles, along with evacuation & gas release alarms and Warning sign boards will be provided. Discharge nozzles will be provided on the gas distribution pipe network will be connected to a gas manifold, through a manually operated valve. The manifold will be connected to a group of inert gas cylinders.

Portable and Trolley mounted fire Extinguishers

Portable CO2, Dry Chemical Powder, Foam type extinguishers and stored pressure type fire extinguisher (ABC fire) as per TAC requirements will be provided. Stored pressure type fire extinguisher (ABC fire) 5 kg, Carbon Di-Oxide Type Portable Fire Extinguishers 9 kg, Dry Chemical Powder Type Portable Fire Extinguishers 10 kg, 22.5 kg carbon di-oxide type, trolley wheel mounted unit one each and Chemical powder type, trolley wheel mounted unit one each for TG control room, Switch yard control room, ESP control room and Fire station will be provided. 50Lts foam type, trolley wheel mounted unit for TG building lube oil tank area, Fuel oil Pumping area, Fuel oil storage tank area and Transformer area will be provided.

Fire Tender

The chassis for carrying out fabrication work of fire water/foam tender will be of Make TATA1109/TATA 2518 or Ashok Leyland Taurus/Beaver or Volvo. The chassis will be equipped with power assisted steering. It will carry an extension ladder of 10.5M length including with hydraulic platform to operate the water monitor and will be capable of towing a trailer pump.

Water tender

One (1) number of water type fire tender consist of 4500Lts. capacity water tank with rear mounted multistage high pressure pump, DCP and CO2 extinguishers including all accessories will be fabricated as per IS:950.

Foam tender

One (1) number of foam fire tender consist of 3000Lts. capacity water tank, 500 Lts. Capacity foam tank with rear mounted multistage high pressure pump, DCP and CO2 extinguishers including all accessories will be fabricated as per IS:951/87 and IS:10460.

Fire Water Reservoir

The source of water required for hydrant and spray system will be from the reserve storage provided in the desalination water storage tank. The tank will have two equal compartments and both the compartments will be connected to a common suction header of fire water pumps so that any fire pump can be fed by either fire water storage compartment as per TAC regulations. At least two (2) headers will be taken out of pump house for making loops around various risks. Each loop will be interconnected for better reliability of the system. To isolate the system due to damage/repair, suitable nos. of gate valves should be provided.

Fire Water Pumping System

Dedicated fire water pumps will be provided for the fire hydrant and spray system. Blind flange with valve connection for future expansion to be provided in the fire hydrant and spray system network. The fire water pump capacity and head will be designed as per the system requirement/TAC recommendation. The adequate number of fire water pumps (No. of Pumps, pump capacity and head will be firmed up during the detail engineering) will be provided.

The fire hydrant and MVW spray system will have a dedicated electrical motor driven main fire water pumps (minimum 3 Nos.) and 50% standby diesel engine driven pumps (minimum 2 Nos.).

Separate fire water pumping system with electric motor driven spray pumps and 100% standby diesel engine driven pumps will be provided for HVWS system. The electrical power supply scheme for the motor driven fire pumps will be in line with the TAC requirements.

All standby diesel engine driven pumps will be provided with 2 x 100% Battery chargers and Batteries.

The fire water pumping system equipments are located in the comprehensive pump house, adjacent to the desalination water storage tank.

The common pressurization unit will be provided for hydrant and spray water system network. Pressurization unit will consist of Two (2) nos. of electric motor driven fire water jockey pumps (one working + one standby), One (1) no. hydro-pneumatic tank and Two (2) nos. air compressors (one working + one standby) of adequate rating (Initial filling of compressed air will be provided within 2 hours) for pressurization of hydro-pneumatic tank will be provided.

Interconnection between hydrant and spray system headers will be provided by means of providing a normally closed isolation valve and non-return valve which permits flow from hydrant system to spray system and not vice versa.

Dedicated fire water booster pumps comprising adequate number of electric motor driven main pumps and 100% diesel engine driven standby pumps will be provided for higher elevation of boiler units/transfer towers/bunker floors. The pumps and the drivers will be complete with all accessories and appurtenances.

Above-ground piping will be duly painted and complete with all fittings, isolation gate valves, check valves, globe valves, vent valves, drain valves and instrument isolation valves including check valve, etc. as required for the completeness of the system.

Pumps will have continuously rising head characteristic curve towards shut-off with the highest head at shut off. Pumps will be suitable for parallel operation. Pumps will have non-overloading characteristics to avoid motor overload.

Pumps will be capable of furnishing not less than 150% of rated capacity at a head of not less than 65% of rated head. The shut off head will not exceed 120% of rated head for horizontal centrifugal pumps and 140% of rated head for vertical pumps.

The scheme for the Fire water pumping system is represented in **Figure 10.2**.

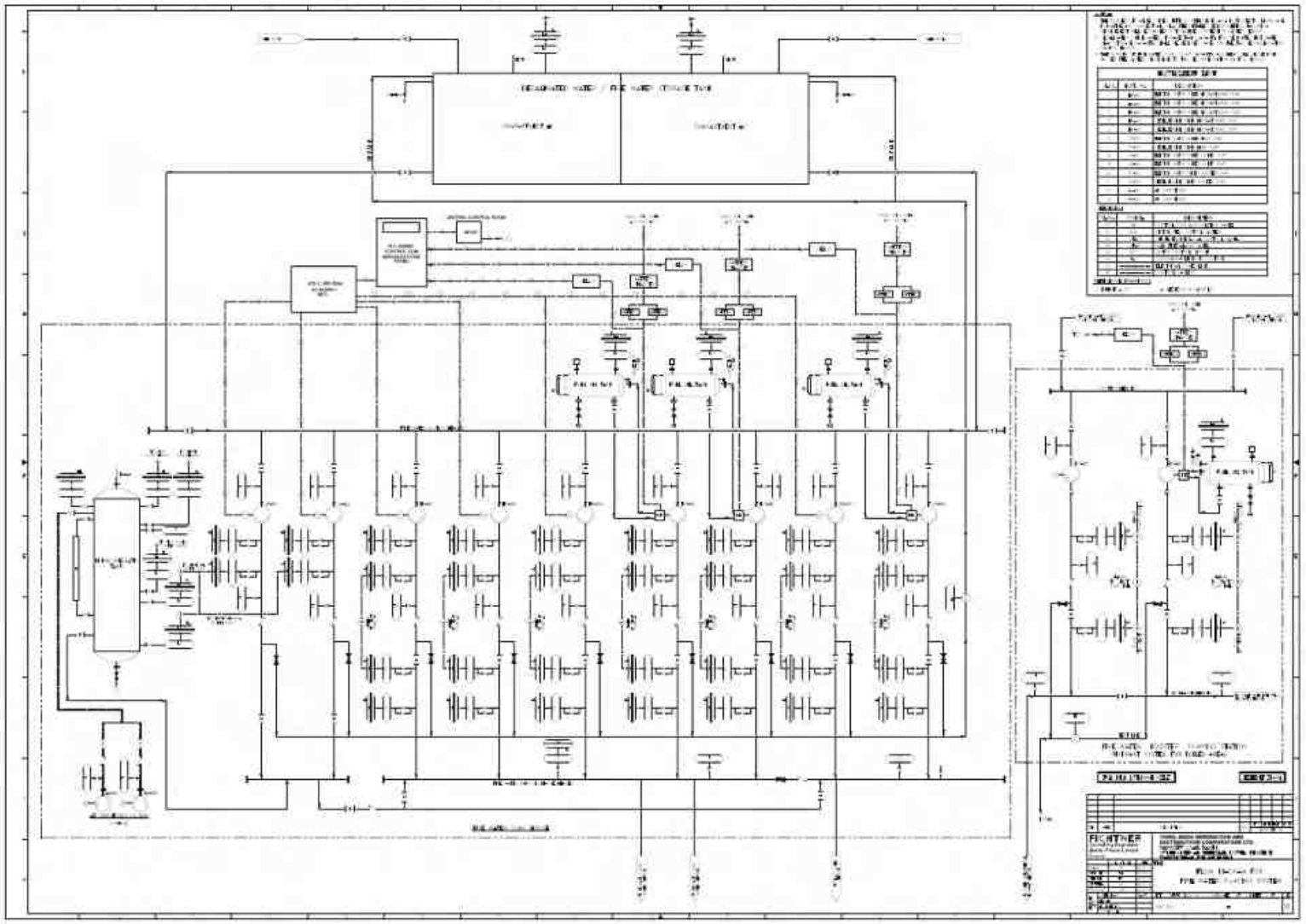


Figure 10-2 Fire water pumping system

Pump controls & Interlocks

The system will be designed for automatic operation. Control and operations are realized in the main plant DCS with all necessary interlocks for starting the fire water pumps in sequence.

All the fire protection equipments that includes the electric motor driven main fire pump sets, standby diesel engine driven fire pump and associated systems are interfaced with the DCS through the DCS remote I/O panel located at fire water pump house.

Fire water pump house will be provided with one(1) no. 24” LCD TFT type Operator station for control and monitoring the FPS locally in addition to remote monitoring from the central control room in the main plant DCS.

In addition to the above, the control cum annunciation panel will be provided with Auto/manual selection in fire water pump house. Control cum annunciation panel will be connected to the MFAP for monitoring. Local control panel of booster fire pumps and foam pumps will be connected to MFAP for monitoring

In case of power failure, the control system remains operative by being connected to the UPS system. It will assure that the plant will be shutdown according to the safety requirements.

Local Control Panels for all deluge valves will be provided. Local control panels will be provided for each diesel engine driven pumps and fire water booster pumps in the respective pump house. All the pump status annunciation in this panel/operator station will be repeated to the Main Fire Alarm Panel in the Central Control Room.

Fire Water Piping Material

Two separate dedicated fire water ring main distribution network will be provided for Hydrant, MVWS system and HVW Spray system as per TAC requirement

All Hydrant, Spray and foam system pipe mains/pipes will be routed aboveground on top of the concrete pedestals at regular intervals. In main plant area and coal (yard) stock pile area pipelines will be routed in RCC pipe trenches filled with sand and covered with pre-cast RCC removable covers. Pipe trenches crossing through road or rail will be through hume pipes.

In case of requirement for modification in pipe routing during detailed engineering due to plant layout constraints, Contractor will carry out such modifications at no extra cost to Purchaser.

Fire water pipes will be of Carbon Steel conforming to IS: 1239 (medium grade) and IS: 3589 (6.35mm thick).

All aboveground piping will be adequately supported by concrete pedestals at regular intervals.

All buried pipes will be double coated and wrapped as per IS: 10221 and/or IS: 15337.

Over ground pipe normally empty but periodically charged will be Galvanized pipes.

The entire pipe network will be hydraulically designed in such a way that the velocity of water in any section does not exceed 5.0 m/s at any segment of pipe network.

All outdoor piping will be buried such that the top of the pipe is atleast 1.0 M below the finished ground level.

RCC hume pipes will be provided as IS:458 NP class II for road crossings and NP class III for rail crossings.

The yard piping will be provided with strategically located sectioalising isolation gate valves to enable maintenance of defective pipeline and also to achieve maximum pressure at the remotest and highest hydrant at the time of fire as per TAC requirement.

All fire hose connection branch pipe and couplings will be of SS 304construction and in accordance with IS: 903.

The pipe work will be provided with gate valves IS:14846 at suitable location to facilitate repairs or other necessary work on the system, all above ground valves will be rising stem type. All above ground Gate valves, check valves and globe valves will confirm to IS:778.

The hydrant valve will be of SS 304construction conforming to IS : 5290.

The water monitors provided will be of fixed type with Swiveling joints SS 304 Nozzle and conforming to IS:8442.

Deluge valve will be quick release, hydraulically operated diaphragm actuated type of valve, set in closed position, by water pressure through external bypass check valve and restriction orifice from the inlet chamber to top chamber. The Deluge valve will be of cast iron construction complete with all accessories.

All the deluge valves will be provided inside the deluge valve shed.

Holiday test for wrapping and coating will be provided.

The medium/high velocity spray nozzle will be of SS 304construction.

Hose cabinets will be provided with 16 SWG thick body and 3 mm glass. The hose will be provided with key box with break glass and pedestal where required. Fire hoses will be of IS 636 type-A.

Fire Detection and Alarm System

Two (2) nos Main Fire alarm panel (MFAP). One (1) will be located in the main plant central control room and one in coal handling plant control room. The MFAP will be Microprocessor based analogue addressable type complete with power supply, LCD colour monitoring display unit, matrix key pad, all input, output & control modules, 24 V sealed maintenance free battery & battery charger, built-in hooters etc.

One (1) no Repeater Fire alarm panel (RFAP) will be located in Fire Station. The RFAP will be microprocessor based analog addressable type complete with power supply, LCD display, matrix key pad, all input, output & control modules, 24 V sealed maintenance free battery & battery charger, built-in hooters etc.

One (1) no of Repeater Fire alarm panel (RFAP) will be provided in the Switch Yard Control Building.

All interface cabling between fire alarm system and DCS system for HVAC equipment interlocks will be complete with double compression glands, lugs, ferrules, markers etc.

Control Units, Heat detectors, Quartzoid bulb detectors, Operation work station, Addressable analogue photo electric smoke detectors, addressable analogue fixed temperature cum rate of rise heat detectors, indoor and outdoor manual call points hooters, response Indicators, addressable interface units, infra red detectors emergency exit and warning signs etc. will be provided. Minimum one (1) no of siren (3 kM range) complete with power supply and control unit including with all accessories. Loop cabling, interface modules etc. required for hooking up the system for annunciation in the main fire alarm panel and supply of all erection hardware will be provided.

The type of detectors will be provided in the following areas / equipments are given below:

Table 10-2 Type of detectors

Equipment to be protected	Type of Detection System Provided
Generator transformers, Unit Auxiliary Transformers, Unit Transformers, Station Auxiliary Transformers, Standby/ Maintenance transformers, Bus reactors, CHP auxiliary transformers, AHP auxiliary Transformers Station transformers and All other oil filled transformer of rating 10 MVA and above, turbine oil canal pipe lines in main plant, Boiler feed pumps lube oil tanks, coolers, consoles etc, Boiler burner front, main lube oil tank, clean and dirty lube oil tanks, and Generator seal oil system tanks and its coolers.	Water filled quartzoid bulb detectors and Manual call points.
All Cable galleries/cable spreader rooms/ Cable vaults	Address able multi-sensory smoke detectors and manual call points. Multisensor detector and digital LHS cable (LHS cables will be provided in zigzag fashion (with an included angle of minimum 90 degree) each of the top tray, bottom tray and in every alternate tray) along with necessary number of interface units in the cable gallery will be cross zoned to actuate the water spray system.
All Switchgear rooms/MCC room, SWAS room, UPS room, Computer rooms, Engineers room, Air-conditioning equipment room, Control room, Control equipment room. Air washer room	Addressable multisensory detectors (Below the true ceiling, below the false ceiling and false floor as the case may be) and manual call points.
Battery and Battery charger room,	Addressable corrosion resistant rate of rise of temperature detector with fixed Temperature element (Heat Detectors)

Fuel oil Storage tanks and dyke area	Minimum 2 nos. of probe type heat detector with different temperature setting and flame proof manual call points.
Auxiliary buildings/non-plant buildings	Addressable multisensory detectors (Below the true ceiling, below the false ceiling and false floor as the case may be) and manual call points.
Emergency Diesel Generator Building	Water filled quartzoid bulb detectors. Manual call point
Fuel oil pump house	Water filled quartzoid bulb detectors and Flame proof Manual call point
Coal conveyors	Linear heat sensor cables (Minimum 3 runs will be provided one for top conveyor centre and (2 runs) each one run either side of the bottom conveyors), Minimum 3 nos Infra red type detectors for each coal conveyor: one each at a distance of 1-2 m from tail end and head end and one at the middle with Continuous air-blow system for cleaning of detectors and flame proof manual call points.
Entire Coal handling system area	Flame proof manual call points.
Hydrogen generation plant room	Gas detector and flame proof manual call points.
All Plant Buildings and entire plant area	Manual call points strategically located.

10.2.12 Measures for conservation of energy

M/s. TANGEDCO shall adopt various measures for energy conservation:

- Energy efficient machineries will be used during operation phase.
- Installation of economizer & high efficiency burner on steam boilers.
- Enough care will be taken to prevent/minimize energy losses at each stage.
- Energy audit will be used as a tool for monitoring purpose.
- External lights will be controlled through timers for auto on/off function based on timings.
- The cable size will be selected so as to minimize the power losses.
- The power factor improvement capacitors will be provided individually for AC loads.
- Using water cooled chillers, variable frequency drives for secondary pumps and public area and building management system for HVAC equipments with non-CFC and non-HCFC based refrigerants.
- Use of VFDs for various utilities in variable load application to optimize pump and air handling unit performance, wherever required.
- Automated day light control.
- Efficient lamps and ballasts.
- Automated control for external lighting (Astronomical/Sensor).
- Occupancy Sensors.

- Phase-wise implementation of Advance Process Control (APC) in the process plants.
- Replacement of conventional lighting fixture by more energy efficient fittings.
- Installation of improved insulation over the High Pressure (HP) steam line to reduce the heat loss.
- Use of FRP blade on Cooling Tower.
- Use of Energy Efficient Lighting, Transformers, HVAC system, Use of Energy Efficient Motors, electrical appliances to minimize the energy consumption in addition to Process Planning.

Table 10-3 Energy conservation details

Description of use	No. of units that will be provided	kWh	Total kWh per day
Rooftop solar panels covering 50% of roof area	9088 Solar panels (350W or 0.35kW each)	0.35 kWh/day (1 * 0.35 kW)	3180.8 kWh/day (9088 * 0.35 kWh/day)

Total energy conservation from solar is about 3180.8 kWh per day. Initially, TNPGCL (TANGEDCO) 750 kW will be implemented. The remaining will come in the future.

Interaction with statutory bodies

EMC will be in regular touch with TNPCB and the Regional Office of MoEF&CC and sends them periodic compliance report on EMP compliance in the prescribed format. Any new regulations/ guidelines considered by TNPCB/CPCB is taken care of by EMC. Action is taken to update the EMP on regular basis in accordance to the guidelines of regulatory authorities as TNPCB/MoEF&CC etc.

Training

For the Ongoing project, training facilities will be developed for environmental control. For proper implementation of the EMP, the officials responsible for EMP implementation will be trained as per need.

The training will be given to employees covering the following areas:

- Awareness of pollution control and environmental protection (for all employees)
- Operation and maintenance of specialized pollution control equipment/systems.
- Field monitoring, maintenance and calibration of pollution monitoring instruments
- Laboratory testing of pollutants.
- Repair of pollution monitoring instruments.
- Occupational health and safety.
- Disaster management.
- Environmental management.
- Plantation and post care of plants.
- Knowledge of norms, regulations and procedures.
- Risk assessment and Disaster Management.

11 SUMMARY AND CONCLUSION

11.1 Introduction

Tamil Nadu Generation and Distribution Corporation (TANGEDCO) (A subsidiary of TNEB Ltd) is a state Government utility undertaking power Generation, Distribution and operation and maintenance of power plants. The power generation business of TANGEDCO under Tamil Nadu Electricity Board is unbundled into a separate company named as Tamil Nadu Power Generation Corporation Limited (TNPGCL) vide G.O (MS.) No. 6 Dated 24.01.2024 issued by Government of Tamil Nadu. Till such time TNPGCL is fully established TANGEDCO shall continue the business of Power Generation. To meet the increasing demand for power supply in the sectors of agriculture, domestic, industrial and commercial purposes in Tamil Nadu, TNPGCL (TANGEDCO) has proposed to install a 2 x 800 MW coal based Thermal Power Plant with supercritical technology at Udangudi village, Thiruchendur taluk, Thoothukudi district of Tamil Nadu, and obtained an Environmental Clearance for the same. Subsequently, TNPGCL (TANGEDCO) obtained amendment to the above-mentioned Environmental Clearance for reduction of unit sizes from 2 x 800 MW to 2 x 660 MW. Presently, the physical work progress for the Project is completed to the tune of 85% for which EC was granted. Since the validity of EC was extended for all the projects on account of Covid-19 pandemic, the validity of EC for Udangudi Supercritical Thermal Power Plant is valid upto 13.10.2024 As the validity of EC is completed, it is planned to obtain fresh EC for the project.

11.2 Project description

The ongoing power plant will be operated with coal as the main fuel to generate 1320 MW power (2×660 MW) and would be developed with super critical technology to obtain benefits under Clean Development Mechanism (CDM Project). It is proposed to use blended coal based on efficiency (50% imported Coal from Indonesia, South Africa, Australia, China, etc and 50%Indian coal from Talcher coal fields of Mahanadi coal fields limited from Odisha) as fuel. The annual consumption of coal for the ongoing power plant is estimated as 5.893 million tonnes for two units considering Plant Load Factor of 85%. The requirement of Indian coal from Talcher coal field will be about 3.647 million tonnes per annum and imported coal requirement will be 2.246 million tonnes per annum.

Land use area break up

S. No.	Purpose	Area in Ha
1	Main Plant, Transformer yard, Switch yard and FGD	26.305
2	Coal Yard	26.305
3	Cooling Water System	17.402
4	Fuel oil system	1.699
5	Water system including Chlorination system	7.782
6	Ash Dyke	48.562
7	Administration building and other non-plant buildings	4.719
8	Miscellaneous such as Corridor for CW piping, Ash piping, Intake & outfall, Silo & its utility building, Workshop, Stores, Roads etc.	80.168
9	Green Belt	167.058 (about 44% of total area)
Total		**380**

The project proposes to have its own captive coal jetty at Udangudi with transportation of coal through pipe conveyor system to the power plant to handle coal up to 15.33 million tonnes per annum. IITM, Chennai has studied the feasibility of the coal jetty. Based on the feasibility study NIO, Goa has finalized the location by model studies.

The Govt of Tamil Nadu has accorded approval for the development of coal jetty as Udangudi Minor Port by declaring the Port Limits for captive use of TANGEDCO. M/s. The coal jetty is located at about 7.5km from shore and possess a separate EC and CRZ clearance from MoEF&CC vide Lr. No. - EC22A004TN156490, 10-66/2020-IA.III dt. 03.08.2022.

The total water requirement for boiler and cooling water for the ongoing plant would be around 13,063 m^3/hr and the source is seawater. The NIO, Goa, has finalized the location of the cooling water intake and outfall in sea by conducting the modeling studies. The total intake length is located at 2.68 km (onshore – 1 km & offshore – 1.68 km) and the total outfall length is located at 2.39 km (onshore – 1.51 km & offshore – 0.88 km).

TANGEDCO has planned to install Supercritical pulverized fuel combustion technology for this ongoing 2x660 MW power plant, targeting higher efficiency (and hence minimum coal consumption) as well as conforming to best possible friendliness to environment at reduced emission.

Additionally, following pollution control equipment are attached to the once-through steam generator, for compliance to latest MoEF &CC guidelines.

- Selective Catalytic Reactor (SCR)
- Flue Gas Desulphurization (FGD
- Electrostatic Precipitator (ESP)
- Fly Ash Handling system and Storage Pond & Silos
- Sewage Treatment Plant
- Effluent treatment Plant

TANGEDCO is proposing 2x660 MW, in the district of Tuticorin, Tamil Nadu. The major components of (2x660 MW) Power Project are as follows:

- Steam Generator and its Auxiliaries;
- Steam Turbine and its Auxiliaries;
- Electrical Generators, Transformers and Switchyard
- Control and Instrumentation systems
- Air Pollution Control Systems like Dust Suppression and Extraction Systems, Electrostatic Precipitators, Flue Gas Desulphurization System and NOx Control (SCR) System;
- Water Intake and Treatment Systems;
- Condenser and Auxiliary Cooling System;
- Fuel Oil System;
- Coal Handling and Storage System;
- Ash Handling, Utilization and Disposal System;
- Site Drainage, Sewage Treatment Systems with facilities for Recycle and Reuse;
- Green belt, afforestation and landscaping systems.

Raw material requirement

Sl. No.	Raw Material	Quantity	Source	Calorific Value	Mode of Transport	Distance in kms.
1.	Imported Coal	2.246 (MTPA)	Indonesia	4350 kcal/kg (Blended coal)	captive jetty at Udangudi	9.356
2.	Indigenous coal	3.647 (MTPA)	Odisha			
Other Raw materials						
4.	Wet Lime stone	288 (T/day)	Indigenous	-	by road	-
5.	Fuel oil	41500m^3	Indigenous	-	By road	-

Utilities for the ongoing project

About 3,13,512 KLD of sea water shall be required, with closed cycle cooling system with natural-draft cooling tower (NDCT). Water for construction purpose will be sourced from local water resource & Desalinated water will be used during operation stage. No extraction of ground water is envisaged. Water requirement for the operation phase will be met through captive desalination plant of 16 MLD capacity.

Water requirement

Sr. No.	Description flow rate	m^3/hr
1.	Desalination Plant Feed Water	3632
2.	Cooling Water makeup	9431
3.	Total sea water requirement	13063

The RO reject (reject concentrate or Brine) from the desalination plant will be about 36840 m^3/day. This reject will be diluted by discharging the same into the large quantity of blow down water let into the sea. Thereby the impact of RO reject over the marine ecology is negligible. The storm water drains will be segregated and channelized to water harvesting area.

STP Details: STP sludge generated will be used as manure for green belt development and maintenance. Quantity of sewage generated during operational phase will be 22.5KLD which will be treated through Two sequential batch reactors (SBR) based Sewage Treatment Plant of capacity 40 KLD. One STP at jetty (underground deck) and the other near shore within the port landward boundary is proposed. Treated wastewater from the Jetty STP will be reused for flushing while the landward STP treated water will be reused for gardening.

ETP Details: Effluent generation from Transformer yard, TG hall, floor wash, fuel oil and coal handling area of about 720 KLD will be transferred/ collected/ treated in the Effluent Treatment plant of capacity 720 KLD are planned for the project.

The expected power to be evacuated from the plant will be in the order of about 1228 MW after accounting 7% auxiliary power consumption for entire plant auxiliaries and desalination plant. Considering a plant load factor of 85% the available energy for

evacuation per annum will be about 9140.7 million units from 2x660 MW power plant. The generators are connected to the 400 kV switchyard through step-up transformers. Gas insulated switchgear (GIS) is considered for the Switchyard; in view of the fact that project site is located in coastal area. GIS Switchyard will have 4 number line feeders. One double circuit (2 lines) 400 kV line will be routed to 400 kV Ottapidaram Substation, one double circuit (2 lines) 400 kV line will be routed to 400 kV Samugarengapuram Substation and another double circuit (2 lines) 400 kV line will be routed to Viruthunagar Substation.

The rain (storm) water removed from the building roofs, non-process area and grade level surfaces will be directed through the open ditches and culverts to the storm drainage piping. The rain water is collected in the storm water drain running all around the project. Rain water harvesting pits 30 nos. and 100 m3 pond is proposed.

During the construction phase the project requires direct employment of about 114 persons (permanent) and contractual workers of about 500 persons during construction period for supervision and execution. After construction of the project, the Plant will require about 545 persons for operation and maintenance of the plant.

The project site has about 40.469 Ha of land adjacent to the power plant identified for residential development which is currently in the design phase and will be implement later.

The greenbelt is planned around the plant as well as coal stock yards and fly ash ponds. About 167.058 Ha of land is earmarked for greenbelt, which is 44%. The species and plantation norms will be as per directives of CPCB guidelines in consultation with local forest department. M/s. Tamil Nadu Power Generation Corporation Limited (TNPGCL) conducted the '**EK PED MAA KE NAAM**' tree plantation program at two schools, such as Sri R.K.C. Hr. Sec. School on 19.09.2024 and T.D.T.A. Hr. Sec. School on 26.09.2024. The plantation program engaged 200 school students, and 50 saplings were planted at each school.

The project cost is estimated to be Rs.13,076.705 Crore.

11.3 Description of environment

The baseline environmental study has been carried out during pre-monsoon season i.e. March 2024 to May 2024 by ABC Techno Labs India Pvt Ltd., NABL Accredited Lab, in accordance with the guidelines of EIA issued by the Ministry of Environment Forests and Climate Change, Govt. of India and CPCB, New Delhi. Secondary data was collected from public domain as well as different Government sources. The scope of the study has been done as per approved ToR by 11th EAC MoEF&CC vide file no J-13012/19/2008-IA. II(T) dated 29.07.2024. Granted Terms of References for EIA/EMP Study of ongoing 2 x 660 MW Udangudi Supercritical Thermal Power plant of M/s. TANGEDCO, Tuticorin District, Tamil Nadu.

11.3.1 Meteorology

From the summary of the wind pattern for study period (March 2024- May 2024) season the predominant direction is ENE and followed by E with less calm of 5.71 percent. The average wind speed is 2.82 m/s. The nearby India Meteorological Department station

that is generating meteorological data is 40 km from the site i.e. IMD, Tuticorin. Hence, secondary information on meteorological conditions has been collected from IMD station.

The monthly mean maximum temperature varied from 28.3°C to 30.1°C while annual mean monthly highest and lowest temperature in the region is about 39.1^0C and 18^0C respectively. The district is very hot and dry during the summer season from March to May. During winter season which was about 81% to 84% (at 08:30 Hours) and 76% to 77% (at 17:30 Hours). The annual average Relative humidity is 76% (at 08:30 Hours) and 69% (at 17:30 Hours).
The rainfall occurred maximum in the month of November (192.8 mm). The total rainfall received in the year is about 630.2 mm. Total rainy days observed was about 32.1 days. It is evident from the available IMD data that the area is not prone to any special weather phenomena like dust storm, hail, cloud burst etc.,

11.3.2 Atmospheric Inversion Level

This height is determined by the observation of the atmospheric temperature profile. The inversion level during winter season ranges above 200 m at 8 A.M. and 1000m at 5 P.M.

11.3.3 Geology

Tuticorin district comprises of well-developed litho package of meta-sedimentary sequence inter banded with charnockite Group of rocks. The rock types exposed are of quartzite, calc-granulite, garnet-biotite-sillimanite gneiss, garnet quartzo -feldspathic gneiss and garnet-biotite-cordierite gneiss belonging to Khond alite group of rock. The economic minerals found in the district are gypsum, limestone, beach sand, kankar and shell limestone. Minor occurrences of quartzite were also observed in Thoothukudi District. Major deposits of garnet and ilmenite sand were present in the coastal part of Tiruchendur Taluk whereas proposed project site comprises of recent deposits (younger age of formation, which is called Quaternary comprises of alluvium and coastal sand).

11.3.4 Hydrogeology

The district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) unconsolidated & semi consolidated formations and ii) weathered and fractured crystalline rocks.

The porous formations in the district include sandstones and clays of Recent to subrecent and Tertiary age (Quaternary). The Recent formations comprising mainly sands, clays and gravels are confined to major drainage courses in the district. The maximum thickness of alluvium is 45m bgl, whereas the average thickness is about 25m. Ground water occurs under water table and semi-confined conditions in these formations and is being developed by means of dug wells and filter points. The productive zones are encountered in the depth range of 29.5 to 62 m bgl. Alluvium, which forms a good aquifer system along the Vaippar and Gundar river bed which is one of the major sources of water supply to the villages.

11.3.5 Land use/ Land cover

Landsat 8-9 & TIRS of 1:150000 scale is used for land use and landcover study. From the study it is observed that Barren land is covering 22% (90.48 Sq.km) of the total area followed by mixed plantation 21% (87.58 Sq.km).

11.3.6 Environmental status

Air: The maximum and minimum concentrations for PM_{10} were recorded as 58 µg/m^3 and 33 µg/m^3 respectively. The maximum and minimum concentrations for $PM_{2.5}$ were recorded as 27 µg/m^3 and 16 µg/m^3 respectively. The maximum SO_2 concentrations were recorded as 8.9 µg/m^3 and minimum is found to be BDL(<5). The maximum and minimum NO_x concentrations were recorded as 17.7 µg/m^3 and 10.4 µg/m^3. it is observed that very marginal decrease in the revalidated baseline data.

Noise: The day time noise level at industrial zone was observed to be 51.7 dB(A) which is within the prescribed limit of 75 dB(A). The day time noise level at commercial zone was observed to be 53.7 dB(A) which is within the prescribed limit of 65 dB(A). The day time noise level at all residential zone was observed to be 47.5 to 53.7 dB(A) which is within the prescribed limit of 55 dB(A). The night time noise level at industrial zone was observed to be 42.2 dB(A) which is within the prescribed limit of 70 dB(A). The night time noise levels at residential locations were found to be 40.8 to 44.5 dB(A) within the prescribed limit of 45 dB(A). From the revalidated data, it is observed that the noise level is decreasing when compared with existing baseline data.

Water: The pH value of the collected ground water in the study area varies from 7.41 to 8.02 and meets the acceptable limit for drinking water standards. The essential parameters of ground water are well within the permissible limits. The heavy metal parameters are also well within the IS10500 norms. The surface water analytical results are compared with best of use norms given by MoEF&CC and the observed values are well within the limit.

From the revalidated data of surface and groundwater samples, it is evident that there is no change in the chemical parameters and hence, it can be concluded the operation of plant does not have any impact on surface and ground water.

Soil: Eight numbers of soil samples have been collected from the study area and all the physical and chemical parameters are observed to be normal.

Ecology: The detailed study about 121 floral species observed. The most dominant tree species in the entire study area was dominated Cocos nucifera, Azadirachta indica, Musa paradisiaca, Acacia nilotica, Psidium guajava etc. Most dominant shrubs in the study area were, Prosopis juliflora, Lantana camara, Datura metel, Calotropis procera, Tecoma stans etc. Among the herb species observed are Boerhavia diffusa, Cynodon dactylon, Achyranthes aspera, Amaranthus spinosus, Ageratum conyzoides, Mimosa pudica, etc.

Livestock like cattle, buffalo, goat, poultry, and duck are reared for dairy products, meat, egg and for agriculture purpose. Majority of cattle and buffalo are of local variety. Backyard poultry farms are mostly common in this area; however, some commercial poultry farms are also recorded in the study area.

To assess the planktonic profile of Phytoplankton and Zooplankton, 3 water samples from estuary region, intertidal zone and coastal water were collected at sub surface level. The marine ecological study was conducted in different water bodies of the study area and the flora and fauna was recorded.

Traffic: The existing PCU per day volume of SH 176 (Thoothukudi - Tiruchendur - Kanyakumari Road) is about 21638.4 against the capacity of 36000 PCU per day.

11.4 Anticipated Impacts and Mitigation Measures

Land: As the project site (total area 380 Ha) is under possession of TANGEDCO and preparatory activities like construction of access roads, temporary offices and godowns, piling, storage of construction materials etc. will be confined within the project area. Topography of the proposed site appears to be flat with level + 2.00 m AMSL and it may not require any major excavation. The filling material will be fly ash from Tuticorin Thermal Power station of TANGEDCO (TNEB). The filling material will be transported by closed trucks through all-weather metalled road. However, the above activities are already completed and suitable mitigation measures taken and hence does not warrant for further analysis.

Water: The study area is demarcated with dentritic drainage pattern as the area is completely covered by recent alluviam. The surface run-off water from the project site is naturally diverted into surface water network system which is constructed one side of the road and all along the boundary wall and finally diverted to rainwater harvesting pits. The increase runoff will be directed to 100 m^3 rainwater storage pond. The excess runoff (i.e., pre-construction stage quantity) will be drained into rainwater harvesting pits 30 Ns. which is having 180 m^3 carrying capacity. The harvested water will be used for plant purposes.

Air: The construction and other associated activities will lead to emission of different pollutants, viz. particulate matter and gaseous pollutants (SO2 and NOx) from machineries and vehicles. The important air pollutants generated from thermal power plant are Particulate Matter (PM), Sulphur dioxide (SO_X) and Oxides of Nitrogen (NO_X) due to burning of coal.

The maximum GLCs for each grid point were predicted with respect to pollutants PM10, PM2.5, SO2 and NOx. In order to obtain the impact due to proposed project, Background concentration recorded in the study area are considered and the contribution due to proposed project is added to it. The predicted cumulative GLC values are as follows and the isopleths are enclosed in the report.

Resultant concentrations due to incremental GLC's at project site

Pollutant	Maximum AAQ Concentrations Recorded During the Study Period in Project site (µg/ m^3)	Incremental Concentration (µg/m^3) – Worst Case	Resultant Concentration (µg/m^3)	AAQ Standards (mg/Nm^3)
PM	31.849	1.17	33.01	100
NOx	51.374	1.89	53.264	80
SOx	28.78	1.06	29.84	80

Noise: The proposed project related activities will lead to generation of noise that may have minor impact on the surrounding communities in terms of minor increase in noise levels. The machinery envisaged for the plant operation is a source of noise. Generally,

this noise is generated due to continuous operation of machineries like coal mills, turbine, boilers, generators, pumps and cooling towers etc.

The propagation modeling Dhawani Pro considered for operation and the predicted noise level at source during operation is 85 dB(A). The results of the noise modelling reveal that the maximum noise level will be 23.4 dB(A) at 1.5km distance due to the proposed plant.

Waste water:

The effluent generated from the plant is treated in Sequential Batch Reactor (SBR) based ETP capacity of 720 KLD. The treated water will meet the requirement of TNPCB norms viz. BOD <30 mg/l, TSS <20 mg/l and pH 5.5-8.5. The SBR plant consists of clarifier, oil and grease removal, closed aeration followed by pressure sand filter and activated carbon filter.

Solid waste: The estimated Municipal solid waste is about 109 kg/day. Out of this, 40% that is about 43.6 kg/day is Bio-degradable waste. The non Bio-degradable waste 60% is estimated to be 65.4 kg/day. As the plastic waste recirculation is maximized and usage of plastic is reduced the expected plastic waste is about 20% of 65.4 kg/day that is 13.08 kg/day will be collected, segregated and disposed through Udangudi town panchayat as per Solid Waste Management Rules, 2016.

Hazardous Wastes are properly handled in containers and stored in hazardous waste storage areas as per rules and also bunding is provided to avoid overflow of spillage waters which can contaminate the surroundings. Recyclable waste is handed over to authorized recyclers and other hazardous waste will be disposed through approved TSDF facility.

Brine discharge: Delft 3D salinity dispersion modelling study was conducted to understand the salinity dispersion pattern near the point of brine cum cooling water disposal. The peak salinity was observed during the summer season of 1.7 PPT above ambient conditions during spring-ebb tide conditions. It takes 2.9 km in the NE direction for the discharged reject to attain near ambient conditions (Δ 0.5 PPT above baseline condition). However, as predicted from the model study, this influence is limited due to good brine dispersion.

Traffic: TNPGCL (TANGEDCO) is located near to Udangudi village about 4.85 km in the West direction on SH-176 (Thoothukudi – Tiruchendur – Kanyakumari Road) - 0.12 km East which is leading to Udangudi. Since, the plant is located on the isolated path major traffic is not expected. The LOS study shows that the existing traffic scenario is “Excellent” and the free flow of vehicles is observed during the study period February 2024. Out of the total traffic vehicles, 2 wheelers are very high followed by Trucks& Bus, 4-wheeler light and medium vehicles. Due to the proposed 2 x 660 MW supercritical thermal power plant, the traffic density will have negligible increase and traffic scenario is “High” and stable flow.

11.5 Analysis of alternatives

The ongoing plant is already in construction and about 85% of the work is completed and it is planned to obtain a fresh EC as the validity is expired in the month October, 2024.

Hence, alternative site and technology consideration is not applicable for this project at this stage.

11.6 Environmental monitoring programme

The key issues associated with the life cycle of a project are the monitoring of environmental parameters. Three types of environmental monitoring are ensured the compliance through separate EMC.

11.7 Additional studies

The preliminary risk assessment has been completed for the ongoing plant and associated facilities:

- Individual risk from the thermal power plant is negligible, as it is below the tolerance criterion of individual risk not to exceed 1.0E-5 per year in populated areas,
- Individual risk contour for 1.0E-5 per year is also within the boundary limit of the Udangudi thermal power plant,
- The Individual Risk Potential for Loss of Life (Potential Loss of Life- PLL) due to Udangudi thermal power plant is 2.3527E-005 per avg. year.

The project is located on the sea shore the nearest mangrove has been identified at the distance of 8.08 km within the impact zone of the proposed plant. Hence, it is planned to identify the area and density in association with forest department for inter plantation for the mangroves are considered as carbon sink. This goal will be achieved after estimating the carbon foot print of the proposed plant. The inter plantation will be reducing the carbon print to the extent of two times of the source.

Socio-economic: The district population growth rate is 3% Which is used for projecting the population within the study area of 10 km radius. The projected population for 2024 study area is 140279 (13%).

11.8 Project benefits

The ongoing 2 X 660 MW Power plant will result in improvement of infrastructure as well as up-liftment of social infrastructure in the area. The people residing in the nearby areas will be benefited directly and indirectly through employment opportunities likely to arise due to the project. It will also help in sustainable development of this area including development of physical Infrastructural facilities such as road transport facilities, educational facilities and water supply and sanitation. It is anticipated that the ongoing power plant will provide benefits to the locals in two phases i.e. during construction phase as well as during the operational stage of the plant.

The capital cost of the project is estimated to be Rs. 13076.705 Crore. As the project is a greenfield project about 0.25% of the cost is to be spent towards CER activity as per OM F.No. 22-65/2017-IA. III dated. 1st May,2018. Accordingly, the ongoing project authority planned to spend Rs.32.694 Crore. This amount will be spent for the development of local people within the impact area of 10 km radius from the project site. During 2018 to 2020, Rs. 10.843 Crore was spent on equipment purchase/ repair/ alteration in government hospitals, construction of fish landing center and temporary protection of sea erosion, etc.

The CSR initiatives of TANGEDCO have been prioritized on local needs, which focus on Health, Education, Sustainable Livelihood, Social Mobilization, Infrastructure Development, Water Harvesting, Agriculture and Environment Conservation.

11.9 Environmental management plan

The EMC is headed by a Plant Head. In his day to day work, the plant head is assisted by chemists, laboratory assistants and other staff. Services of forest officials are also taken for effective implementation of plantation schemes. For development and maintenance of jobs like drainage, clearing settling pits etc. assistance from the plant's civil engineering department is taken. The officers of the department meet frequently to assess the progress and analyses the data collected during the preceding fortnight/month. Total manpower of EMC is about 41 numbers.

The updated capital cost for the environmental facilities for ongoing project works out to Rs.1287 Crore.

11.10 Conclusion

Anticipated adverse environmental impacts from the ongoing of TNPGCL (TANGEDCO) will be localized, short term and low/moderate in nature, and visible only during construction phase. Adverse environmental impacts identified in EIA study due to the ongoing project will be mitigated by implementation of mitigation measures/environmental management plan (EMP) described in EIA report and compliance of applicable environmental regulations. The proposed project will have long term and regional beneficial/positive direct and indirect impacts on employment, socioeconomic conditions and development of the area and region.

12 DISCLOSURE OF CONSULTANT ENGAGED

12.1 General

This chapter describes about the environmental consultant engaged in preparation of Environmental Impact Assessment for Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village, Tiruchendur Taluk, Tuticorin District, Tamil Nadu.

12.2 Introduction

ABC Techno Labs India Private Limited (formerly ABC Environ Solutions Pvt. Ltd.) is an ISO 9001, ISO 14001 & OHSAS 18001 Certified Company & leading Environmental Engineering & Consultancy Company constantly striving towards newer heights since its inception in 2006. Our Company is dedicated to providing strategic services in the areas of Environment, Infrastructure, Energy, Engineering and Multi lab.

It is the first firm to be accredited by NABET (National Accreditation Board for Education and Training), Quality Council of India, as an EIA Consultant, approved for carrying out EIA studies and obtaining environmental clearance for various sectors such as Thermal Power Plants, Infrastructure, Industrial Estates/Complexes/Areas, Mining, Township & area development and Building construction projects etc. ABC Techno Labs is equipped with in-house, spacious laboratory, accredited by NABL (National Accreditation Board for Testing & Calibration Laboratories), Department of Science & Technology, Government of India.

M/s. ABC Techno Labs India Private Limited, Chennai has been accredited for 25 sectors including Sector-4 (Thermal power plants) for Category 'A' by the National Accreditation Board for Education & Training (NABET), Quality Council of India (QCI) vide Certificate NABET/EIA/2225/RA0290 dated 11.06.2023 with a validity till 16.11.2025 (Sl. No. 4 of QCI/NABET List dated 26.04.2024). M/s. ABC Techno Labs India Private Limited Laboratory is accredited by the National Accreditation Board for Testing and Calibration Laboratories (NABL) vide Certificate No. TC-5770 dated 03.04.2024 with validity till 02.04.2026. The Lab is also recognized by the Ministry of Environment, Forest and Climate Change (MoEF&CC) vide letter F. No. LB/99/7/2021-INST LAB-HO-CPCB-HO/Pvt./5877 dated 30.10.2024 with validity of 3 years.

Since establishment ABC Techno Labs focus on sustainable development of Industry and Environment based on sound engineering practices, innovation, quality, R&D and most important is satisfying customers need. The company has successfully completed more than 100 projects of a variety of industries, in the field of pollution control and environmental management solutions. The company is also dealing in the projects of waste minimization and cleaner production technology.

12.3 Services of ABC Techno Labs India Pvt. Ltd

Environmental Services

- Environmental Impact Assessment (EIA)
- Environmental Management Plan (EMP)
- Social Impact Assessment (SIA)
- Environmental Baseline data collection for Air, Meteorology, Noise, Water, Soil, Ecology, Socio-Economic and Demography etc;

- Environmental Monitoring
- Socio-Economic Studies
- Resettlement & Rehabilitation Plan
- Ecological & Human Health Risk Assessment Studies
- Ecological Impact Assessment
- Environmental Management Framework
- Solid Waste Management
- Hazardous Waste Management
- Internship & Training

Turnkey Projects

- Water Treatment Plants
- Sewage Treatment Plant
- Recycling & Water Conservation Systems
- Zero Discharge System

Other Services

- Operation & Maintenance of Water & Waste Water Plants
- Water & Waste Water Treatment Chemicals
- Pilot Plant studies
- Feasibility studies & preparation of budgetary estimates

Laboratory Services

- Chemical Testing
- Environmental Testing
- Microbiological Testing
- Food Testing
- Metallurgical Testing

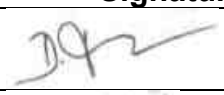
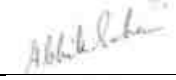
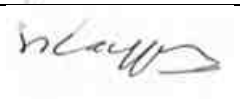
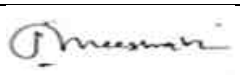
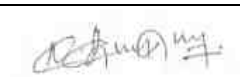
12.4 Sectors Accrediated by NABET

Sl. No.	Name of sectors	NABET Sector No	MoEF&CC Sl. No.
1.	Mining of Minerals including Opencast/Underground	1	1 (a) (i)
2.	Offshore & Onshore Oil and gas exploration, development & productions	2	1 (b)
3.	River Valley Projects	3	1 (c)
4.	Thermal Power Plant	4	1 (d)
5.	Mineral Beneficiation including palletisation	7	2 (b)
6.	Metallurgical Industries – (Ferrous & non-ferrous)	8	3 (a)
7.	Cement Plants	9	3 (b)
8.	Petroleum Refining Industry	10	4 (a)
9.	Leather/Skin/hide processing industry	15	4 (f)
10.	Chemical Fertilizers	16	5 (a)
11.	Petro-chemical Complexes	18	5 (c)
12.	Petrochemical based processing	20	5 (e)

Sl. No.	Name of sectors	NABET Sector No	MoEF&CC Sl. No.
13.	Synthetic organic chemicals industry	21	5 (f)
14.	Distilleries	22	5 (g)
15.	Integrated Paint Industry	23	5 (h)
16.	Sugar Industry	25	5 (j)
17.	Oil & gas transportation pipe line (crude and refinery/ petrochemical products)	27	6 (a)
18.	Airports	29	7 (a)
19.	Industrial estates/ parks/ complexes/ areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes	31	7 (c)
20.	Ports, Harbours, Jetties, Marine terminals, break waters and desilting	33	7 (e)
21.	Highways, Railways, Transport terminals, mass rapid transport system	34	7 (f)
22.	Common Effluent Treatment Plants (CETPs)	36	7 (h)
23.	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)
24.	Building and large Construction projects including shopping malls, multiplexes, commercial complexes, housing estates, hospitals, institutions	38	8 (a)
25.	Townships and Area development projects	39	8 (b)

12.5 Study team

ABC Techno Labs India Private Limited has carried out this Environmental Impact Assessment (EIA) study. The multi-disciplinary team included expertise in Environmental Impact Assessment, Air & Water pollution & Control measures, Noise Control measures, Ecology & bio-diversity, Land use, Geology, Environmental Chemistry and Socio-Economic planner. The team members involved in EIA study area.

S. No	Functional Areas	Name of the Expert/s	Signature
1.	WP	Vaishnavi Dhinakaran	
2.	EB	Abhik Saha	
3.	SHW		
4.	AP	Muthiah Mariappan	
5.	AQ	Vinod Kumar Gautam	
6.	RH		
7.	HG	Dr. Veezhinathan Subramaniyam	
8.	LU	Dr. N Rama Krishnan	
9.	SE		

10.	NV	Haneesh	
11.	SC	Hemambika Balakrishnan	

Team Members		
1.	Laxman Prasanth R	Environmental Engineer
2.	Mr. Robson Chinnadurai	Senior Chemist
3.	Mr. Selvakumar	Field Technician
4.	Mr. Venkateshwaralu	Field Technician

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National Accreditation Board for Education and Training

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Certificate of Accreditation

ABC Techno Labs India Private Limited, Chennai

ABC Tower, 400, 13th Street, SIDCO Industrial Estate, North Phase, Ambattur, Chennai 600098

*The organization is accredited as **Category-A** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –*

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including opencast/ underground mining	1	1 (a) (i)	A
2	Offshore and onshore oil and gas exploration, development & production	2	1 (b)	A
3	River Valley projects	3	1 (c)	A
4	Thermal power plants	4	1 (d)	A
5	Mineral beneficiation including pelletisation	7	2 (b)	A
6	Metallurgical industries (ferrous & non-ferrous)	8	3 (a)	A
7	Cement Plants	9	3(b)	A
8	Petroleum refining industry	10	4 (a)	A
9	Leather/skin/hide processing industry	15	4 (f)	A
10	Chemical fertilizers	16	5 (a)	A
11	Petro-chemical complexes	18	5 (c)	A
12	Petrochemical based processing	20	5 (e)	A
13	Synthetic organic chemicals industry	21	5 (f)	A
14	Distilleries	22	5 (g)	A
15	Integrated paint industry	23	5 (h)	B
16	Sugar Industry	25	5 (j)	B
17	Oil & gas transportation pipeline, passing through national parks/ sanctuaries/coral reefs / ecologically sensitive areas including LNG terminal	27	6 (a)	A
18	Airports	29	7 (a)	A
19	Industrial estates/ parks/ complexes/ Areas, export processing zones(EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes	31	7 (c)	A
20	Ports, harbours, break waters and dredging	33	7 (e)	A
21	Highways	34	7 (f)	A
22	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
23	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)	B
24	Building and construction projects	38	8 (a)	B
25	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated June 09, 2023 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no QCI/NABET/ENV/ACO/23/2795 dated July 11, 2023. The accreditation needs to be renewed before the expiry date by ABC Techno Labs India Private Limited, Chennai following due process of assessment.

Sr. Director, NABET
Dated: July 11, 2023

Certificate No.
NABET/EIA/2225/RA 0290

Valid up to
Nov 16, 2025

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to the QCI-NABET website.

Annexure - I

Ek Ped Maa Ke Naam Action Plan

Ek Ped Maa Ke Naam

Introduction

On World Environment Day, P.M started a campaign **'EK PED MAA KE NAAM'** and called upon everyone, in India and around the world, to plant a tree in the coming days as a tribute to our mother. P.M planted a tree in line with our commitment to protecting Mother Nature and making sustainable lifestyle choices. It would make we all very happy that in the last decade, India has undertaken numerous collective efforts which have led to increased forest cover across the nation. This is great for our quest towards sustainable development. It is also commendable how local communities have risen to the occasion and taken a lead in this. As per the Committee's suggestion of the specific and standard Terms of Reference (ToR), M/s. Tamil Nadu Power Generation Corporation Limited (TNPGCL) conducted the **'EK PED MAA KE NAAM'** tree plantation program at two schools, such as Sri R.K.C. Hr. Sec. School on 19.09.2024 and T.D.T.A. Hr. Sec. School on 26.09.2024. The initiative included 200 school students, and 50 saplings were planted at each school.

The plantation program photos are given below.


TREE PLANTATION


TREE PLANTATION


TREE PLANTATION


TREE PLANTATION


T.D.T.A. HR. SEC. SCHOOL
CHRISTIANAGARAM
TREE PLANTATION


TREE PLANTATION


TREE PLANTATION

Annexure - II

NIO Goa Report

Modelling study for the intake and outfall of cooling water system for super critical thermal power project at Udangudi, Tuticorin Dist., Tamil Nadu

Sponsored by
Udangudi Power Corporation Limited, Chennai

August 2009

National Institute of Oceanography
(Council of Scientific & Industrial Research)
Dona Paula - 403 004
Goa

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PROJECT TEAM

MT Babu	Project Leader
P Vethamony	
V Sanil Kumar	
K Sudheesh	
R Manimurali	
PS Pednekar	
Siddharth Ghatkar	
R Rashmi	
Jyoti Khalap	

EXECUTIVE SUMMARY

- M/s Udangudi Power Corporation Ltd, (UPCL) Chennai, Ltd., is planning to develop a power project to generate 2x800 MW power at Udangudi in Tuticorin Dist., Tamil Nadu. This project proposes to draw sea water for cooling purpose and the warm water from the cooling plant will be discharged into a suitable location off Udangudi. M/s UPCL approached NIO to identify a suitable location off Udangudi for installing the marine outfall and intake facilities. Accordingly, NIO has taken up this project.
- This report describes the hydrodynamics, temperature and salinity of the coastal waters off Udangudi. The field data available for the region has been used to setup the numerical model for simulating hydrodynamics and dispersion of thermal and saline plumes.
- The currents observed off Tuticorin and Kulasekarapattinam exhibited northeastward and southwestward directions, alternating with tidal reversals. A maximum speed of 0.27 m/s was observed during the measurement period.
- Surface elevations at Tuticorin and Kulasekarapattinam have been predicted using the four major constituents M2, S2, K1 and O1, available for the tide gauge stations at Tuticorin and Kulasekarapattinam. The maximum water level obtained during spring tide is 1.19m.
- MIKE21 Model has been used to simulate water levels, currents and thermal plume dispersion off Udangudi during September 2008. Model validation experiments showed that surface elevations are in good agreement with the tides predicted for Udangudi and the components of currents showed good agreement with the measured values.
- Three experimental locations were tested for fixing the outfall positions: outfall-1 is located at 250m offshore, outfall-2 is at 360m offshore and outfall-3 is 1060, respectively at depths of 3.80m, 3.90m and 5. 0m below CD. Based on model results it is recommended that outfall-3 is suitable for warm water discharge and the intake-2 located off 2050m from the shore line is suitable for drawing sea water.

- The intake pipeline corridor extends to the sea 2050m off the coastline. The intake and outfall pipeline will travel offshore along the sea bed. Though the discharge temperature will be nearly the same as the ambient sea water temperature, as an extreme case an outfall temperature of +5°C above ambient temperature is considered with a source salinity of 50 psu and maximum flow rate of 13,500 m^3/h for model studies.
- Under the prevailing currents, the advection of warm water released from the proposed outfall-3 is southwestwards and northeastwards, parallel to the shoreline, associated with reversing tidal currents and it did not exhibit any recirculation towards the intake-2 location.
- Model results indicate that impact of high saline, warm water released into the coastal sea is very negligible as the net excess temperature at the outfall-3 is 1.46°C and excess salinity 4.82 psu. The warm and high salinity waters are confined to a radial distance of 200 m from the discharge location and there will not be any change in the water quality in the coastal environment.
- No recirculation of warm water has been noticed during spring tide, neap tide, calm period, and northeastward current or southwestward current except minor advection of saline waters (+2 PSU) for brief periods during spring tide.

1 Introduction

1.1 Background

M/s Udangudi Power Corporation Limited (UPCL), Chennai, is planning to develop 2X800 MW coal-based super critical thermal power plant at Udangudi in Tuticorin Dist., Tamil Nadu. It is a joint venture project of Tamil Nadu Electricity Board (TNEB) and Bharat Heavy Electricals Limited (BHEL). The project proposes to have a cooling plant for which sea water will be drawn from an offshore location using an intake pipeline. The warm water from the cooling plant will be discharged into the coastal sea at a suitable depth off Udangudi coast. M/s Udangudi Power Corporation Limited approached NIO to identify suitable locations off Udangudi for installing the marine outfall and intake facilities. Accordingly, NIO has taken up this project to find out whether (i) there would be sufficient dilution of thermal and effluent discharges near the discharge region and (ii) any possibility of recirculation of the discharged warm water around the intake point. We have used the marine environmental data available for the Tuticorin coastal region as well as the bathymetry survey data of the intake-outfall corridor provided by M/s UPCL to setup the model domain and grid file required for mathematical modelling of the region.

1.2 Objectives

The objectives of the study are as follows:

a) to find out a suitable location for placing a marine outfall in order to facilitate the release of warm and high saline water into the coastal sea off Udangudi, Tuticorin.
b) to find out a suitable location for placing the marine intake point in such a way that there is no recirculation from the outfall towards intake point.

1.3 Scope of work

i. Compilation of available oceanographic data on physical characteristics of the coastal waters off Udangudi, pertaining to this project at specified locations between Tuticorin and Kulasekarapattinam.
ii. Identification of a suitable location for the proposed outfall.
iii. Modelling study includes the following components:

a) Flow modelling – numerical simulation of the flow patterns in the project area over a horizontal grid covering over 10 Km^2 to generate currents in the study area
b) Thermal plume modelling –simulation of thermal plume around the proposed outfall location
c) Saline plume modeling – simulation of saline plume around the proposed outfall location

d) Optimization of the outfall distance from the coast and from the intake location using recirculation studies

The study envisages conducting numerical experiments to decide the distance between the outfall and intake locations in such a way that the warm water gets dispersed within a reasonable distance from the outfall location and no recirculation takes place at the intake location.

2 Physical aspects of coastal waters

Detailed site-specific information on physical characteristics of the prevailing marine environment is a pre-requisite to set up marine facilities such as sea water intake and outfall and to study recirculation, if any. The field data collected off Tuticorin during September 2008, covering both spring and neap phases of the tide have been used in the study for estimating the currents prevailing in the region during calm season of the year. Calm season is specifically selected to study the dispersion of the warm/saline water discharge because of less advection/dispersion rates and maximum impact on coastal waters. The area of study and locations of marine facilities are shown in Fig.1a & 1b.

2.1 Predicted tides

Surface elevations at Kulasekarapattinam and Tuticorin have been predicted using the harmonic constituents available for these tide gauge stations. The surface elevations have been predicted using the four major constituents M2, S2, K1 and O1 for September 2008.

These predicted tides are applied to run the large scale model to simulate hydrodynamics of the coastal region, lying between Kulasekarapattinam (located to the south of Udangudi) and Tuticorin, Fig. 1a. The surface elevations required at the offshore boundaries of the high-resolution domain (Fig. 1b) were extracted from the model results of the large model domain and these surface elevations are applied to drive the high resolution model. The water level variations prescribed along the southern and northern boundary of the model are given in Fig. 2.

2.2 Bathymetry

Hydrographic survey data supplied by M/s UPCL has been used to prepare bathymetry grid required for modelling the hydrodynamics and temperature-salinity plumes. The bathymetry data required for the model has been obtained from the NHO hydrographic charts (Naval Hydrographic Office, Dehra Dun) and C-MAP hydrographic charts. The depth contours given in these hydrographic charts, are digitized and the digital bathymetry maps are prepared in UTM coordinates. Later, this bathymetry has been updated with C-MAP hydrographic charts (DHI, Denmark) and survey data supplied by UPCL. For setting up the model, measured bathymetry of the study area, initial and boundary conditions of water level variations in the model domain and at the boundaries have been used. Atmospheric parameters such as wind speed, wind direction, air temperature and humidity are needed to estimate the heat flux. Initial and boundary temperature conditions, source and sink characteristics and locations, discharge properties (quantity, flow rate, temperature), heat dissipation, decay and heat exchange are also provided as input parameters.

2.3 Model domain and input parameters

In order to simulate currents off Tuticorin – Kulasekarapattinam coastal region, MIKE21 nested hydrodynamic model was set up using tidal elevations along the open boundaries. MIKE21 modelling software has been applied in EIA projects related to industrial and tourism development activities in the coastal waters and to deduce conclusions, which are helpful for sustainable planning development of the marine and coastal environment. MIKE21 NHD Flow model is a 2-D, hydrodynamic (HD) modeling system used for the simulation of currents, water level variations, water quality, temperature-salinity fields and sediment transport in lakes, estuaries, bays, coastal areas and seas. Specific modules used in the present study are the nested hydrodynamics (NHD) module and Advection-Dispersion module (AD). HD results form the basic requirement to run all other modules as the hydrodynamic properties of the system influence all other processes in the marine environment. MIKE21 can accommodate high-resolution grid for simulation of water level variations, currents and all other related parameters. It solves 2-dimensional shallow water momentum and continuity equations on a vertically integrated and incompressible mode. The vertical acceleration of the flow is assumed to be much smaller than the pressure gradient.

A large scale model was used to simulate currents and water level variations between Kulasekarapattinam and Tuticorin. The NHD large scale model with 150m x 150 m square grid is used to simulate water level variation and currents present in the study area. Further, a Cartesian coordinate system is used in the model with high resolution grid (50m x 50m) to accommodate the proposed intake and outfall system. Both the model domains were used for simulation. The large scale model domain used for simulation is given in Fig. 1a.

Case – 1 : ***Larger model domain***

The nearest coastal tidal stations, situated to the south and north of this domain are Kulasekarapattinam and Tuticorin, respectively. These tidal stations are separated by a distance of ~49 km; this large area (30 X 49 sq. km) was divided into 150 x 150 m grids. The depth values have been interpolated to provide at the grid points. A Cartesian coordinate system has been selected with x-axis = 30 km and y-axis = 49 km, thereby dividing the model domain into 200 X 325 square grids ($\Delta x = \Delta y = 150$m). The offshore boundary extends upto 28.65 km along the south and 17.85 km along the north. The model domain has a maximum depth of 23.5 m.

Case -2: High resolution model domain

The inner model domain includes the study area, off Udangudi with high resolution bathymetry grid of 50m x 50m. The model domain includes an area of ~16.20 X 10.40 sq. km, and it has been selected in such a way that the proposed landfall, outfall and intake points are located in the central part of the model domain. A Cartesian coordinate system has been selected with x-axis = 16.20 km and y-axis = 10.40 km, thereby dividing the model domain into 325 X 215 square grids ($\Delta x = \Delta y = 50$ m). The offshore boundary extends

up to 15.5 km along the south and 8.5 km along the north. The model domain has a maximum depth of 19.95 m. The model domain and the bathymetry are shown in Fig.1b.

In addition to the surface elevations, wind data available for the region also have been used to drive the model hydrodynamics. Surface elevations at Kulasekarapattinam (78° 3′ E: 08° 24′N) in the south and Tuticorin (78° 10′ E: 08° 48′ N) in the north have been predicted using the harmonic constituents available for these tide gauge stations and using these values the tides along the open boundary are generated for the period 18 September – 3 October 2008. MIKE21 toolbox utilities are used for predicting the surface elevations from major constituents such as M2, S2, K1 and O1 at these coastal tidal stations. The variations of predicted water levels at Kulasekarapattinam and Tuticorin are given in Fig. 2 and the maximum and minimum of predicted water levels in Table1. The tide elevations required along the open eastern model boundary are interpolated and used to drive the model. The model was run for a period of 15 days. From these results, surface elevation and velocity components have been generated.

Table 1. Maximum and minimum values of predicted water levels at Kulasekarapattinam and Tuticorin for during September

Station	Water level (m) for September 2008	
	Min	Max
Tuticorin	0.26	1.19
Kulasekarapattinam	0.22	1.10

Table 2. Maximum and minimum values of measured and model simulated water level variations during 18 September – 3 October 2008

Type of data	Water level (m)	
	Min	Max
Measured	0.14	1.16
modelled	0.27	1.18

3 Results

3.1 Model validation

The model runs made for the period 18 September – 3 October 2008 have been used for the validation of surface elevation and velocity components.

3.1.1 Tides

A comparison between measured and model simulated tides is given in Fig. 3. The measured and model simulated tide elevations vary from 0.14 to 1.16m, and 0.27 to 1.18m respectively during 18 September – 3 October 2008. Measured and model simulated high and low water levels are given in Table 2. The model results show good agreement with the measurements.

3.1.2 Currents

In order to understand the zonal and meridional component of the currents in the Gulf of Mannar, the measured currents were resolved into U (east-west) and V (north-south) components. Comparison between measured and model simulated current velocity components and current speed is given in Figs. 4 & 5. The maximum and minimum of east-west (U) and north-south (V) velocity components and current speed of measured and model are given in Table 3.

Measured currents off Tuticorin have been used for validation of the modelled currents. The measured and model simulated maximum current speeds are 0.26 and 0.27 m/s. The measured U and V velocity components vary from -0.15 to 0.21 m/s and -0.14 to 0.20 m/s. The corresponding model values are in the range of -0.26 to 0.13 m/s and -0.14 to 0.14 m/s. The comparison shows that model predicted values match very well with the measured values. This gives the confidence to use these hydrodynamic model results further for thermal and saline plume modeling.

Results obtained from the model results show reversal of currents associated with the tides. Typical flood currents present at 0000 h on 24 September 2008 is shown in Fig. 6 and typical ebb currents at 0300 h on 30 September is shown in Fig. 7.

Table 3. Comparison between measured and modeled velocity components during 18 September – 3 October 2008.

Parameter	Measured (m)		Modelled (m)	
	Min	Max	Min	Max
U-Component	-0.15	0.21	-0.26	0.13
V-Component	-0.14	0.20	-0.14	0.14
Speed	0.00	0.26	0.00	0.27

Table 4. Details of discharge quantity and locations of outfall/intake points

	Discharge/intake Quantity (m^3/h)	Location Lat/Long	Distance from shore	Depth (m) -CD
Outfall-1	13,500	8° 26.28'N 78° 4.85'E	250m	-3.80
Outfall-2	13,500	8° 26.22'N 78° 4.88'E	360m	-3.90
Outfall-3	13,500	8° 25.95'N 78° 5.157'E	1060m	-5.00
Intake-1	21,000	8° 25.70'N 78° 5.43'E	1600m	-5.40
Intake-2	21,000	8° 25.548'N 78° 5.511'E	2050 m	-5.40

3.2 Simulation of Thermal and saline plume.

MIKE 21 Hydrodynamic model (HD) has been used to study the circulation of sea water discharged into coastal waters off Udangudi. Three experimental outfall locations have been tested. Outfall-1 is placed at a depth of -3.80m, outfall-2 3.90m and Outfall-3 is 5.0m. These locations are respectively located at 250m, 360m and 1060 m offshore. The intake point-1 is at 5.40m below CD, located 1600m offshore and intake-2 below -5.40 m located at 2050 m from the landfall point. The locations of intake and outfall points are shown in Fig.1b and details of intake, effluent quantities and position coordinates are given in Table 4.

MIKE21 advection-dispersion (AD) has been used to simulate temperature of the warm water discharge at the outfall location. Though the temperature of the discharged water will be almost same as the ambient seawater temperature, an extreme case scenario has been modelled keeping the source temperature 33.5^0C, .i.e 5^oC above the ambient temperature of 28.5ºC. Keeping these conditions, thermal plume simulation experiments have been carried out to simulate the plume advection-dispersion pattern for outfall locations, i.e outfall-1 and outfall-2. The thermal plume dispersion pattern obtained at the outfall-3 during neap and spring currents are shown in Figs. 8a and 9a. An average increase of 2.4°C is noticeable in temperature at the outfall-1, 1.96°C at outfall-2 and 1.46°C at outfall-3. Under the prevailing currents, the plume exhibited a net northeastward advection and the maximum temperature increase is confined to an area of ~200 sq.m around the outfall. The temperature variation

around the both the intake-1 and intake-2 are shown in Fig. 8c and the salinity variations are shown in Fig 9c.

Salinity plume has been modeled assuming a source salinity of 50.0 psu. The ambient salinity measured off Tuticorin is 34.0 psu. Model runs have been carried out and the plume patterns obtained during neap and spring currents, and maximum salinity events are shown in Figs. 8b & 9b. An average increase of 8.6 psu is seen in the salinity at outfall-1 and 6.6 psu at outfall-2. However at outfall-3 , due to more dilution, the mean excess salinity reduced to 4.82 psu and mean excess temperature to 1.46°C. The results showed that both the plumes plume exhibited a net northeastward or southwestward advection under the northeasterly or southwesterly currents respectively. Therefore, outfall-3 is suitable for warm water release as the plume is away from the shoreline and there is no recirculation towards the intake point-2 located at 2050 m from the shoreline.

4. Summary and conclusions

The outfall/intake pipeline corridor considered for this study extends to the sea upto 2050m offshore, normal to the coastline. The pipeline will traverse offshore along the sea bed and the impacts, if any, will be associated with laying of the pipelines onshore and offshore areas only. Though the temperature of the discharge will be nearly the same as the ambient sea water temperature, as an extreme case an outfall temperature of +5°C above ambient

temperature is considered with a source salinity of 50 psu with maximum flow rate of 13,500 m^3/h.

Model results indicate that the water released into the sea exhibited an excess temperature of 1.46ºC and an excess salinity of 4.82 psu around outfall-3. The high salinity and temperature fields are confined to an area of 200 sq.m around the outfall and the spreading and advection of the warm, high saline plume is in northeast-southwest direction, parallel to the coastline. When the warm, high saline water is released at outfall-1, the model results indicate that there is a possibility of the discharge come within the reach of the shoreline. This can be avoided by choosing the location at outfall-3. The warm/saline water discharge attained higher dilution at outfall-3 which is reflected in lowering of ex temperature

Model results suggest that there is no re-circulation of warm water discharged from the outfall area into the intake point during spring tide, neap tide or calm period and high salinity and high temperature events. As the influence of warm/saline water is confined to a very small region, there will not be any change in the water quality in the coastal environment in the vicinity of the outfall.

Therefore, the outfall-3 location situated at 1060m from the shore is recommended for discharge of the warm water. The intake point (intake-2) located at 2050m from the coast would be suitable, as there is no recirculation of the warm water from outfall-3 towards this point and also this location has sufficient water depth of 5.4m.

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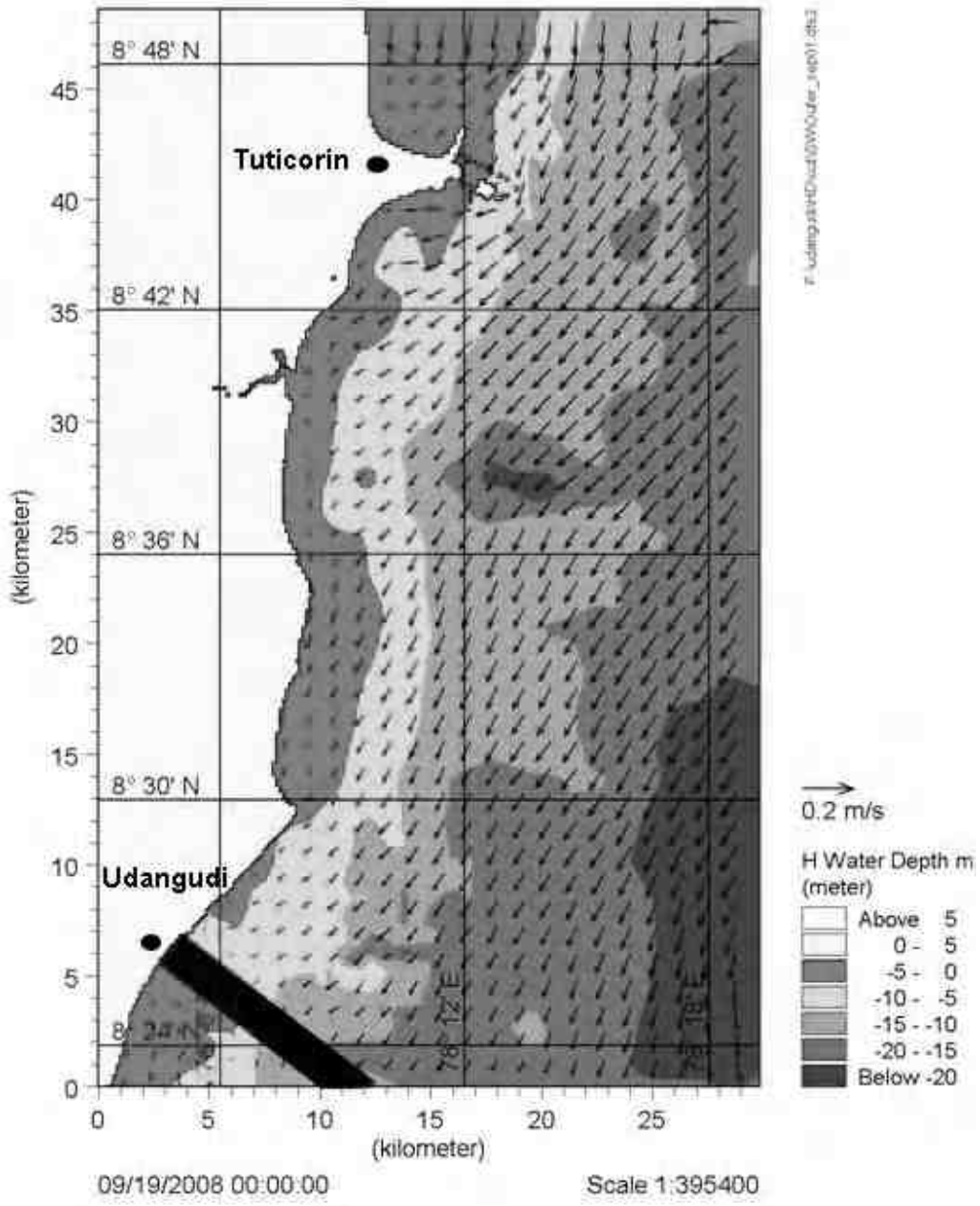

Fig.1a. Large Model domain with depth contours and typical current pattern between Tuticorin (in the north) and Kulasekarapattinam lying along the southern boundary. (Tracks indicate the lines of bathymetry survey conducted off Udangudi)

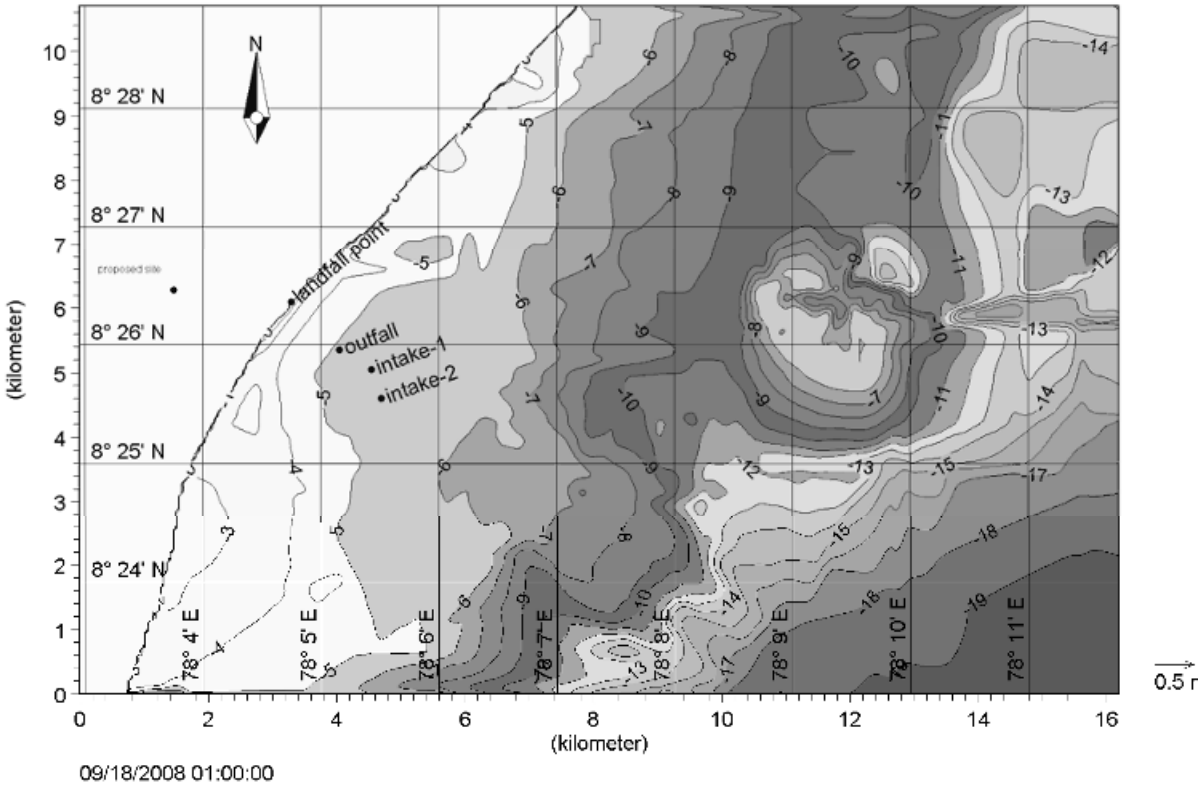

Fig.1b. Proposed Udangudi Power Corporation Ltd (UPCL) project site and outfall-intake locations.

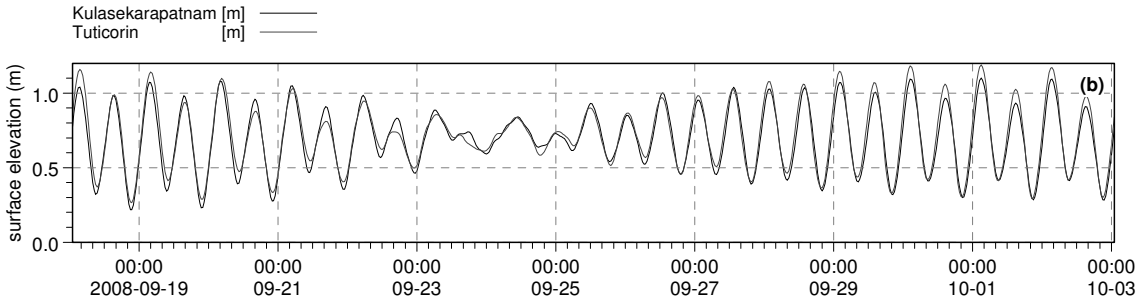

Fig. 2. Input tides applied at the open boundaries (Kulasekarapattinam and Tuticorin) during September 2008.

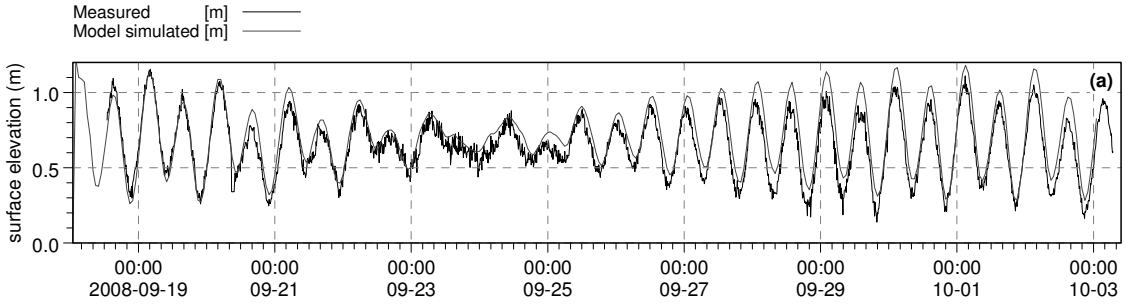

Fig. 3. Comparison between measured tides and model simulated tides at Tuticorin.

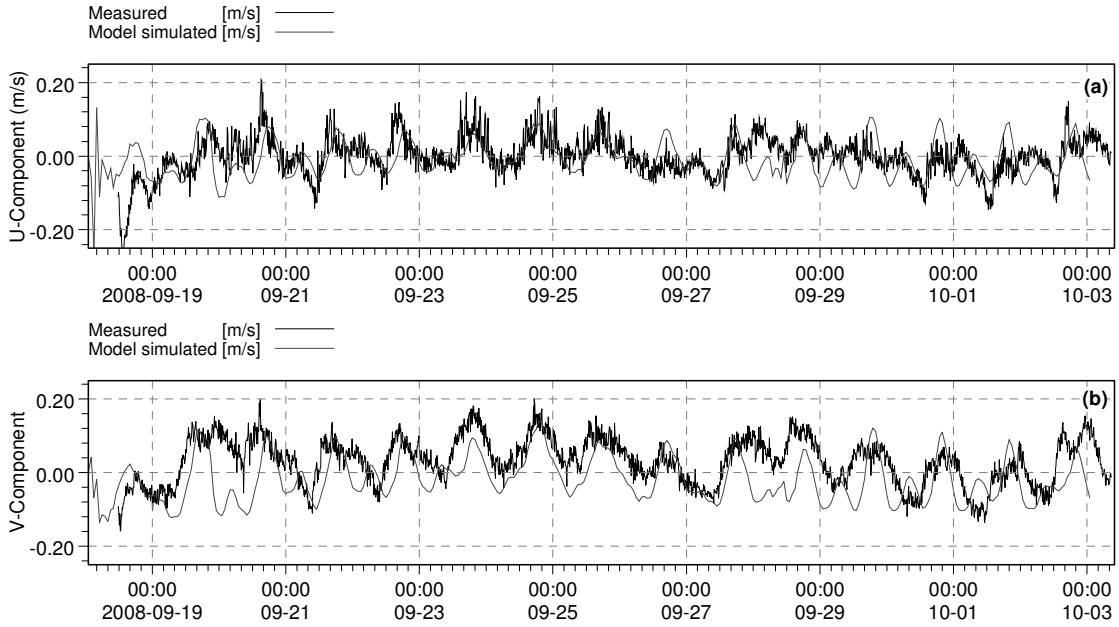

Fig. 4. Comparison between measured and model simulated (a) crossshore and (b) alongshore current velocity components off Tuticorin

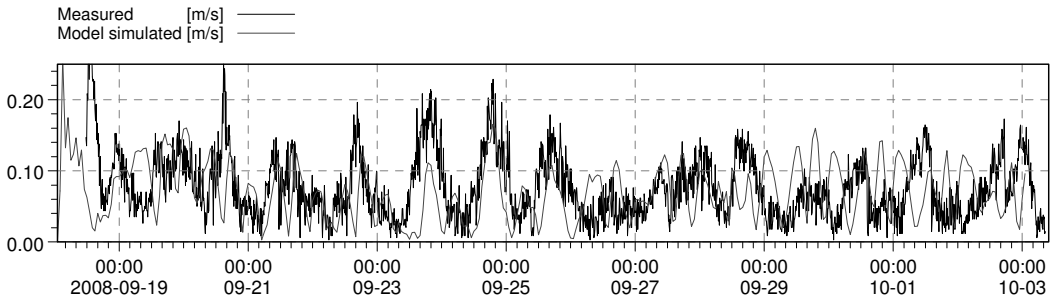

Fig. 5. Comparison between measured and model simulated current speeds off Tuticorin

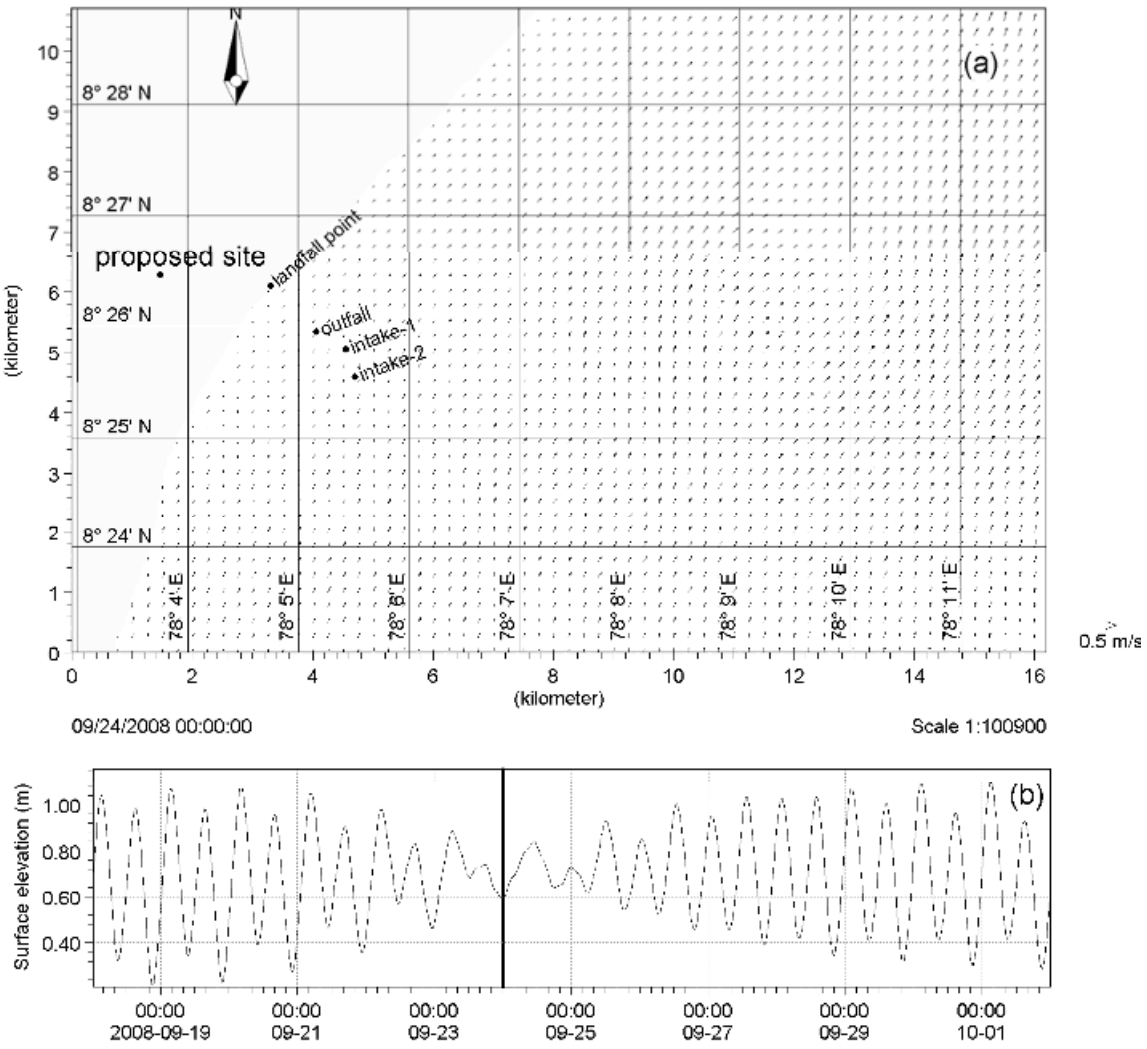

Fig. 6 (a) Typical current pattern during neap tide and (b) surface elevation off Udangudi.

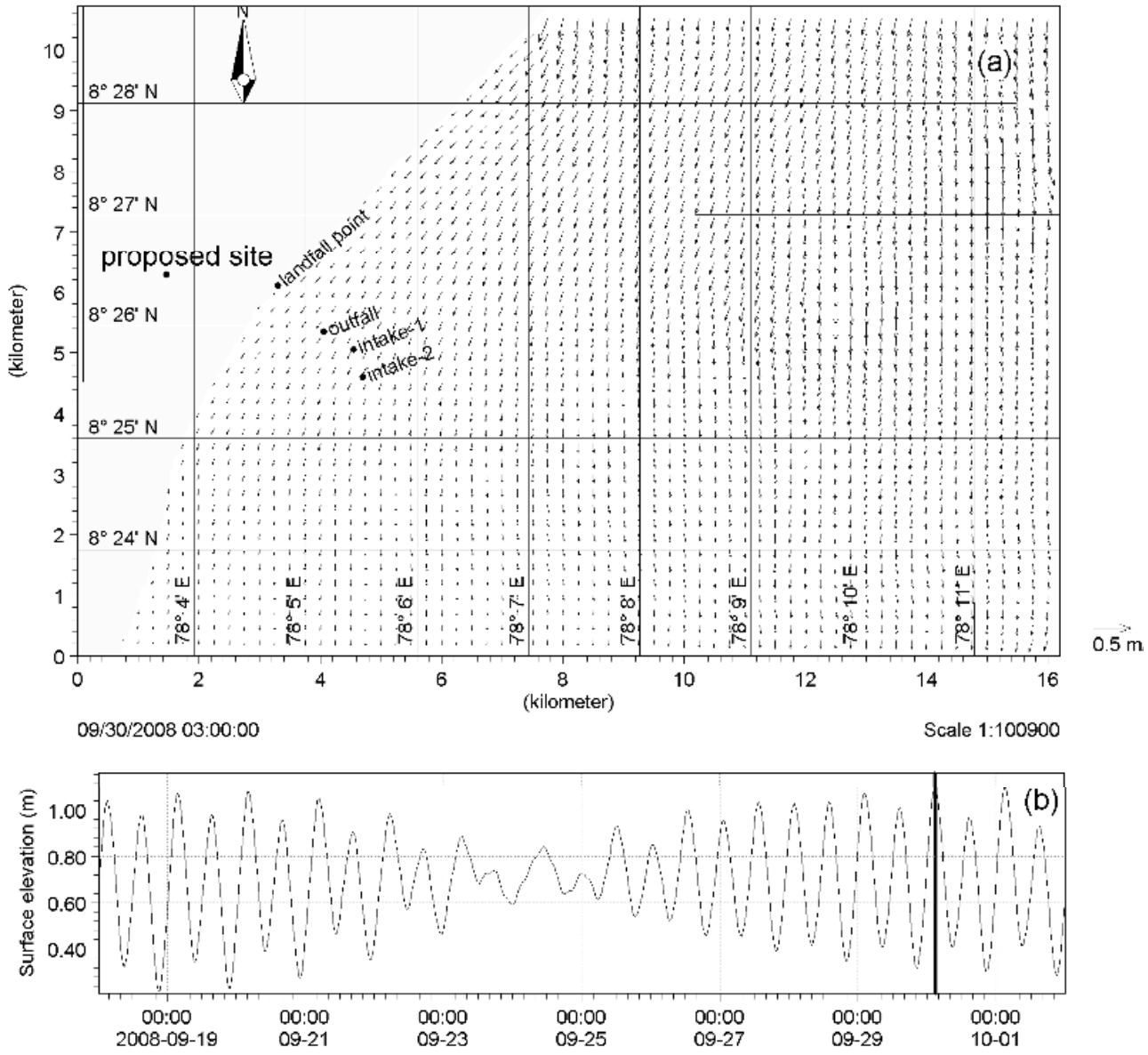

Fig. 7 (a) Typical current pattern during spring tide and (b)surface elevation off Udangudi.

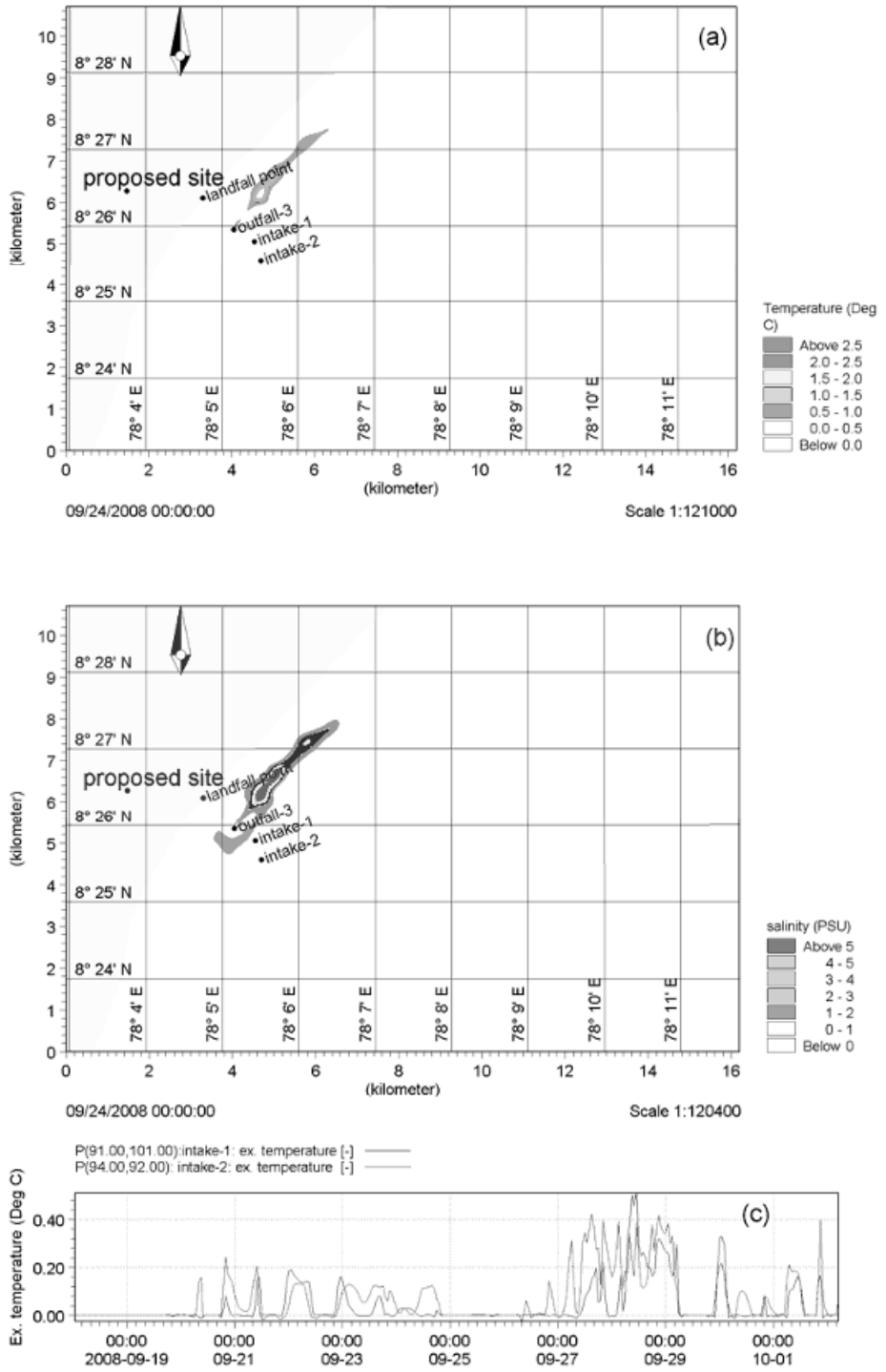

Fig. 8. Spreading of (a) thermal plume and (b) salinity plume around outfall-2 during neap currents, and (c) the variation of excess temperature at intake-1 and intake-2 during the simulation period.

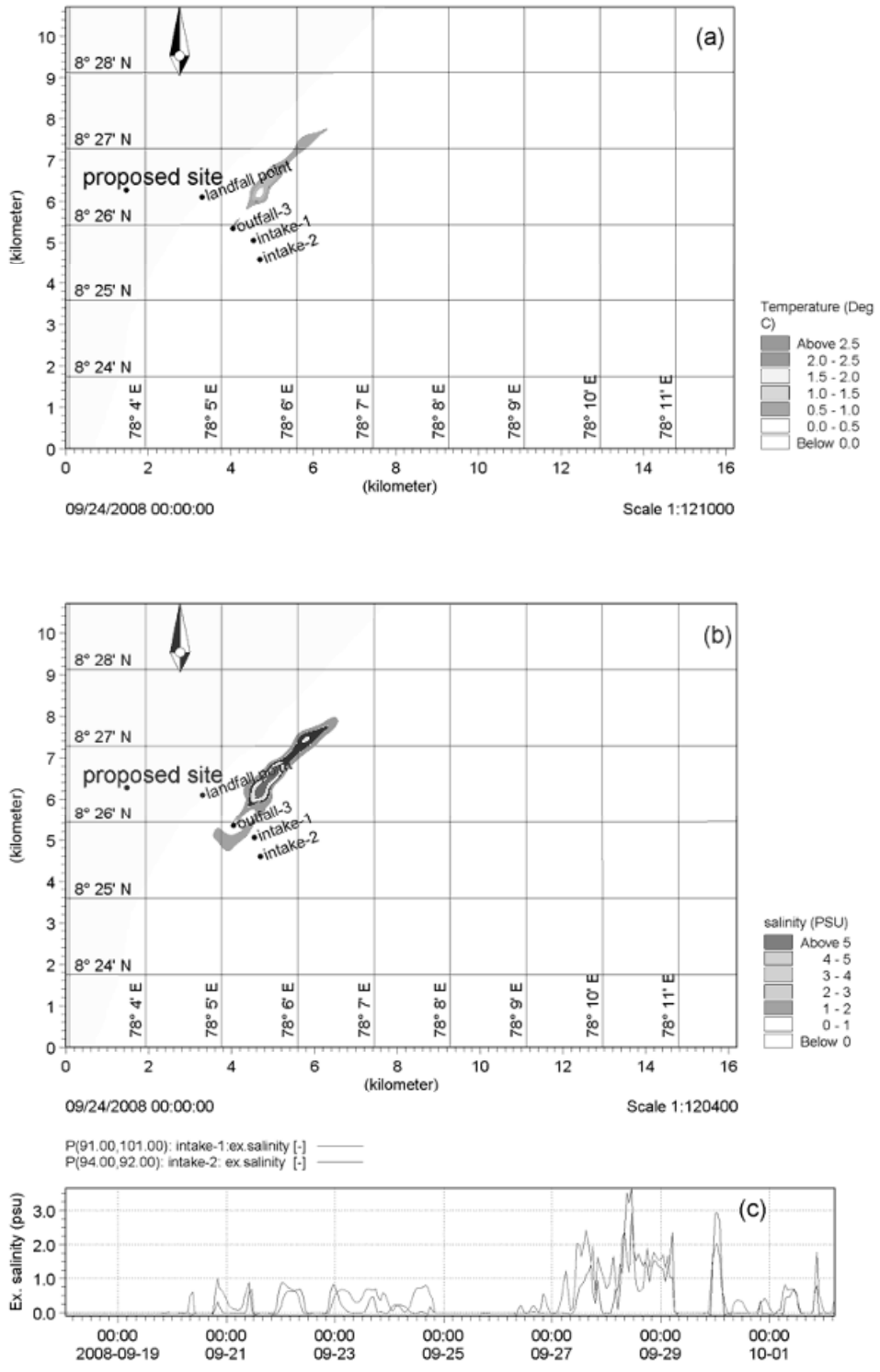

Fig. 9. Spreading of (a) thermal plume and (b) salinity plume around outfall-2 during spring currents, and (c) the variation of excess salinity at the intake-1 and intake-2 during the simulation period.

Annexure - III

Fly Ash Lifting Agencies

EMC-I ✓	EMC-II
EE-	-
EA/CHD	APO/

SE/C/P&E 24/9/24

eecemcell

1076
25 SEP 2024

::TAMIL NADU POWER GENERATION CORPORATION LIMITED::

O/o Superintending Engineer/
Civil Designs/Chennai-2.

U. O. to SE/C/P&E:

U. O. No. SE/CD/EE-2/AEE-4/F.FBM Tender Agt./D.221/24,Dt.26.07.2024.

Sub: FAM – Udangudi Super Critical Thermal Power Project (2x660MW) – Fresh EC to be obtained – Details to be submitted to MOEF & CC, New Delhi- Fly Ash Lifting Agencies details furnished – Reg.

Ref: 1.U.O.No.SE/C/P&E/EE/EMC-1/F. Udangudi STPP/D.438/24, dt.25.07.2024.

****

With reference to the above, the details of fly ash lifting agencies in respect of all Thermal Power Stations for the period 2022-25 are enclosed herewith for reference.

Encl: As above (5 sheets)

Superintending Engineer/
Civil Designs

Copy submitted to the Chief Engineer/MTS & GTS /Chennai-2.

LIST OF ASH CONTRACTS AWARDED IN **METTUR THERMAL POWER STATION -I (T.S. No. 01/2021-22 of SE/CD &HP)** FOR THE PERIOD OF THREE YEARS (EXTENDABLE UP YO 5 YEAPS) THROUGH E-TENDER CUM AUCTION VIA NIC PORTAL UNDER FORWARD BIDDING METHOD **2022 to 2025)**

Sl.No.	Name of Company Awarded
1	M/s.Malabar Cements Ltd.
2	M/s.ACC Ltd.
3	M/s.India Cements Ltd.
4	M/s.Chettinad Cements Ltd.
5	UltraTech Cement Ltd.(Unit: Reddipalayam Cement Works)
6	M/s.Renattus Procon Pvt. Ltd.
7	M/s.Malampuzha Cements & Chemicals Pvt. Ltd.

LIST OF ASH CONTRACTS AWARDED IN **METTUR THERMAL POWER STATION -II (T.S. No. 02/2021-22 of SE/CD &HP)** FOR THE PERIOD OF THREE YEARS (EXTENDABLE UP YO 5 YEARS) THROUGH E-TENDER CUM AUCTION VIA NIC PORTAL UNDER FORWARD BIDDING METHOD **(2022 to 2025)**

Sl.No.	Name of Company Awarded
1	M/s.India Cements Ltd.
2	M/s.Malabar Cements Ltd.,
3	M/s.Visaka Industries Ltd.,
4	M/s.UltraTech (Reddipalayam Cement Works)
5	M/s. Renaatus Procon (P) Ltd.
6	M/s.ACC Limited

LIST OF ASH CONTRACTS AWARDED IN **NORTH CHENNAI THERMAL POWER STATION -I (T.S. No. 03/2021-22 of SE/CD&MP)** FOR THE PERIOD OF THREE YEARS (EXTENDABLE UP YO 5 YEARS) THROUGH E-TENDER CUM AUCTION VIA NIC PORTAL UNDER FORWARD BIDDING METHOD **(2022 to 2025)**

Sl.No.	Name of Company Awarded
1	M/s.The KCP Ltd.
2	M/s. AshTech India Pvt. Ltd.
3	M/s.The Ramco Cements Ltd.
4	M/s.India Cements Ltd.
5	M/s.Zuari Cements
6	M/s.UltraTech Cements Ltd. (Reddipalayam)
7	M/s.UltraTech Cements Ltd. (Andhra Pradesh)
8	M/s.UltraTech Cements Ltd. (Arakkonam Cement Works)
9	M/s.UltraTech Cements Ltd. (Balaji Cement Works)
10	M/s. Malampuzha Cements & Chemicals Pvt. Ltd.,
11	M/s.HIL Ltd.
12	M/s.Dalmia Cements (Bharat) Ltd.(Ariyalur)

LIST OF ASH CONTRACTS AWARDED IN **TUTICORIN THERMAL POWER STATION (T.S. No. 05/2021-22 of SE/CD&MP)** FOR THE PERIOD OF THREE YEARS (EXTENDABLE UP YO 5 YEARS) THROUGH E-TENDER CUM AUCTION VIA NIC PORTAL UNDER FORWARD BIDDING METHOD **(2022 to 2025)**

Sl.No.	Name of Company Awarded
1	M/s. India Cements Ltd.,
2	M/s. Ultra tech (Reddipalayam Cements Works,
3	M/s. Chettinad Cements Corp.(P) Ltd.,
4	M/s. Dalmai Cements (Bhara) Ltd Dalmiapuram
5	M/s. Sundar PozzoMalabar Cement Ltd.,

LIST OF ASH CONTRACTS AWARDED IN **NORTH CHENNAI THERMAL POWER STATION - II (T.S, No. 04/2021-22 of SE/CD&HP)** FOR THE PERIOD OF THREE YEARS (EXTENDABLE UP YO 5 YEARS) THROUGH E-TENDER CUM AUCTION VIA NIC PORTAL UNDER FORWARD BIDDING METHOD **(2022 to 2025)**

Sl.No.	Name of Company Awarded
1	M/s.HIL Ltd.
2	M/s. AshTech India Pvt. Ltd.
3	M/s.India Cements Ltd.
4	M/s.Ziani Cements
5	M/s.UltraTech (Arakkonam)
6	M/s.Chettinad Cements Corporation Ltd.
7	M/s.UltraTech (Andhra Pradesh)
8	M/s.UltraTech (Reddipalayam Cement Works)
9	M/s.UltraTech (Balaji Cement Works)
10	M/s.Dalmia Cements (Bharat) Ltd.(Ariyalur)
11	M/s.Dalmia Cements (Bharat) Ltd.(Dalmiapuram)
12	M/s.Ramco Cements Ltd.
13	M/s.The KCP Ltd.
14	M/s. Renaatus Procon (P) Ltd.
15	M/s.Methra Industries (I) Pvt. Ltd.
16	M/s.Sundar Pozzo

26/07/22

Superintending Engineer/Civil Designs

Annexure - IV

Baseline Report

ABC Techno Labs India Private Limited

ABC TOWER #400, 13th Street, SIDCO Industrial Estate - North Phase,
Ambattur, Chennai - 600 098, Tamilnadu, INDIA.
Ph : +91-44-2625 7788 / 99, +91 94442 60000 / 95661 87777
Email: lab@abctechnolab.com / Web: www.abctechnolab.com

ABC Techno Labs™
India Private Limited
Quality Uncompromised

TC - 5770

(An ISO : 9001, ISO : 14001, ISO : 45001 & ISO : 22000 Certified Company)

Accredited by NABL vide TC-5770, NABET / QCI, Approved by FSSAI, Recognised by MoEF&CC, BIS, APEDA, IOPEPC, Tea Board India

ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/AAQ1
Sample drawn by	:	ABC Techno Labs India Private Limited
Sample description	:	Ambient Air Quality Monitoring -24 Hourly Basis Twice a week for three Month
Location of sampling	:	AAQ1 - Project Site
Project name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 27-05-2024
Report date	:	05-06-2024

Parameter	PM 2.5 µg/m³	PM 10 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	O_3 µg/m³	NH_3 µg/m³	Lead µg/m³	Benzene µg/m³	B[a]P ng/m³	Ni ng/m³	As ng/m³
Test Method	EPA 40 CFR P50	IS: 5182 P23	IS: 5182 P2	IS: 5182 P6	IS: 5182 P10	ABCTL/ SOP/A/ 07	ABCTL/S OP/A/05	IS: 5182 P22	IS: 5182 Part 11	IS: 5182 Part 12	USEPA Method IO- 3.2	ABCTL/ SOP/A10
Date of Monitoring												
04.03.2024	21	46	6.9	13.9	0.11	10.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
07.03.2024	27	57	7.8	15.5	0.13	11.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
11.03.2024	25	52	7.9	14.4	0.1	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
14.03.2024	27	57	6.8	13.1	0..19	9.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.03.2024	25	53	6.7	14.7	0.11	10.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
21.03.2024	23	48	8.1	15.8	0.13	11.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
25.03.2024	26	55	7.5	16.6	0.14	12.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
28.03.2024	24	50	8.9	12.9	0.15	8.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
01.04.2024	27	57	6.7	13.7	0.17	9.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
04.04.2024	25	53	7.5	15.4	0.1	12.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.04.2024	22	46	5.9	15.9	0.12	12.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
12.04.2024	26	56	6.7	14.2	0.18	11.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
15.04.2024	22	46	7.4	13.3	0.13	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.04.2024	26	55	8.3	16.2	0.17	12.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.04.2024	23	49	8.1	15.5	0.21	11.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
26.04.2024	26	53	7.9	14.9	0.12	12.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
03.05.2024	27	57	6.3	15.7	0.18	13.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
06.05.2024	24	51	8.7	14.1	0.14	11.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.05.2024	27	58	7.4	13.5	0.18	10.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
13.05.2024	22	46	6.9	13.9	0.13	11.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
16.05.2024	26	53	8.2	15.5	0.11	12.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.05.2024	22	47	8.1	12.9	0.19	8.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
23.05.2024	26	54	7.5	15.8	0.14	9.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
27.05.2024	21	48	6.9	13.1	0.12	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
Min	21	46	5.9	12.9	0.1	8.9	-	-	-	-	-	-
Max	27	58	8.9	16.6	0.21	13.1	-	-	-	-	-	-
Mean	24.58	51.96	7.46	14.60	0.14	11.07	-	-	-	-	-	-
98 percentile	27	57.54	8.808	16.416	0.2012	12.87	-	-	-	-	-	-
CPCB Standard	60	100	80	80	2	100	400	1	5	1	20	6

BDL-Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs India Private Limited

ABC TOWER #400, 13th Street, SIDCO Industrial Estate - North Phase,
Ambattur, Chennai - 600 098, Tamilnadu, INDIA.
Ph : +91-44-2625 7788 / 99, +91 94442 60000 / 95661 87777
Email: lab@abctechnolab.com / Web: www.abctechnolab.com

ABC Techno Labs™
India Private Limited
Quality Uncompromised

TC - 5770

(An ISO : 9001, ISO : 14001, ISO : 45001 & ISO : 22000 Certified Company)

Accredited by NABL vide TC-5770, NABET / QCI, Approved by FSSAI, Recognised by MoEF&CC, BIS, APEDA, IOPEPC, Tea Board India

ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/AAQ2
Sample drawn by	:	ABC Techno Labs India Private Limited
Sample description	:	Ambient Air Quality Monitoring -24 Hourly Basis Twice a week for three Month
Location of sampling	:	AAQ 2: Thandavankadu
Project name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 27-05-2024
Report date	:	05-06-2024

Parameter	PM 2.5 µg/m³	PM 10 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	O_3 µg/m³	NH_3 µg/m³	Lead µg/m³	Benzene µg/m³	B[a]P ng/m³	Ni ng/m³	As ng/m³
Test Method	EPA 40 CFR P50	IS: 5182 P23	IS: 5182 P2	IS: 5182 P6	IS: 5182 P10	ABCTL/SOP/A/07	ABCTL/SOP/A/05	IS: 5182 P22	IS: 5182 Part 11	IS: 5182 Part 12	USEPA Method IO- 3.2	ABCTL/SOP/A10
Date of Monitoring												
04.03.2024	17	38	5.5	12.8	BDL(<0.1)	9.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
07.03.2024	21	45	6.1	13	BDL(<0.1)	10.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
11.03.2024	19	39	5.9	12.1	BDL(<0.1)	9.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
14.03.2024	22	47	6.9	11.9	BDL(<0.1)	8.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.03.2024	19	41	7.1	13.3	BDL(<0.1)	9.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
21.03.2024	21	46	5.1	14.2	BDL(<0.1)	10.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
25.03.2024	17	38	5.8	10.9	BDL(<0.1)	8.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
28.03.2024	19	40	6.7	13.5	BDL(<0.1)	9.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
01.04.2024	21	43	6.1	12.6	BDL(<0.1)	9.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
04.04.2024	18	38	6.9	13.7	BDL(<0.1)	10.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.04.2024	21	45	7.3	14.4	BDL(<0.1)	11.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
12.04.2024	18	37	5.8	12.9	BDL(<0.1)	10.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
15.04.2024	21	43	5.4	14.2	BDL(<0.1)	11.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.04.2024	22	46	6.2	12.8	BDL(<0.1)	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.04.2024	17	38	5.8	15.1	BDL(<0.1)	12.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
26.04.2024	19	41	7.1	12.9	BDL(<0.1)	9.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
03.05.2024	18	39	5.3	12.2	BDL(<0.1)	9.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
06.05.2024	22	47	6.8	13.7	BDL(<0.1)	11.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.05.2024	19	41	6.1	12.4	BDL(<0.1)	10.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
13.05.2024	21	46	5.7	12.9	BDL(<0.1)	10.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
16.05.2024	18	38	5.1	12.5	BDL(<0.1)	9.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.05.2024	19	41	6.9	12.8	BDL(<0.1)	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
23.05.2024	22	47	7.1	11.6	BDL(<0.1)	8.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
27.05.2024	18	39	6.6	12.7	BDL(<0.1)	9.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
Min	17	37	5.1	10.9	-	8.2	-	-	-	-	-	-
Max	22	47	7.3	15.1	-	12.3	-	-	-	-	-	-
Mean	19.54	41.79	6.22	12.96	-	10.06	-	-	-	-	-	-
98 percentile	22	47	7.208	14.778	-	11.97	-	-	-	-	-	-
CPCB Standard	60	100	80	80	2	100	400	1	5	1	20	6

BDL-Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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ABC Techno Labs™
India Private Limited
Quality Uncompromised

TC - 5770

(An ISO : 9001, ISO : 14001, ISO : 45001 & ISO : 22000 Certified Company)

Accredited by NABL vide TC-5770, NABET / QCI, Approved by FSSAI, Recognised by MoEF&CC, BIS, APEDA, IOPEPC, Tea Board India

ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/AAQ3
Sample drawn by	:	ABC Techno Labs India Private Limited
Sample description	:	Ambient Air Quality Monitoring -24 Hourly Basis Twice a week for three Month
Location of sampling	:	AAQ 3: Nainarpathu
Project name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 27-05-2024
Report date	:	05-06-2024

Parameter	PM 2.5 µg/m³	PM 10 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	O_3 µg/m³	NH_3 µg/m³	Lead µg/m³	Benzene µg/m³	B[a]P ng/m³	Ni ng/m³	As ng/m³
Test Method / Date of Monitoring	EPA 40 CPR P50	IS: 5182 P23	IS: 5182 P2	IS: 5182 P6	IS: 5182 P10	ABCTL/ SOP/A/ 07	ABCTL/ SOP/A/ 05	IS: 5182 P22	IS: 5182 Part 11	IS: 5182 Part 12	USEPA Method IO- 3.2	ABCTL/ SOP/A10
04.03.2024	22	48	6.6	14.4	BDL(<0.1)	11.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
07.03.2024	19	41	5.8	13.6	BDL(<0.1)	10.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
11.03.2024	21	46	6.1	12.8	BDL(<0.1)	9.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
14.03.2024	25	51	5.9	14.7	BDL(<0.1)	10.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.03.2024	19	40	7.1	13.2	BDL(<0.1)	10.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
21.03.2024	22	48	6.3	14.8	BDL(<0.1)	11.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
25.03.2024	20	43	6.5	16.3	BDL(<0.1)	12.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
28.03.2024	21	47	7.2	14.7	BDL(<0.1)	11.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
01.04.2024	24	51	5.8	15.2	BDL(<0.1)	12.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
04.04.2024	21	44	6.7	14.4	BDL(<0.1)	11.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.04.2024	19	40	7.1	13.9	BDL(<0.1)	10.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
12.04.2024	18	39	6.9	12.8	BDL(<0.1)	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
15.04.2024	22	48	6.4	13.3	BDL(<0.1)	9.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.04.2024	19	41	5.8	14.9	BDL(<0.1)	11.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.04.2024	21	46	5.1	14.1	BDL(<0.1)	11	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
26.04.2024	24	50	5.6	12.8	BDL(<0.1)	10.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
03.05.2024	19	37	6.3	13.6	BDL(<0.1)	11.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
06.05.2024	23	49	7.1	14.7	BDL(<0.1)	12	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.05.2024	19	41	5.8	14.1	BDL(<0.1)	11.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
13.05.2024	22	46	6.9	15.6	BDL(<0.1)	12.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
16.05.2024	20	42	7.4	12.8	BDL(<0.1)	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.05.2024	22	47	6.8	13.9	BDL(<0.1)	11.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
23.05.2024	23	48	7.3	16	BDL(<0.1)	12.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
27.05.2024	19	40	7.1	14.2	BDL(<0.1)	10.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
Min	18	37	5.1	12.8	-	9.8	-	-	-	-	-	-
Max	25	51	7.4	16.3	-	12.9	-	-	-	-	-	-
Mean	21.00	44.71	6.48	14.20	-	11.20	-	-	-	-	-	-
98 percentile	24.54	51	7.354	16.162	-	12.854	-	-	-	-	-	-
CPCB Standard	60	100	80	80	2	100	400	1	5	1	20	6

BDL-Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs India Private Limited

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ABC Techno Labs™
India Private Limited
Quality Uncompromised

TC - 5770

(An ISO : 9001, ISO : 14001, ISO : 45001 & ISO : 22000 Certified Company)

Accredited by NABL vide TC-5770, NABET / QCI, Approved by FSSAI, Recognised by MoEF&CC, BIS, APEDA, IOPEPC, Tea Board India

ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/AAQ4
Sample drawn by	:	ABC Techno Labs India Private Limited
Sample description	:	Ambient Air Quality Monitoring -24 Hourly Basis Twice a week for three Month
Location of sampling	:	AAQ 4: Muthaiyapuram
Project name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 27-05-2024
Report date	:	05-06-2024

Parameter	PM 2.5 µg/m³	PM 10 µg/m³	SO_2 ng/m³	NO_x µg/m³	CO mg/m³	O_3 ng/m³	NH_3 µg/m³	Lead µg/m³	Benzene µg/m³	B[a]P ng/m³	Ni ng/m³	As ng/m³
Test Method	EPA 40 CFR P50	IS: 5182 P23	IS: 5182 P2	IS: 5182 P6	IS: 5182 P10	ABCTL/SOP/A/07	ABCTL/SOP/A/05	IS: 5182 P22	IS: 5182 Part 11	IS: 5182 Part 12	USEPA Method IO- 3.2	ABCTL/SOP/A10
Date of Monitoring												
04.03.2024	21	46	6.9	15.5	0.13	12.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
07.03.2024	19	41	7.4	13.6	BDL(<0.1)	11.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
11.03.2024	26	53	7.1	14.7	0.15	12.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
14.03.2024	22	47	6.8	16.9	0.18	13.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.03.2024	19	42	6.5	15.5	0.11	12.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
21.03.2024	26	56	6.9	14.2	BDL(<0.1)	11.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
25.03.2024	21	44	7.1	14.9	0.15	12.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
28.03.2024	23	48	6.8	13.5	BDL(<0.1)	11.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
01.04.2024	20	43	7.2	17	0.17	13.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
04.04.2024	24	51	6.9	16.6	0.14	12.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.04.2024	21	43	7.4	15.5	0.13	12.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
12.04.2024	24	50	5.8	14.2	BDL(<0.1)	11.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
15.04.2024	20	42	6.9	14.9	0.13	11.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.04.2024	23	48	7.1	13.5	BDL(<0.1)	10.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.04.2024	25	53	6.6	14.7	0.16	12	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
26.04.2024	20	42	5.8	15.1	0.15	12.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
03.05.2024	22	46	6.3	13.9	BDL(<0.1)	11.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
06.05.2024	24	51	5.7	14.4	BDL(<0.1)	10.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.05.2024	23	49	7.1	16.9	0.21	12.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
13.05.2024	24	53	7.6	13.4	BDL(<0.1)	10.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
16.05.2024	21	44	6.9	15.2	0.13	12.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.05.2024	23	49	7.9	13.8	BDL(<0.1)	10.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
23.05.2024	20	43	8.1	15.5	0.12	12.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
27.05.2024	25	53	7.7	13.9	BDL(<0.1)	10.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
Min	**19**	**41**	**5.7**	**13.4**	-	**10.2**		-	-	-	-	-
Max	**26**	**56**	**8.1**	**17**	**0.21**	**13.6**	-	-	-	-	-	-
Mean	**22.33**	**47.38**	**6.94**	**14.89**	-	**11.88**	-	-	-	-	-	-
98 percentile	**26**	**54.62**	**8.008**	**16.954**	-	**13.416**	-	-	-	-	-	-
CPCB Standard	**60**	**100**	**80**	**80**	**2**	**100**	**400**	**1**	**5**	**1**	**20**	**6**

BDL-Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs India Private Limited

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TC - 5770

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ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
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Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/AAQ5
Sample drawn by	:	ABC Techno Labs India Private Limited
Sample description	:	Ambient Air Quality Monitoring -24 Hourly Basis Twice a week for three Month
Location of sampling	:	AAQ 5: Kulasekharapatnam
Project name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 27-05-2024
Report date	:	05-06-2024

Parameter	PM 2.5 µg/m³	PM 10 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	O_3 µg/m³	NH_3 µg/m³	Lead µg/m³	Benzene µg/m³	B[a]P ng/m³	Ni ng/m³	As ng/m³
Test Method	EPA 40 CFR P50	IS: 5182 P23	IS: 5182 P2	IS: 5182 P6	IS: 5182 P10	ABCTL/ SOP/A/ 07	ABCTL/ SOP/A/5	IS: 5182 P22	IS: 5182 Part 11	IS: 5182 Part 12	USEPA Method IO- 3.2	ABCTL/ SOP/A10
Date of Monitoring												
04.03.2024	20	42	BDL(<5)	12.8	BDL(<0.1)	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
07.03.2024	23	48	BDL(<5)	10.9	BDL(<0.1)	8.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
11.03.2024	17	39	BDL(<5)	11.6	BDL(<0.1)	8.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
14.03.2024	19	41	6.3	12.7	BDL(<0.1)	9.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.03.2024	18	37	7.2	13.6	0.11	10.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
21.03.2024	21	45	BDL(<5)	14.7	0.13	11.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
25.03.2024	19	39	6.1	12.3	BDL(<0.1)	10.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
28.03.2024	24	49	BDL(<5)	11.9	BDL(<0.1)	8.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
01.04.2024	22	47	6.9	13.6	0.12	9.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
04.04.2024	21	43	BDL(<5)	12.8	BDL(<0.1)	9.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.04.2024	22	46	7.2	14	BDL(<0.1)	11.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
12.04.2024	19	40	6.5	12.9	BDL(<0.1)	10.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
15.04.2024	17	38	BDL(<5)	11.7	BDL(<0.1)	9.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.04.2024	22	47	6.5	13.5	0.11	9.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.04.2024	18	39	BDL(<5)	11.2	BDL(<0.1)	8.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
26.04.2024	20	41	BDL(<5)	14	BDL(<0.1)	10.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
03.05.2024	21	46	6.7	12.8	BDL(<0.1)	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
06.05.2024	18	38	7.6	13.9	0.14	9.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.05.2024	21	46	7.1	14.7	0.12	12.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
13.05.2024	18	38	BDL(<5)	11.5	BDL(<0.1)	9.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
16.05.2024	20	42	BDL(<5)	12.4	BDL(<0.1)	8.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.05.2024	18	39	6.6	13.1	0.11	9.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
23.05.2024	18	40	BDL(<5)	12.8	BDL(<0.1)	9.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
27.05.2024	17	37	5.9	13	BDL(<0.1)	10.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
Min	**17**	**37**	-	**10.9**	-	**8.1**	-	-	-	-	-	-
Max	**24**	**49**	**7.6**	**14.7**	**0.14**	**12.1**	-	-	-	-	-	-
Mean	**19.71**	**41.96**	-	**12.85**	-	**9.91**	-	-	-	-	-	-
98 percentile	**23.54**	**48.54**	-	**14.7**	-	**11.96**	-	-	-	-	-	-
CPCB Standard	**60**	**100**	**80**	**80**	**2**	**100**	**400**	**1**	**5**	**1**	**20**	**6**

BDL-Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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TC - 5770

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ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/AAQ6
Sample drawn by	:	ABC Techno Labs India Private Limited
Sample description	:	Ambient Air Quality Monitoring -24 Hourly Basis Twice a week for three Month
Location of sampling	:	AAQ 6: Paramankuruchi
Project name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 27-05-2024
Report date	:	05-06-2024

Parameter	PM 2.5 µg/m³	PM 10 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	O_3 µg/m³	NH_3 µg/m³	Lead µg/m³	Benzene µg/m³	B[a]P ng/m³	Ni ng/m³	As ng/m³
Test Method	EPA 40 CFR P50	IS: 5182 P23	IS: 5182 P2	IS: 5182 P6	IS: 5182 P10	ABCTL/ SOP/A/ 07	ABCTL/ SOP/A/ 05	IS: 5182 P22	IS: 5182 Part 11	IS: 5182 Part 12	USEPA Method IO- 3.2	ABCTL/ SOP/A10
Date of Monitoring												
04.03.2024	20	43	5.6	14.7	0.14	12.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
07.03.2024	23	49	7.1	13.6	0.13	11.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
11.03.2024	26	53	6.6	15.8	0.17	12.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
14.03.2024	24	50	6.4	16.9	0.15	13.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.03.2024	22	47	7.2	14.4	0.13	12.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
21.03.2024	25	52	8	12.8	0.15	11.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
25.03.2024	19	40	6.9	13.5	0.12	10.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
28.03.2024	22	48	5.4	14.7	0.16	11.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
01.04.2024	21	46	6.3	15.1	0.21	12.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
04.04.2024	20	43	7.8	13.9	0.15	10.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.04.2024	23	47	8.7	14.7	0.17	12.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
12.04.2024	25	53	7.2	16.6	0.18	13.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
15.04.2024	19	41	7.7	15.2	0.13	12.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.04.2024	22	48	6.4	14.2	0.15	12.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.04.2024	21	45	6.9	16.9	0.19	13.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
26.04.2024	25	53	8	14.7	0.12	12.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
03.05.2024	20	42	7.1	13.7	0.14	11.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
06.05.2024	22	47	5.3	12.5	0.11	10.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.05.2024	19	40	6.8	16.9	0.17	13.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
13.05.2024	25	53	7.3	14.8	0.12	12.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
16.05.2024	22	48	6.8	15.5	0.13	12.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.05.2024	20	43	7.1	16.2	0.17	13.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
23.05.2024	23	49	6.4	14.8	0.11	11.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
27.05.2024	21	44	7.8	17	0.13	13.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
Min	19	40	5.3	12.5	0.11	10.2	-	-	-	-	-	-
Max	26	53	8.7	17	0.21	13.8	-	-	-	-	-	-
Mean	22.04	46.83	6.95	14.96	0.15	12.35	-	-	-	-	-	-
98 percentile	25.54	53	8.378	16.954	0.2008	13.8	-	-	-	-	-	-
CPCB Standard	60	100	80	80	2	400	100	1	5	1	20	6

BDL-Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs India Private Limited

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ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/AAQ7
Sample drawn by	:	ABC Techno Labs India Private Limited
Sample description	:	Ambient Air Quality Monitoring -24 Hourly Basis Twice a week for three Month
Location of sampling	:	AAQ 7: Mardhukarai
Project name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 27-05-2024
Report date	:	05-06-2024

Parameter / Test Method / Date of Monitoring	PM 2.5 µg/m³ EPA 40 CFR P50	PM 10 µg/m³ IS: 5182 P23	SO_2 µg/m³ IS: 5182 P2	NO_x µg/m³ IS: 5182 P6	CO mg/m³ IS: 5182 P10	O_3 µg/m³ ABCTL/ SOP/A/ 07	NH_3 µg/m³ ABCTL/ SOP/A/ 05	Lead µg/m³ IS: 5182 P22	Benzene µg/m³ IS: 5182 Part 11	B[a]P ng/m³ IS: 5182 Part 12	Ni ng/m³ USEPA Method IO- 3.2	As ng/m³ ABCTL/ SOP/A10
04.03.2024	16	35	BDL(<5)	10.4	BDL(<0.1)	8.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
07.03.2024	18	41	BDL(<5)	11.6	BDL(<0.1)	9.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
11.03.2024	17	39	BDL(<5)	10.7	BDL(<0.1)	8.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
14.03.2024	19	42	BDL(<5)	12.5	BDL(<0.1)	9.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.03.2024	16	34	BDL(<5)	11.7	BDL(<0.1)	8.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
21.03.2024	21	44	BDL(<5)	12.8	BDL(<0.1)	9.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
25.03.2024	19	40	BDL(<5)	10.4	BDL(<0.1)	8.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
28.03.2024	17	38	BDL(<5)	13.3	BDL(<0.1)	10.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
01.04.2024	19	41	BDL(<5)	10.8	BDL(<0.1)	8.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
04.04.2024	18	39	BDL(<5)	11.9	BDL(<0.1)	9.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.04.2024	16	33	BDL(<5)	12.2	BDL(<0.1)	10.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
12.04.2024	21	45	BDL(<5)	12.8	BDL(<0.1)	11.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
15.04.2024	19	40	BDL(<5)	13.1	BDL(<0.1)	11.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.04.2024	18	38	BDL(<5)	12.8	BDL(<0.1)	10.4	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.04.2024	20	42	BDL(<5)	11.4	BDL(<0.1)	9.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
26.04.2024	17	37	BDL(<5)	13.6	BDL(<0.1)	10.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
03.05.2024	16	34	BDL(<5)	10.9	BDL(<0.1)	9.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
06.05.2024	18	39	BDL(<5)	12.2	BDL(<0.1)	10.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.05.2024	19	41	BDL(<5)	13.1	BDL(<0.1)	10.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
13.05.2024	19	33	BDL(<5)	10.9	BDL(<0.1)	8.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
16.05.2024	19	42	BDL(<5)	11.7	BDL(<0.1)	8.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.05.2024	17	37	BDL(<5)	11.1	BDL(<0.1)	9.3	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
23.05.2024	19	40	BDL(<5)	12	BDL(<0.1)	9.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
27.05.2024	21	43	BDL(<5)	12.2	BDL(<0.1)	10.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
Min	16	33	-	10.4	-	8.1	-	-	-	-	-	-
Max	21	45	-	13.6	-	11.6	-	-	-	-	-	-
Mean	18.29	39.04	-	11.92	-	9.65	-	-	-	-	-	-
98 percentile	21	44.54	-	13.462	-	11.416	-	-	-	-	-	-
CPCB Standard	60	100	80	80	2	400	100	1	5	1	20	6

BDL-Below Detection Limit

...End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs India Private Limited

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ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
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Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/AAQ8
Sample drawn by	:	ABC Techno Labs India Private Limited
Sample description	:	Ambient Air Quality Monitoring -24 Hourly Basis Twice a week for three Month
Location of sampling	:	AAQ 8: Udangudi
Project name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 27-05-2024
Report date	:	05-06-2024

Parameter	PM 2.5 µg/m³	PM 10 µg/m³	SO_2 µg/m³	NO_x µg/m³	CO mg/m³	O_3 µg/m³	NH_3 µg/m³	Lead µg/m³	Benzene µg/m³	B[a]P ng/m³	Ni µg/m³	As ng/m³
Test Method	EPA 40 CFR P50	IS: 5182 P23	IS: 5182 P2	IS: 5182 P6	IS: 5182 P10	ABCTL/ SOP/A/ 07	ABCTL/ SOP/A/ 05	IS: 5182 P22	IS: 5182 Part 11	IS: 5182 Part 12	USEPA Method IO- 3.2	ABCTL/ SOP/A10
Date of Monitoring												
04.03.2024	22	47	8.5	16.6	0.19	13.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
07.03.2024	24	53	7.4	15.2	0.13	12.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
11.03.2024	26	56	7.1	17.3	0.14	14.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
14.03.2024	22	47	8.3	15.4	0.21	12.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.03.2024	26	53	6.9	13.9	0.15	11.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
21.03.2024	21	45	7.4	14.7	0.28	12.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
25.03.2024	27	58	6.8	15.2	0.24	13.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
28.03.2024	20	43	7.9	16.3	0.17	14.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
01.04.2024	24	50	8.4	17.7	0.16	14.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
04.04.2024	23	49	8.1	15.9	0.12	13.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.04.2024	26	56	6.5	14.6	0.19	12.9	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
12.04.2024	24	51	7.4	13.8	0.25	11.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
15.04.2024	27	58	7.9	15.1	0.22	12.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
18.04.2024	23	49	6.8	16.9	0.18	13.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.04.2024	25	53	6.9	15.4	0.26	12.7	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
26.04.2024	21	46	8.2	13.7	0.17	11.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
03.05.2024	26	57	7.6	14.6	0.13	12.5	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
06.05.2024	23	49	7.1	17.1	0.19	13.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
09.05.2024	26	54	6.6	16.9	0.21	13.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
13.05.2024	24	50	6.8	15.8	0.18	12.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
16.05.2024	21	46	6.2	16.7	0.21	14.2	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
20.05.2024	25	52	5.9	14.2	0.14	12.6	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
23.05.2024	22	49	7.4	15.5	0.16	13.1	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
27.05.2024	26	54	8.3	16.7	0.23	13.8	BDL(<5)	BDL(<0.1)	BDL(<0.1)	BDL(<0.01)	BDL(<1)	BDL(<1)
Min	20	43	5.9	13.7	0.12	11.6	-	-	-	-	-	-
Max	27	58	8.5	17.7	0.28	14.8	-	-	-	-	-	-
Mean	23.92	51.04	7.35	15.63	0.19	13.08	-	-	-	-	-	-
98 percentile	27	58	8.454	17.516	0.2708	14.524	-	-	-	-	-	-
CPCB Standard	60	100	80	80	2	400	100	1	5	1	20	6

BDL-Below Detection Limit

....End of report....

S.Dharani
Quality Manager
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A. Robson Chinnadurai
Technical Manager-Lab
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ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/N1-N8
Sampled by	:	ABC Techno Labs India Private Limited
Sample description	:	Noise Level Monitoring
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 09-03-2024
Date of Receipt	:	11-03-2024
Report date	:	26-03-2024

Location Code	Sample Location	Lday [dB(A)]	Lnight [dB(A)]	Leq [dB(A)]
N1	Project site	51.7	42.2	50.2
N2	Tbandavankadu	48.6	41.1	47.2
N3	Nainarpathu	49.1	41.8	47.7
N4	Muthaiya puram	50.8	42.6	49.4
N5	Kulasekharapatnam	47.5	41.9	46.3
N6	Paramankurichi	51.9	43.5	50.4
N7	Mardhurkarai	47.6	40.8	46.3
N8	Udangudi	53.7	44.5	52.2

Method: IS: 9989-1981(Reaff: 2020)-Ambient

Ambient Noise Standards

Zone Classification	Lday dB(A)	Lnight dB(A)
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/SOIL/S1-S4
Sample collected by	:	ABC Techno Labs India Private Limited
Sample description	:	Soil Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 09-03-2024
Date of Receipt	:	11-03-2024
Date of Analysis	:	12-03-2024
Report date	:	26-03-2024

S. No.	Parameters	Test Methods	S1	S2	S3	S4
1	pH	IS-2720(Part 26)1987(RA 2021)	7.54	7.81	7.37	7.84
2	Bulk Deusity, g/cc	FAO Chapter 3, ABCTL/SOIL/SOP 1	1.57	1.51	1.53	1.38
3	Electrical Conductivity, mS/cm	IS -14767:2000 (RA 2021)	0.178	0.114	0.097	0.138
4	Total Nitrogen, kg/ha	IS -14684:1999, Reaff:2019	59	87	68	94
5	Available Phosphorous, kg/ha	FAO Chapter 3, ABCTL/SOIL/SOP 2	21.1	32.8	27.4	46.9
6	Available Potassium, kg/ha	FAO Chapter 3, ABCTL/SOIL/SOP 7	324	282	364	391
7	Exchangeable Calcium as Ca,m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 4	15.6	16.6	17.1	18.4
8	Exchangeable Magnesium as Mg, m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 5	4.89	6.11	5.84	5.23
9	Exchangeable Sodium as Na, m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 6	1.34	1.08	1.47	1.16
10	Organic matter (%)	IS 2720(Part 22):1972, RA:2020	0.58	0.91	0.84	0.73
11	Lead as Pb	EPA 3500 B & 6020 B	3.21	2.58	4.97	2.78
12	Chromium as Cr	EPA 3500 B & 6020 B	4.74	5.69	7.54	6.98
13	Nickel as Ni	EPA 3500 B & 6020 B	2.65	4.18	3.11	2.57
14	Cadmium as Cd	EPA 3500 B & 6020 B	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)
15	Mercury as Hg	EPA 3500 B & 6020 B	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)
16	Arsenic as As	EPA 3500 B & 6020 B	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)

S1- Project Site, S2– Thandavankadu, S3- Nainarpathu, S4- Muthayapuram

Contd....

BDL-Below Detection Limit, DL-Detection Limit

S. 26/3/24

S.Dharani
Quality Manager
Verified by

ABC TECHNO LABS INDIA PVT. LTD. CHENNAI 600 098

ABC

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/SOIL/S5-S8
Sample collected by	:	ABC Techno Labs India Private Limited
Sample description	:	Soil Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 09-03-2024
Date of Receipt	:	11-03-2024
Date of Analysis	:	12-03-2024
Report date	:	26-03-2024

S. No.	Parameters	Test Methods	S5	S6	S7	S8
1	pH	IS-2720(Part 26)1987(RA 2021)	7.33	7.62	7.44	7.81
2	Bulk Density, g/cc	FAO Chapter 3, ABCTL/SOIL/SOP 1	1.58	1.39	1.41	1.47
3	Electrical Conductivity, mS/cm	IS -14767:2000 (RA 2021)	0.214	0.121	0.098	0.154
4	Total Nitrogen, kg/ha	IS -14684:1999, Reaff:2019	45	76	89	53
5	Available Phosphorous, kg/ha	FAO Chapter 3, ABCTL/SOIL/SOP 2	30.3	41.1	37.3	22.9
6	Available Potassium, kg/ha	FAO Chapter 3, ABCTL/SOIL/SOP 7	352	258	312	362
7	Exchangeable Calcium as Ca,m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 4	14.8	19	17.7	16.5
8	Exchangeable Magnesium as Mg, m.eq/100g	PAO Chapter 3, ABCTL/SOIL/SOP 5	5.56	6.87	4.97	5.22
9	Exchangeable Sodium as Na, m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 6	1.84	1.34	1.09	1.28
10	Organic matter (%)	IS 2720(Part 22):1972, RA:2020	0.51	0.73	0.88	0.64
11	Lead as Pb	EPA 3500 B & 6020 B	4.11	2.63	4.84	3.69
12	Chromium as Cr	EPA 3500 B & 6020 B	8.21	6.84	9.26	7.45
13	Nickel as Ni	EPA 3500 B & 6020 B	4.75	3.62	2.98	5.47
14	Cadmium as Cd	EPA 3500 B & 6020 B	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)
15	Mercury as Hg	EPA 3500 B & 6020 B	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)
16	Arsenic as As	EPA 3500 B & 6020 B	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)	BDL (DL:0.5)

S5- Kulasekharapatnam, S6- Paramankuruchi, S7- Mardhurkarai, S8- Udangudi

BDL-Below Detection Limit, DL-Detection Limit ....End of report....

S- 26/3/24

S.Dharani
Quality Manager
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ABC TECHNO LABS INDIA PVT. LTD. CHENNAI 600 098

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TEST REPORT

M/s. TNPGCL S/o TANGEDCO
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5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/SOIL/S1-S4
Sample collected by	:	ABC Techno Labs India Private Limited
Sample description	:	Soil Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 09-03-2024
Date of Receipt	:	11-03-2024
Date of Analysis	:	12-03-2024
Report date	:	26-03-2024

S. No.	Parameters	Test Methods	S1	S2	S3	S4
1	Texture Classification	Robinson Pipette Method	Loamy Sand	Sandy Loam	Sandy Loam	Loam
2	Sand (%)		81.4	68.4	65.2	39.2
3	Clay (%)		1.1	5.4	4.8	26.4
4	Silt (%)		17.5	26.2	30	34.4

S1- Project Site, S2– Thandavankadu, S3- Nainarpathu, S4- Muthayapuram

Contd....

BDL-Below Detection Limit, DL-Detection Limit

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Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/SOIL/S5-S8
Sample collected by	:	ABC Techno Labs India Private Limited
Sample description	:	Soil Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	04-03-2024 to 09-03-2024
Date of Receipt	:	11-03-2024
Date of Analysis	:	12-03-2024
Report date	:	26-03-2024

S. No.	Parameters	Test Methods	S5	S6	S7	S8
1	Texture Classification	Robinson Pipette Method	Loamy Sand	Loam	Loam	Sandy Loam
2	Sand (%)		83.6	37.7	38.4	68.1
3	Clay (%)		0.8	25.4	26.9	3.7
4	Silt (%)		15.6	36.9	34.7	28.2

S5- Kulasekharapatnam, S6- Paramankuruchi, S7- Mardhurkarai, S8- Udangudi

BDL-Below Detectiou Limit, DL-Detection Limit ....End of report....

ABC

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TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/GW1-GW2
Sample drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 22 : 2021 & IS 17614 : Part 25 : 2022
Sample description	:	Ground Water
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	09-03-2024
Date of Receipt	:	11-03-2024
Date of Analysis	:	12-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW1	GW2		
1	Colour	Hazen	<1	<1	IS 3025(part 4)1983(RA 2017)	5
2	Odour	-	No Odour Observed	No Odour Observed	IS 3025(part 8)1984(RA 2017)	Agreeable
3	Turbidity	NTU	0.7	BDL(<0.5)	IS:3025 Part 10-1984(Reaff: 2017)	1
4	pH at 25 °C	-	7.57	7.63	IS :3025 Part 11-1983(Reaff: 2017)	6.5-8.5
5	Conductivity at 25 °C	µS/cm	1917	1365	IS :3025 Part 14- 1984 (Reaff:2017)	Not Specified
6	Total dissolved solids	mg/l	1112	792	IS :3025 Part 16-1984(Reaff: 2017)	500
7	Total Suspended solids	mg/l	<2	<2	IS :3025 Part 17-1984(Reaff: 2017)	Not Specified
8	Total Alkalinity as $CaCO_3$	mg /l	310	330	IS : 3025 Part 23-1986(Reaff: 2019)	200
9	Total Hardness as $CaCO_3$	mg/l	470	390	IS : 3025 Part 21-2009	200
10	Calcium as Ca	mg/l	112	94	IS : 3025 Part 40-1991(Reaff: 2019)	75
11	Magnesium as Mg	mg/l	46	37.6	APHA 23rd EDN -3500 Mg B	30
12	Chloride as Cl^-	mg/l	335	198	IS :3025 Part 32-1988(Reaff: 2019)	250
13	Sulphate as SO_4	mg/l	164	102	APHA 23rd EDN -4500-SO_4^{2-} E	200
14	Nitrate as NO_3	mg/l	1	3	APHA 23rd EDN -4500- NO_3^- B	45
15	Iron as Fe	mg/l	0.16	BDL(<0.05)	IS 3025(part 53)1987(Reaff: 2019)	1
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B	0.10
17	Fluoride as F	mg/l	0.42	0.33	APHA 23rd EDN -4500-F B&D	1.00

GW1-Near Project Site, GW2 – Thandavankadu

Contd....

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TEST REPORT

Report no	:	ABCTL/TNPGCL/2024/03/GW1-GW2
Sample description	:	Ground Water
Date of report	:	26-03-2024 Page 2 of 2

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW1	GW2		
18	Sodium as Na	mg/l	250	152	IS : 3025 Part 45-1993 (Reaff:2019)	Not Specified
19	Potassium as K	mg/l	12	5.3	IS : 3025 Part 45 -1993 (Reaff:2019)	Not Specified
20	Barium as Ba	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -3111 D	0.7
21	Residual Free Chlorine	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -4500-Cl B	0.20
22	Aluminium as Al	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN 3500 Al B	0.03
23	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B	0.003
24	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
25	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
26	Zinc as Zn	mg/l	0.05	0.09	APHA 23rd EDN -3111 B	5.00
27	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
28	Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
29	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -4500-CN E	0.05
30	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
31	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	IS APHA 23rd EDN -3112 B	0.001
32	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN 5540 C	0.20
33	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C	0.001
34	Pesticides	mg/l	Absent	Absent	APHA 23rd EDN -6630 B, C	Absent
35	Total Coliforms	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff -2019)	Absent /100ml
36	E.coli	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff-2019)	Absent /100ml

GW1- Near Project Site, GW2 – Thandavankadu

BDL- Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab

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ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/GW3-GW4
Sample drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 22 : 2021 & IS 17614 : Part 25 : 2022
Sample description	:	Ground Water
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	09-03-2024
Date of Receipt	:	11-03-2024
Date of Analysis	:	12-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable Limit as per IS 10500 : 2012
			GW3	GW4		
1	Colour	Hazen	<1	<1	IS 3025(part 4)1983(RA 2017)	5
2	Odour	-	No Odour Observed	No Odour Observed	IS 3025(part 8)1984(RA 2017)	Agreeable
3	Turbidity	NTU	BDL(<0.5)	BDL (<0.5)	IS:3025 Part 10-1984(Reaff: 2017)	1
4	pH at 25 °C	-	7.89	8.02	IS :3025 Part 11-1983(Reaff: 2017)	6.5-8.5
5	Conductivity at 25 °C	µS/cm	1310	1274	IS :3025 Part 14- 1984 (Reaff:2017)	Not Specified
6	Total dissolved solids	mg/l	768	741	IS :3025 Part 16-1984(Reaff: 2017)	500
7	Total Suspended solids	mg/l	<2	<2	IS :3025 Part 17-1984(Reaff: 2017)	Not Specified
8	Total Alkalinity as $CaCO_3$	mg /l	370	350	IS : 3025 Part 23-1986(Reaff: 2019)	200
9	Total Hardness as $CaCO_3$	mg/l	410	452	IS : 3025 Part 21-2009	200
10	Calcium as Ca	mg/l	97	102	IS : 3025 Part 40-1991(Reaff: 2019)	75
11	Magnesium as Mg	mg/l	58	48	APHA 23rd EDN -3500 Mg B	30
12	Chloride as Cl^-	mg/l	174	155	IS :3025 Part 32-1988(Reaff: 2019)	250
13	Sulphate as SO_4	mg/l	97	128	APHA 23rd EDN -4500-SO_4^{2-} E	200
14	Nitrate as NO_3	mg/l	5	7	AFHA 23rd EDN -4500- NO_3^- B	45
15	Iron as Fe	mg/l	BDL(<0.05)	0.11	IS 3025(part 53)1987(Reaff: 2019)	1
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B	0.10
17	Fluoride as F	mg/l	0.35	0.32	APHA 23rd EDN -4500-F B&D	1.00

GW3- Nadiaapathiu, GW4- Muthayapuram

Quality Manager

Verified by

Contd....

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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(A Successor entity of TNEB),
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Chennai, Tamil Nadu 600002

TEST REPORT

Report no	:	ABCTL/TNPGCL/2024/03/GW3-GW4
Sample description	:	Ground Water
Date of report	:	26-03-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW3	GW4		
18	Sodium as Na	mg/l	130	122	IS : 3025 Part 45-1993 (Reaff:2019)	Not Specified
19	Potassium as K	mg/l	2.8	3.7	IS : 3025 Part 45 -1993 (Reaff:2019)	Not Specified
20	Barium as Ba	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -3111 D	0.7
21	Residual Free Chlorine	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -4500-Cl B	0.20
22	Aluminium as Al	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN 3500 Al B	0.03
23	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B	0.003
24	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
25	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
26	Zinc as Zn	mg/l	0.05	0.12	APHA 23rd EDN -3111 B	5.00
27	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
28	Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
29	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -4500-CN E	0.05
30	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
31	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	IS APHA 23rd EDN -3112 B	0.001
32	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN 5540 C	0.20
33	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C	0.001
34	Pesticides	mg/l	Ahsent	Ahsent	APHA 23rd EDN -6630 B, C	Ahsent
35	Total Coliforms	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff -2019)	Absent /100ml
36	E.coli	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff-2019)	Absent /100ml

GW3- Nainarpathu, GW4- Muthayapuram

BDL- Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/GW5-GW6
Sample drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 22 : 2021 & IS 17614 : Part 25 : 2022
Sample description	:	Ground Water
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	09-03-2024
Date of Recelpt	:	11-03-2024
Date of Analysis	:	12-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW5	GW6		
1	Colour	Hazen	<1	<1	IS 3025(part 4)1983(RA 2017)	5
2	Odour	-	No Odour Observed	No Odour Observed	IS 3025(part 8)1984(RA 2017)	Agreeable
3	Turbidity	NTU	BDL(<0.5)	BDL(<0.5)	IS:3025 Part 10-1984(Reaff: 2017)	1
4	pH at 25 °C	-	7.62	7.58	IS :3025 Part 11-1983(Reaff: 2017)	6.5-8.5
5	Conductivity at 25 °C	µS/cm	994	1180	IS :3025 Part 14- 1984 (Reaff:2017)	Not Specified
6	Total dissolved solids	mg/l	577	684	IS :3025 Part 16-1984(Reaff: 2017)	500
7	Total Suspended solids	mg/l	<2	<2	IS :3025 Part 17-1984(Reaff: 2017)	Not Specified
8	Total Alkalinity as $CaCO_3$	mg/l	264	350	IS : 3025 Part 23-1986(Reaff: 2019)	200
9	Total Hardness as $CaCO_3$	mg/l	330	430	IS : 3025 Part 21-2009	200
10	Calcium as Ca	mg/l	86	101	IS : 3025 Part 40-1991(Reaff: 2019)	75
11	Magnesium as Mg	mg/l	28	43	APHA 23rd EDN -3500 Mg B	30
12	Chloride as Cl^-	mg/l	118	137	IS :3025 Part 32-1988(Reaff: 2019)	250
13	Sulphate as SO_4	mg/l	74	88	APHA 23rd EDN -4500-SO_4^{2-} E	200
14	Nitrate as NO_3	mg/l	4	6	APHA 23rd EDN -4500- NO_3^- B	45
15	Iron as Fe	mg/l	0.05	0.05	IS 3025(part 53)1987(Reaff: 2019)	1
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B	0.10
17	Fluoride as F	mg/l	0.35	0.41	APHA 23rd EDN -4500-F B&D	1.00

S. Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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Chennai, Tamil Nadu 600002

TEST REPORT

GW5- Kulasekharapatnam, GW6- Paramankuruchi

Contd....

Report no	:	ABCTL/TNPGCL/2024/03/GW5-GW6
Sample description	:	Ground Water
Date of report	:	26-03-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW5	GW6		
18	Sodium as Na	mg/l	93	110	IS : 3025 Part 45-1993 (Reaff:2019)	Not Specified
19	Potassium as K	mg/l	3.5	4.6	IS : 3025 Part 45 -1993 (Reaff:2019)	Not Specified
20	Barium as Ba	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -3111 D	0.7
21	Residual Free Chlorine	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -4500-Cl B	0.20
22	Aluminium as Al	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN 3500 Al B	0.03
23	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B	0.003
24	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
25	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
26	Zinc as Zn	mg/l	0.11	0.02	APHA 23rd EDN -3111 B	5.00
27	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
28	Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
29	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -4500-CN E	0.05
30	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
31	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	IS APHA 23rd EDN -3112 B	0.001
32	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN 5540 C	0.20
33	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C	0.001
34	Pesticides	mg/l	Absent	Absent	APHA 23rd EDN -6630 B, C	Absent
35	Total Coliforms	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff -2019)	Absent /100ml
36	E.coli	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff-2019)	Absent /100ml

GW5- Kulasekharapatnam, GW6- Paramankuruchi

BDL- Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

ABC TECHNO LABS INDIA PVT. LTD. CHENNAI 600 098

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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(A Successor entity of TNEB),
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Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/GW7-GW8
Sample drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 22 : 2021 & IS 17614 : Part 25 : 2022
Sample description	:	Ground Water
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	09-03-2024
Date of Receipt	:	11-03-2024
Date of Analysis	:	12-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW7	GW8		
1	Colour	Hazen	<1	<1	IS 3025(part 4)1983(RA 2017)	5
2	Odour	-	No Odour Observed	No Odour Observed	IS 3025(part 8)1984(RA 2017)	Agreeable
3	Turbidity	NTU	BDL(<0.5)	BDL(<0.5)	IS:3025 Part 10-1984(Reaff: 2017)	1
4	pH at 25 °C	-	7.41	7.85	IS :3025 Part 11-1983(Reaff: 2017)	6.5-8.5
5	Conductivity at 25 °C	µS/cm	1346	1281	IS :3025 Part 14- 1984 (Reaff:2017)	Not Specified
6	Total dissolved solids	mg/l	781	736	IS :3025 Part 16-1984(Reaff: 2017)	500
7	Total Suspended solids	mg/l	<2	<2	IS :3025 Part 17-1984(Reaff: 2017)	Not Specified
8	Total Alkalinity as $CaCO_3$	mg/l	360	310	IS : 3025 Part 23-1986(Reaff: 2019)	200
9	Total Hardness as $CaCO_3$	mg/l	400	470	IS : 3025 Part 21-2009	200
10	Calcium as Ca	mg/l	84	96	IS : 3025 Part 40-1991(Reaff: 2019)	75
11	Magnesium as Mg	mg/l	36.4	56	APHA 23rd EDN -3500 Mg B	30
12	Chloride as Cl^-	mg/l	177	181	IS :3025 Part 32-1988(Reaff: 2019)	250
13	Sulphate as SO_4	mg/l	110	98	APHA 23rd EDN -4500-SO_4^{2-} E	200
14	Nitrate as NO_3	mg/l	4	2	APHA 23rd EDN -4500- NO_3^- B	45
15	Iron as Fe	mg/l	0.05	0.11	IS 3025(part 53)1987(Reaff: 2019)	1
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B	0.10
17	Fluoride as F	mg/l	0.36	0.41	APHA 23rd EDN -4500-F B&D	1.00

GW7- Maruthur Karai, GW8 – Udangudi

S Dharani
Quality Manager
Verified by

Contd...
A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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TEST REPORT

Report no	:	ABCTL/TNPGCL/2024/03/GW5-GW6
Sample description	:	Ground Water
Date of report	:	26-03-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW7	GW8		
18	Sodium as Na	mg/l	144	112	IS : 3025 Part 45-1993 (Reaff:2019)	Not Specified
19	Potassium as K	mg/l	3.7	4	IS : 3025 Part 45 -1993 (Reaff:2019)	Not Specified
20	Barium as Ba	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -3111 D	0.7
21	Residual Free Chlorine	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -4500-Cl B	0.20
22	Aluminium as Al	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN 3500 Al B	0.03
23	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B	0.003
24	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
25	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
26	Zinc as Zn	mg/l	0.07	0.08	APHA 23rd EDN -3111 B	5.00
27	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
28	Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
29	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -4500-CN E	0.05
30	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
31	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	IS APHA 23rd EDN -3112 B	0.001
32	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN 5540 C	0.20
33	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C	0.001
34	Pesticides	mg/l	Absent	Absent	APHA 23rd EDN -6630 B, C	Absent
35	Total Coliforms	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff -2019)	Absent /100ml
36	E.coli	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff-2019)	Absent /100ml

GW7- Mardhurkarai, GW8 – Udangudi

BDL- Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

Terms and conditions :

•The test results relate only to the items tested. • The test report shall not be reproduced in full or part without the written approval of ABCTL. • The test items will not be retained for more than 15 days from the date of issue of test report for Non-Perishable samples and in the case of Perishable samples test items will be retained for 7 days after date of issue of report or as per customer requirement. •The laboratory's responsibility under this report is limited to proven willful negligence and will in no case be more than the invoiced amount. • The test report is issued for the purpose of identifying the characteristic and not intended to use for any publicity / litigation purpose.

ABC Techno Labs India Private Limited

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ABC Techno Labs™
India Private Limited
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TC - 5770

(An ISO : 9001, ISO : 14001, ISO : 45001 & ISO : 22000 Certified Company)

Accredited by NABL vide TC-5770, NABET / QCI, Approved by FSSAI, Recognised by MoEF&CC, BIS, APEDA, IOPEPC, Tea Board India

ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/SW1-SW3
Sample Drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 (part 6)2021
Sample description	:	Surface Water
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	09-03-2024
Date of Receipt	:	11-03-2024
Date of Analysis	:	12-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024

S. No	Parameter	Unit	Results			Test procedure
			SW1	SW2	SW3	
1	Temperature	°C	30.1	29.4	29.7	APHA 23rd EDN -2550B
2	Colour	Hazen	3	10	5	APHA 23rd EDN-2120 C
3	Odour	-	No Odour Observed	No Odour Observed	No Odour Observed	APHA 23rd EDN -2150 B
4	pH at 25°C	-	7.63	7.84	7.42	IS : 3025 Part 11- 1983 (Reaff: 2017)
5	Electrical Conductivity	µS/cm	632	725	538	IS : 3025 Part 14- 1984 (Reaff: 2019)
6	Turbidity	NTU	2.4	3.5	1.9	IS : 3025 Part 10-1984 (Reaff: 2017)
7	Total Dissolved Solids	mg/l	367	421	305	IS : 3025 Part 16-1984 (Reaff: 2017)
8	Total Hardness as CaCO3	mg/l	150	168	130	IS : 3025 Part 21-1983 (Reaff: 2019)
9	Total Alkalinity as CaCO3	mg/l	120	142	112	IS : 3025 Part 23- 1986(Reaff: 2019)
10	Chloride as Cl	mg/l	107	115	96	IS : 3025 Part 32-1988 (Reaff: 2019)
11	Sulphate as SO_4	mg/l	42	48	30	APHA 23rd EDN - 4500- SO_4^{2-} E
12	Fluoride as F	mg/l	0.24	0.29	0.16	APHA 23rd EDN - 4500-F B&D
13	Nitrate as NO_3	mg/l	9	14	5	APHA 23rd EDN - 4500- NO_3^- B
14	Ammonia as NH_3	mg/l	0.52	0.98	0.38	APHA 23rd EDN - 4500- NH_3 B&C
15	Phosphate as PO_4	mg/l	0.47	0.64	0.42	IS : 3025 Part 31-1988 (Reaff: 2019)
16	Sodium as Na	mg/l	80	88	68	IS:3025 Part 45-1993(Reaff: 2019)
17	Potassium as K	mg/l	2.9	5.2	3.6	IS:3025 Part 45-1993(Reaff: 2019)
18	Calcium as Ca	mg/l	39	45	33	IS:3025 Part 40-1991(Reaff: 2019)
19	Magnesium as Mg	mg/l	12.8	13.2	11.5	APHA 23rd EDN 3500 Mg B

BDL - Below Detection Limit

SW1- Avudayarkulam, SW2- Thangai kulam, SW3- Ellapanayakan kulam

Contd .....

S.Dharani
Quality Manager

Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs™
India Private Limited
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TC - 5770

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ISSUED TO:

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/03/SW1-SW3
Sample description	:	Surface Water
Report date	:	26-03-2024

S. No	Parameter	Unit	Results			Test Procedure
			SW1	SW2	SW3	
20	Iron as Fe	mg/l	0.19	0.22	0.13	IS : 3025 Part 53-2003(Reaff: 2019)
21	Manganese as Mn	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -3111 B
22	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN -5540 C
23	Total Suspended Solids	mg/l	4	7	3	IS:3025 Part 17-1984(Reaff: 2017)
24	Dissolved Oxygen as O_2	mg/l	5.6	4.8	5.9	IS:3025:Part-38:1989(Reaff: 2019)
25	Chemical Oxygen Demand	mg/l	18	23	16	IS:3025:Part-58:2006(Reaff: 2017)
26	Bio-Chemical Oxygen Demand @ 27°C for 3 days	mg/l	2.3	2.6	BDL(<2)	IS:3025:Part-44:1993(Reaff: 2019)
27	Phenolic compounds as C_6H_5OH	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C,D
28	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B
29	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN -3112 B
30	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B
31	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B
32	Total Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B
33	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN-4500-CN E
34	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B
35	Zinc as Zn	mg/l	0.09	0.11	0.05	APHA 23rd EDN -3111 B
36	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B
37	Nickel as Ni	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -3111 B
38	Oil & Grease	mg/l	BDL(<1)	BDL(<1)	BDL(<1)	IS:3025:Part-39:1991(Reaff: 2019)
39	Mineral oil	mg/l	BDL(<0.5)	BDL(<0.5)	BDL(<0.5)	IS:3025:Part-39:1991(Reaff: 2019)
40	Poly Chlorinated Biphenyls (PCBs)	mg/l	BDL (<0.0001)	BDL (<0.0001)	BDL (<0.0001)	APHA 23rd EDN -6630 B
41	Poly Nuclear Aromatic Hydrocarbon as PAH	mg/l	BDL (<0.0001)	BDL (<0.0001)	BDL (<0.0001)	APHA 23rd EDN -6440 B
42	Total Coliform	MPN/ 100ml	>1600	>1600	>1600	IS – 1622 -1981 (Reaff – 2019)
43	Faecal Coliform	MPN/ 100ml	>1600	1100	>1600	IS – 1622-1981(Reaff – 2019)

BDL - Below Detection Limit
SW1- Avudayarkulam, SW2- Thangai kulam, SW3- Ellapanayakan kulam

...End of Report...

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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TEST REPORT

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/MW1-MW3
Sample Drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 (part 9)2021
Sample description	:	Marine Water Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	11-03-2024
Date of Receipt	:	13-03-2024
Date of Analysis	:	14-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024

MW1- 08°24'31.05"N, 78° 04'19.24"E, MW2- 08°26'01.21"N, 78° 05'20.92"E,, MW3- 08°28'10.09"N, 78°07'16.38"E,,

S. No	Parameter	Unit	Results			Test procedure
			MW1	MW2	MW2	
1	Temperature	°C	28.7	28.5	27.8	APHA 23rd Edn -2550B
2	Salinity	ppt	34	34.5	34.3	APHA 23rd Edn-Electrometric Method
3	pH	-	8.14	8.25	8.20	IS : 3025 Part 11-1983 (Reaff: 2017)
4	Total Suspended Solids	mg/l	2	BDL(<2)	BDL(<2)	IS:3025 Part 17-1984(Reaff:2017)
5	Turbidity	mg/l	2.8	1.5	1.8	IS : 3025 Part 10-1984 (Reaff: 2017)
6	Dissolve Oxygen as O2	mg/l	6.8	6.7	6.8	IS:3025:Part-38:1989(Reaff: 2019)
7	Bio-Chemical Oxygen Demand	mg/l	<2	<2	<2	IS:3025:Part-44:1993(Reaff: 2019)
8	Nitrite as NO_2	mg/l	0.05	0.03	0.04	APHA 23rd Edn - 4500-NO_2-B.
9	Nitrate as NO_3	mg/l	2.3	1.8	2	APHA 23rd Edn -4500-NO3- B
10	Pbosphate as PO_4	mg/l	0.14	0.07	0.09	IS:3025:Part-31:1988 (Reaff:2019)
11	Total Nitrogen as N	mg/l	3.7	3	3.4	APHA 23rd Edn -4500- Norg B
12	Iron as Fe	mg/l	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	APHA 23rd Edn -3111 B
13	Zinc as Zn	mg/l	0.06	0.05	0.03	APHA 22nd Edn -3111 B
14	Manganese as Mn	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	APHA 23rd Edn -3111 B
15	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	APHA 23rd Edn -3111 B
16	Cadmium as Cd	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	APHA 23rd Edn -3111 B

Contd ....

S. 26/3/24
S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab

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TEST REPORT

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/MW1-MW3
Sample description	:	Marine Water Analysis
Report date	:	26-03-2024 Page 2 of 2

S. No	Parameter	Unit	Results			Test Procedure
			MW1	MW2	MW2	
17	Nickel as Ni	mg/l	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	APHA 23rd Edn -3111 B
18	Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	APHA 23rd Edn -3111 B
28	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	APHA 23rd Edn -3111 B
19	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	APHA 23rd Edn -3112 B
20	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	APHA 23rd Edn -3113 B
21	Total Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	APHA 23rd Edn -3113 B
22	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	BDL(<0.02)	APHA 23rd Edn -4500-CN E
23	Total Petroleum Hydrocarbon	mg/l	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	APHA 23rd Edn -6440 B

BDL - Below Detection Limit

...End of Report...

S. Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab

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TEST REPORT

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/MW4-MW5
Sample Drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 (part 9)2021
Sample description	:	Marine Water Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	11-03-2024
Date of Receipt	:	13-03-2024
Date of Analysis	:	14-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024 Page 1 of 2
MW4- 08°25'59.84"N, 78°07'25.93"E,, MW5- 08°23'32.28"N, 78°06'13.92"E		

S. No	Parameter	Unit	Results		Test procedure
			MW4	MW5	
1	Temperature	°C	28.2	27.3	APHA 23rd Edn -2550B
2	Salinity	ppt	34.1	34.3	APHA 23rd Edn-Electrometric Method
3	pH	-	8.19	8.23	IS : 3025 Part 11-1983 (Reaff: 2017)
4	Total Suspended Soiids	mg/l	3	2	IS:3025 Part 17-1984(Reaff:2017)
5	Turbidity	mg/l	2.9	2.2	IS : 3025 Part 10-1984 (Reaff: 2017)
6	Dissolve Oxygen as O2	mg/l	6.6	6.7	IS:3025:Part-38:1989(Reaff: 2019)
7	Bio-Chemical Oxygen Demand	mg/l	<2	<2	IS:3025:Part-44:1993(Reaff: 2019)
8	Nitrite as NO_2	mg/l	0.03	0.02	APHA 23rd Edn - 4500-NO_2-B.
9	Nitrate as NO_3	mg/l	1.8	2.1	APHA 23rd Edn -4500-NO3- B
10	Phosphate as PO_4	mg/l	0.11	0.12	IS:3025:Part-31:1988 (Reaff:2019)
11	Total Nitrogen as N	mg/l	3.7	4	APHA 23rd Edn -4500- Norg B
12	Iron as Fe	mg/i	BDL(<0.05)	BDL(<0.05)	APHA 23rd Edn -3111 B
13	Zinc as Zn	mg/l	0.03	0.04	APHA 22nd Edn -3111 B
14	Manganese as Mn	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd Edn -3111 B
15	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd Edn -3111 B
16	Cadmium as Cd	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd Edn -3111 B

Contd ....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab

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TEST REPORT

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/MW4-MW5
Sample description	:	Marine Water Analysis
Report date	:	26-03-2024 Page 2 of 2

S. No	Parameter	Unit	Results		Test Procedure
			MW4	MW5	
17	Nickel as Ni	mg/l	BDL (<0.02)	BDL (<0.02)	APHA 23rd Edn -3111 B
18	Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd Edn -3111 B
28	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd Edn -3111 B
19	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd Edn -3112 B
20	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd Edn -3113 B
21	Total Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd Edn -3113 B
22	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd Edn -4500-CN E
23	Total Petroleum Hydrocarbon	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd Edn -6440 B

BDL - Below Detection Limit

...End of Report...

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab

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TEST REPORT

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/MS1-MS2
Sample Drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 19 : 2021
Sample description	:	Marine Sediment Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	11-03-2024
Date of Receipt	:	13-03-2024
Date of Analysis	:	14-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024 Page 1 of 2
MS1- 08°24'31.05"N, 78° 04'19.24"E, MS2- 08°26'01.21"N, 78° 05'20.92"E		

S. No	Parameter	Unit	Results		Test procedure
			MS1	MS2	
1	pH	-	7.28	7.41	IS -2720(Part 26)1987(RA 2021)
2	Texture	%	Sand	Sand	Robinson Pipette Method
3	Total Organic Carbon as C	%	2.33	1.74	IS 2720 (Part 22):1972 (RA 2020)
4	Phosphorous as P	mg/kg	118	132	EPA 3050 B & FAO Chapter 3/ ABCTL/SOIL SOP02
5	Total Petroleum Hydrocarbon	mg/kg	BDL (<0.05)	BDL (<0.05)	ABCTL/INS/SOP/31

BDL - Below Detection Limit

Cond ...

S - 26/3/24
S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs™
India Private Limited
Quality Recommended

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TEST REPORT

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/MS1-MS2
Sample Drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 19 : 2021
Sample description	:	Marine Sediment Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	11-03-2024
Date of Receipt	:	13-03-2024
Date of Anaiysis	:	14-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024

MS1- 08°24'31.05"N, 78° 04'19.24"E, MS2- 08°26'01.21"N, 78° 05'20.92"E

S. No	Parameter	Unit	Results		Test procedure
			MS1	MS2	
6	Iron as Fe	mg/kg	474	332	USEPA 3050B & USEPA 7000B
7	Zinc as Zn	mg/kg	67	89	USEPA 3050B & USEPA 7000B
8	Manganese as Mn	mg/kg	94	73	USEPA 3050B & USEPA 7000B
9	Lead as Pb	mg/kg	5.23	3.74	USEPA 3050B & USEPA 7000B
10	Cadmium as Cd	mg/kg	BDL(<2)	BDL(<2)	USEPA 3050B & USEPA 7000B
11	Chromium as Cr	mg/kg	15.6	12.2	USEPA 3050B & USEPA 7000B
12	Nickel as Ni	mg/kg	BDL(<2)	BDL(<2)	USEPA 3050B & USEPA 7000B
13	Copper as Cu	mg/kg	24.5	19.3	USEPA 3050B & USEPA 7000B
14	Mercury as Hg	mg/kg	BDL(<1)	BDL(<1)	USEPA 3050B & USEPA 7471B
15	Selenium as Se	mg/kg	BDL(<2)	BDL(<2)	USEPA 3050B & USEPA 7000B
16	Total Arsenic as As	mg/kg	BDL(<2)	BDL(<2)	USEPA 3050B & USEPA 7000B

BDL - Below Detection Limit

....End of Report..

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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TEST REPORT

M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/MS3-MS5
Sample Drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 19 : 2021
Sample description	:	Marine Sediment Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	11-03-2024
Date of Receipt	:	13-03-2024
Date of Analysis	:	14-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024 Page 1 of 2
MS3- 08°28'10.09"N, 78°07'16.38"E, MS4- 08°25'59.84"N, 78°07'25.93"E,, MS5- 08°23'32.28"N, 78°06'13.92"E		

S. No	Parameter	Unit	Results			Test procedure
			MS3	MS4	MS5	
1	pH	-	7.39	7.64	7.14	IS -2720(Part 26)1987(RA 2021)
2	Texture	%	Sand	Silt Loam	Silty Clay	Robinson Pipette Method
3	Total Organic Carbon as C	%	2.36	3.24	2.98	IS 2720 (Part 22):1972 (RA 2020)
4	Phosphorous as P	mg/kg	174	234	205	EPA 3050 B & FAO Chapter 3/ ABCTL/SOIL SOP02
5	Total Petroleum Hydrocarbon	mg/kg	BDL (<0.05)	BDL (<0.05)	BDL (<0.05)	ABCTL/INS/SOP/31

BDL - Below Detection Limit

Cond ...

S.Dharani
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TEST REPORT

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(A Successor entity of TNEB),
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Chennai, Tamil Nadu 600002

Report number	:	ABCTL/TNPGCL/2024/03/MS3-MS5
Sample Drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 19 : 2021
Sample description	:	Marine Sediment Analysis
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	11-03-2024
Date of Receipt	:	13-03-2024
Date of Analysis	:	14-03-2024
Date completed	:	25-03-2024
Report date	:	26-03-2024

MS3- 08°28'10.09"N, 78°07'16.38"E, MS4- 08°25'59.84"N, 78°07'25.93"E,, MS5- 08°23'32.28"N, 78°06'13.92"E

S. No	Parameter	Unit	Results			Test procedure
			MS3	MS4	MS5	
6	Iron as Fe	mg/kg	674	811	634	USEPA 3050B & USEPA 7000B
7	Zinc as Zn	mg/kg	82	118	98	USEPA 3050B & USEPA 7000B
8	Manganese as Mn	mg/kg	134	171	116	USEPA 3050B & USEPA 7000B
9	Lead as Pb	mg/kg	6.78	9.25	7.81	USEPA 3050B & USEPA 7000B
10	Cadmium as Cd	mg/kg	BDL(<2)	BDL(<2)	BDL(<2)	USEPA 3050B & USEPA 7000B
11	Chromium as Cr	mg/kg	15.5	24.7	19.1	USEPA 3050B & USEPA 7000B
12	Nickel as Ni	mg/kg	BDL(<2)	BDL(<2)	BDL(<2)	USEPA 3050B & USEPA 7000B
13	Copper as Cu	mg/kg	26.1	39.7	31.4	USEPA 3050B & USEPA 7000B
14	Mercury as Hg	mg/kg	BDL(<1)	BDL(<1)	BDL(<1)	USEPA 3050B & USEPA 7471B
15	Selenium as Se	mg/kg	BDL(<2)	BDL(<2)	BDL(<2)	USEPA 3050B & USEPA 7000B
16	Total Arsenic as As	mg/kg	BDL(<2)	BDL(<2)	BDL(<2)	USEPA 3050B & USEPA 7000B

BDL - Below Detection Limit

....End of Report...

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab

ABC Techno Labs India Private Limited

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ISSUED TO: M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TANGEDCO/2024/08/GW1-GW2
Sample drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 22 : 2021 & IS 17614 : Part 25 : 2022
Sample description	:	Ground Water GW1-08°26'29.00"N, 78° 04'10.28 E, GW2-08°26'19.99"N, 78° 02'59.55 E,
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	05-08-2024
Date of Receipt	:	06-08-2024
Date of Analysis	:	06-08-2024
Date completed	:	12-08-2024
Report date	:	13-08-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW1	GW2		
1	Colour	Hazen	<1	3	IS 3025(part 4)1983(RA 2017)	5
2	Odour	-	No Odour Observed	No Odour Observed	IS 3025(part 8)1984(RA 2017)	Agreeable
3	Turbidity	NTU	0.8	0.6	IS:3025 Part 10-1984(Reaff: 2017)	1
4	pH at 25 °C	-	7.91	6.99	IS :3025 Part 11-1983(Reaff: 2017)	6.5-8.5
5	Conductivity at 25 °C	µS/cm	1780	21490	IS :3025 Part 14- 1984 (Reaff:2017)	Not Specified
6	Total dissolved solids	mg/l	1061	12897	IS :3025 Part 16-1984(Reaff: 2017)	500
7	Total Suspended solids	mg/l	<2	<2	IS :3025 Part 17-1984(Reaff: 2017)	Not Specified
8	Total Alkalinity as $CaCO_3$	mg /l	202	306	IS : 3025 Part 23-1986(Reaff: 2019)	200
9	Total Hardness as $CaCO_3$	mg/l	555	3800	IS : 3025 Part 21-2009	200
10	Calcium as Ca	mg/l	78	514	IS : 3025 Part 40-1991(Reaff: 2019)	75
11	Magnesium as Mg	mg/l	87	608	APHA 23rd EDN -3500 Mg B	30
12	Chloride as Cl^-	mg/l	496	7188	IS :3025 Part 32-1988(Reaff: 2019)	250
13	Sulphate as SO_4	mg/l	58	590	APHA 23rd EDN -4500-SO_4^{2-} E	200
14	Nitrate as NO_3	mg/l	2	3	APHA 23rd EDN -4500- NO_3^- B	45
15	Iron as Fe	mg/l	0.16	0.18	IS 3025(part 53)1987(Reaff: 2019)	1
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B	0.10
17	Fluoride as F	mg/l	0.42	0.37	APHA 23rd EDN -4500-F B&D	1.00

Contd....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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ISSUED TO: M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report no	:	ABCTL/TNPGCL/2024/08/GW1-GW2
Sample description	:	Ground Water
Date of report	:	13-08-2024 Page 2 of 2

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW1	GW2		
18	Sodium as Na	mg/l	214	3800	IS : 3025 Part 45-1993 (Reaff:2019)	Not Specified
19	Potassium as K	mg/l	5	13	IS : 3025 Part 45 -1993 (Reaff:2019)	Not Specified
20	Barium as Ba	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -3111 D	0.7
21	Residual Free Chlorine	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -4500-Cl B	0.20
22	Aluminium as Al	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN 3500 Al B	0.03
23	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B	0.003
24	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
25	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
26	Zinc as Zn	mg/l	0.02	0.07	APHA 23rd EDN -3111 B	5.00
27	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
28	Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
29	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -4500-CN E	0.05
30	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
31	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	IS APHA 23rd EDN -3112 B	0.001
32	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN 5540 C	0.20
33	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C	0.001
34	Pesticides	mg/l	Absent	Absent	APHA 23rd EDN -6630 B, C	Absent
35	Total Coliforms	MPN/ 100mi	<2	<2	IS-1622-1981 (Reaff -2019)	Absent /100ml
36	E.coli	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff-2019)	Absent /100ml

BDL- Below Detection Limit

....End of report....

S. Dharani
Quality Manager
Verified by

ABC TECHNO LABS INDIA P. LTD. CHENNAI 600 098

ABC

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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ISSUED TO: **M/s. TNPGCL S/o TANGEDCO**
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/08/GW3-GW4
Sample drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 22 : 2021 & IS 17614 : Part 25 : 2022
Sample description	:	Ground Water GW3-08°53.69"N, 78° 03'11.53 E, GW4-08°25'57.12"N, 78° 02'38.53 E,
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	05-08-2024
Date of Receipt	:	06-08-2024
Date of Analysis	:	06-08-2024
Date completed	:	12-08-2024
Report date	:	13-08-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable Limit as per IS 10500 : 2012
			GW3	GW4		
1	Colour	Hazen	2	<1	IS 3025(part 4)1983(RA 2017)	5
2	Odour	-	No Odour Observed	No Odour Observed	IS 3025(part 8)1984(RA 2017)	Agreeable
3	Turbidity	NTU	BDL(<0.5)	BDL (<0.5)	IS:3025 Part 10-1984(Reaff: 2017)	1
4	pH at 25 °C	-	7.01	7.56	IS :3025 Part 11-1983(Reaff: 2017)	6.5-8.5
5	Conductivity at 25 °C	µS/cm	23180	1419	IS :3025 Part 14- 1984 (Reaff:2017)	Not Specified
6	Total dissolved solids	mg/l	14124	809	IS :3025 Part 16-1984(Reaff: 2017)	500
7	Total Suspended solids	mg/l	<2	<2	IS :3025 Part 17-1984(Reaff: 2017)	Not Specified
8	Total Alkalinity as $CaCO_3$	mg /l	240	230	IS : 3025 Part 23-1986(Reaff: 2019)	200
9	Total Hardness as $CaCO_3$	mg/l	4300	333	IS : 3025 Part 21-2009	200
10	Calcium as Ca	mg/l	887	53	IS : 3025 Part 40-1991(Reaff: 2019)	75
11	Magnesium as Mg	mg/l	506	49	APHA 23rd EDN -3500 Mg B	30
12	Chloride as Cl^-	mg/l	7998	327	IS :3025 Part 32-1988(Reaff: 2019)	250
13	Sulphate as SO_4	mg/l	475	42	APHA 23rd EDN -4500-SO_4^{2-} E	200
14	Nitrate as NO_3	mg/l	3	5	APHA 23rd EDN -4500- NO_3^- B	45
15	Iron as Fe	mg/l	0.21	0.12	IS 3025(part 53)1987(Reaff: 2019)	1
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B	0.10
17	Fluoride as F	mg/l	0.44	0.37	APHA 23rd EDN -4500-F B&D	1.00

Contd....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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- The test report shall not be reproduced in full or part without the written approval of ABCTL.
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ISSUED TO: M/s. TNPGCL S/o TANGEDCO
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TEST REPORT

Report no	:	ABCTL/TNPGCL/2024/08/GW3-GW4
Sample description	:	Ground Water
Date of report	:	13-08-2024 Page 2 of 2

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW3	GW4		
18	Sodium as Na	mg/l	4100	192	IS : 3025 Part 45-1993 (Reaff:2019)	Not Specified
19	Potassium as K	mg/l	11	3.3	IS : 3025 Part 45 -1993 (Reaff:2019)	Not Specified
20	Barium as Ba	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -3111 D	0.7
21	Residual Free Chlorine	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -4500-Cl B	0.20
22	Aluminium as Al	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN 3500 Al B	0.03
23	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B	0.003
24	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
25	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
26	Zinc as Zn	mg/l	0.05	0.08	APHA 23rd EDN -3111 B	5.00
27	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
28	Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
29	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -4500-CN E	0.05
30	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
31	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	IS APHA 23rd EDN -3112 B	0.001
32	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN 5540 C	0.20
33	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C	0.001
34	Pesticides	mg/l	Absent	Absent	APHA 23rd EDN -6630 B, C	Absent
35	Total Coliforms	MPN/ 100ml	<2	2	IS-1622-1981 (Reaff -2019)	Absent /100ml
36	E.coli	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff-2019)	Absent /100ml

BDL- Below Detection Limit

....End of report....

S.Dharani
Quality Manager
Verified by

ABC TECHNO LABS INDIA PVT. LTD. CHENNAI 600 098

ABC

A. Robson Chinnadurai
Technical Manager-Lab
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ISSUED TO: **M/s. TNPGCL S/o TANGEDCO**
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/08/GW5-GW6
Sample drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 22 : 2021 & IS 17614 : Part 25 : 2022
Sample description	:	Ground Water GW5-08°25'07.55"N, 78° 03'29.24 E, GW6-08°25'33.44"N, 78° 03'57.56 E,
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	05-08-2024
Date of Receipt	:	06-08-2024
Date of Analysis	:	06-08-2024
Date completed	:	12-08-2024
Report date	:	13-08-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW5	GW6		
1	Colour	Hazen	<1	<1	lS 3025(part 4)1983(RA 2017)	5
2	Odour	-	No Odour Observed	No Odour Observed	IS 3025(part 8)1984(RA 2017)	Agreeahle
3	Turbidity	NTU	BDL(<0.5)	BDL(<0.5)	IS:3025 Part 10-1984(Reaff: 2017)	1
4	pH at 25 °C	-	7.32	7.61	IS :3025 Part 11-1983(Reaff: 2017)	6.5-8.5
5	Conductivity at 25 °C	µS/cm	6180	830	IS :3025 Part 14- 1984 (Reaff:2017)	Not Specified
6	Total dissolved solids	mg/l	3581	473	IS :3025 Part 16-1984(Reaff: 2017)	500
7	Total Suspended solids	mg/l	<2	<2	lS :3025 Part 17-1984(Reaff: 2017)	Not Specified
8	Total Alkalinity as $CaCO_3$	mg/l	250	184	IS : 3025 Part 23-1986(Reaff: 2019)	200
9	Total Hardness as $CaCO_3$	mg/l	787	248	lS : 3025 Part 21-2009	200
10	Calcium as Ca	mg/l	113	61	IS : 3025 Part 40-1991(Reaff: 2019)	75
11	Magnesium as Mg	mg/l	122	24	APHA 23rd EDN -3500 Mg B	30
12	Chloride as Cl^-	mg/l	1811	134	IS :3025 Part 32-1988(Reaff: 2019)	250
13	Sulphate as SO_4	mg/l	254	48	APHA 23rd EDN -4500-SO_4^{2-} E	200
14	Nitrate as NO_3	mg/l	2	4	APHA 23rd EDN -4500- NO_3^- B	45
15	Iron as Fe	mg/l	0.07	0.05	IS 3025(part 53)1987(Reaff: 2019)	1
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B	0.10
17	Fluoride as F	mg/l	0.30	0.25	APHA 23rd EDN -4500-F B&D	1.00

Contd....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs India Private Limited
ABC TOWER #400, 13th Street, SIDCO Industrial Estate - North Phase,
Ambattur, Chennai - 600 098, Tamilnadu, INDIA.
Ph : +91-44-2625 7788 / 99, +91 94442 60000 / 95661 87777
Email: lab@abctechnolab.com / Web: www.abctechnolab.com
TC - 5770

ISSUED TO: M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report no	:	ABCTL/TNPGCL/2024/08/GW5-GW6
Sample description	:	Ground Water
Date of report	:	13-08-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW5	GW6		
18	Sodium as Na	mg/l	1120	90	IS : 3025 Part 45-1993 (Reaff:2019)	Not Specified
19	Potassium as K	mg/l	9	2	IS : 3025 Part 45 -1993 (Reaff:2019)	Not Specified
20	Barium as Ba	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -3111 D	0.7
21	Residual Free Chlorine	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -4500-Cl B	0.20
22	Aluminium as Al	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN 3500 Al B	0.03
23	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B	0.003
24	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
25	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
26	Zinc as Zn	mg/l	0.10	0.08	APHA 23rd EDN -3111 B	5.00
27	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
28	Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
29	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -4500-CN E	0.05
30	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
31	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	IS APHA 23rd EDN -3112 B	0.001
32	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN 5540 C	0.20
33	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C	0.001
34	Pesticides	mg/l	Absent	Absent	APHA 23rd EDN -6630 B, C	Absent
35	Total Coliforms	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff -2019)	Absent /100ml
36	E.coli	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff-2019)	Absent /100ml

BDL- Below Detection Limit

...End of report...

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs India Private Limited

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India Private Limited
Quality Uncompromised

TC - 5770

(An ISO : 9001, ISO : 14001, ISO : 45001 & ISO : 22000 Certified Company)

Accredited by NABL vide TC-5770, NABET / QCI, Approved by FSSAI, Recognised by MoEF&CC, BIS, APEDA, IOPEPC, Tea Board India

ISSUED TO: **M/s. TNPGCL S/o TANGEDCO**
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/08/GW7-GW8
Sample drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 22 : 2021 & IS 17614 : Part 25 : 2022
Sample description	:	Ground Water GW7-08°25'44.63 N, 78° 03'57.56 E, GW8-08°25'42.02"N, 78° 02'46.85 E,
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	05-08-2024
Date of Receipt	:	06-08-2024
Date of Analysis	:	06-08-2024
Date completed	:	12-08-2024
Report date	:	13-08-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW7	GW8		
1	Colour	Hazen	1	<1	IS 3025(part 4)1983(RA 2017)	5
2	Odour	-	No Odour Observed	No Odour Observed	IS 3025(part 8)1984(RA 2017)	Agreeable
3	Turbidity	NTU	BDL(<0.5)	BDL(<0.5)	IS:3025 Part 10-1984(Reaff: 2017)	1
4	pH at 25 °C	-	7.25	6.84	IS :3025 Part 11-1983(Reaff: 2017)	6.5-8.5
5	Conductivity at 25 °C	µS/cm	9290	24550	IS :3025 Part 14- 1984 (Reaff:2017)	Not Specified
6	Total dissolved solids	mg/l	5468	14960	IS :3025 Part 16-1984(Reaff: 2017)	500
7	Total Suspended solids	mg/l	<2	<2	IS :3025 Part 17-1984(Reaff: 2017)	Not Specified
8	Total Alkalinity as $CaCO_3$	mg/l	350	200	IS : 3025 Part 23-1986(Reaff: 2019)	200
9	Total Hardness as $CaCO_3$	mg/l	1600	9100	IS : 3025 Part 21-2009	200
10	Calcium as Ca	mg/l	340	1538	IS : 3025 Part 40-1991(Reaff: 2019)	75
11	Magnesium as Mg	mg/l	182	1276	APHA 23rd EDN -3500 Mg B	30
12	Chloride as Cl^-	mg/l	2890	7345	IS :3025 Part 32-1988(Reaff: 2019)	250
13	Sulphate as SO_4	mg/l	232	470	APHA 23rd EDN -4500-SO_4^{2-} E	200
14	Nitrate as NO_3	mg/l	7	3	APHA 23rd EDN -4500- NO_3^- B	45
15	Iron as Fe	mg/l	0.11	0.08	IS 3025(part 53)1987(Reaff: 2019)	1
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B	0.10
17	Fluoride as F	mg/l	0.39	0.47	APHA 23rd EDN -4500-F B&D	1.00

Contd....

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

Terms and conditions :

•The test results relate only to the items tested. • The test report shall not be reproduced in full or part without the written approval of ABCTL. • The test items will not be retained for more than 15 days from the date of issue of test report for Non-Perishable samples and in the case of Perishable samples test items will be retained for 7 days after date of issue of report or as per customer requirement. •The laboratory's responsibility under this report is limited to proven willful negligence and will in no case be more than the invoiced amount. • The test report is issued for the purpose of identifying the characteristic and not intended to use for any publicity / litigation purpose.

ABC Techno Labs™
India Private Limited
Quality Uncompromised

ABC Techno Labs India Private Limited

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Email: lab@abctechnolab.com / Web: www.abctechnolab.com

TC - 5770

(An ISO : 9001, ISO : 14001, ISO : 45001 & ISO : 22000 Certified Company)

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ISSUED TO: M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report no	:	ABCTL/TNPGCL/2024/08/GW7-GW8
Sample description	:	Ground Water
Date of report	:	13-08-2024 Page 2 of 2

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW7	GW8		
18	Sodium as Na	mg/l	1600	4200	IS : 3025 Part 45-1993 (Reaff:2019)	Not Specified
19	Potassium as K	mg/l	7	8	IS : 3025 Part 45 -1993 (Reaff:2019)	Not Specified
20	Barium as Ba	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -3111 D	0.7
21	Residual Free Chlorine	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -4500-Cl B	0.20
22	Aluminium as Al	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN 3500 Al B	0.03
23	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B	0.003
24	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
25	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
26	Zinc as Zn	mg/l	0.05	0.07	APHA 23rd EDN -3111 B	5.00
27	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
28	Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
29	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -4500-CN E	0.05
30	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
31	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	IS APHA 23rd EDN -3112 B	0.001
32	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN 5540 C	0.20
33	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C	0.001
34	Pesticides	mg/l	Absent	Absent	APHA 23rd EDN -6630 B, C	Absent
35	Total Coliforms	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff -2019)	Absent /100ml
36	E.coli	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff-2019)	Absent /100ml

BDL- Below Detection Limit

....End of report....

S. 13/8/24
S.Dharani
Quality Manager
Verified by

ABC TECHNO LABS INDIA PVT. LTD. CHENNAI 600 098

ABC

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

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TC - 5770

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ISSUED TO: **M/s. TNPGCL S/o TANGEDCO**
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report number	:	ABCTL/TNPGCL/2024/08/ GW9-GW10
Sample drawn by	:	ABC Techno Labs India Private Limited
Sampling method	:	IS 17614 : Part 22 : 2021 & IS 17614 : Part 25 : 2022
Sample description	:	Ground Water GW 9- 08°26'30.08"N, 78° 03'17.78 E, GW10-08°26'48.17"N, 78° 03'25.47 E,
Project Name	:	"Ongoing 2x 660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village,
Date of sampling	:	05-08-2024
Date of Receipt	:	06-08-2024
Date of Analysis	:	06-08-2024
Date completed	:	12-08-2024
Report date	:	13-08-2024

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW9	GW10		
1	Colour	Hazen	1	2	IS 3025(part 4)1983(RA 2017)	5
2	Odour	-	No Odour Observed	No Odour Observed	IS 3025(part 8)1984(RA 2017)	Agreeable
3	Turbidity	NTU	BDL(<0.5)	BDL(<0.5)	IS:3025 Part 10-1984(Reaff: 2017)	1
4	pH at 25 °C	-	7.74	7.28	IS :3025 Part 11-1983(Reaff: 2017)	6.5-8.5
5	Conductivity at 25 °C	µS/cm	22120	23000	IS :3025 Part 14- 1984 (Reaff:2017)	Not Specified
6	Total dissolved solids	mg/l	13274	13815	IS :3025 Part 16-1984(Reaff: 2017)	500
7	Total Suspended solids	mg/l	<2	<2	IS :3025 Part 17-1984(Reaff: 2017)	Not Specified
8	Total Alkalinity as $CaCO_3$	mg/l	168	208	IS : 3025 Part 23-1986(Reaff: 2019)	200
9	Total Hardness as $CaCO_3$	mg/l	5220	6380	IS : 3025 Part 21-2009	200
10	Calcium as Ca	mg/l	871	1052	IS : 3025 Part 40-1991(Reaff: 2019)	75
11	Magnesium as Mg	mg/l	738	1057	APHA 23rd EDN -3500 Mg B	30
12	Chloride as Cl^-	mg/l	7444	7236	IS :3025 Part 32-1988(Reaff: 2019)	250
13	Sulphate as SO_4	mg/l	684	539	APHA 23rd EDN -4500-SO_4^{2-} E	200
14	Nitrate as NO_3	mg/l	6	3	APHA 23rd EDN -4500- NO_3^- B	45
15	Iron as Fe	mg/l	0.13	0.14	IS 3025(part 53)1987(Reaff: 2019)	1
16	Manganese as Mn	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3111 B	0.10
17	Fluoride as F	mg/l	0.29	0.22	APHA 23rd EDN -4500-F B&D	1.00

Contd...

S.Dharani
Quality Manager
Verified by

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

ABC Techno Labs India Private Limited

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ISSUED TO: M/s. TNPGCL S/o TANGEDCO
(A Successor entity of TNEB),
5B Block, First Floor, No.144, Anna Salai,
Chennai, Tamil Nadu 600002

TEST REPORT

Report no	:	ABCTL/TNPGCL/2024/08/GW9-GW10
Sample description	:	Ground Water
Date of report	:	13-08-2024 Page 2 of 2

S. No.	Parameter	Unit	Results		Test procedure	Acceptable limit as per IS 10500 : 2012
			GW9	GW10		
18	Sodium as Na	mg/l	3420	3870	IS : 3025 Part 45-1993 (Reaff:2019)	Not Specified
19	Potassium as K	mg/l	11	14	IS : 3025 Part 45 -1993 (Reaff:2019)	Not Specified
20	Barium as Ba	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -3111 D	0.7
21	Residual Free Chlorine	mg/l	BDL(<0.1)	BDL(<0.1)	APHA 23rd EDN -4500-Cl B	0.20
22	Aluminium as Al	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN 3500 Al B	0.03
23	Cadmium as Cd	mg/l	BDL(<0.003)	BDL(<0.003)	APHA 23rd EDN -3111 B	0.003
24	Lead as Pb	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
25	Copper as Cu	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
26	Zinc as Zn	mg/l	0.06	0.11	APHA 23rd EDN -3111 B	5.00
27	Total Chromium as Cr	mg/l	BDL(<0.03)	BDL(<0.03)	APHA 23rd EDN -3111 B	0.05
28	Arsenic as As	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
29	Cyanide as CN	mg/l	BDL(<0.02)	BDL(<0.02)	APHA 23rd EDN -4500-CN E	0.05
30	Selenium as Se	mg/l	BDL(<0.01)	BDL(<0.01)	APHA 23rd EDN -3113 B	0.01
31	Mercury as Hg	mg/l	BDL(<0.001)	BDL(<0.001)	IS AFHA 23rd EDN -3112 B	0.001
32	Anionic Surfactants as MBAS	mg/l	BDL(<0.025)	BDL(<0.025)	APHA 23rd EDN 5540 C	0.20
33	Phenolic Compounds as Phenol	mg/l	BDL(<0.001)	BDL(<0.001)	APHA 23rd EDN 5530 B,C	0.001
34	Pesticides	mg/l	Absent	Absent	APHA 23rd EDN -6630 B, C	Absent
35	Total Coliforms	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff -2019)	Absent /100ml
36	E.coli	MPN/ 100ml	<2	<2	IS-1622-1981 (Reaff-2019)	Absent /100ml

BDL- Below Detection Limit

....End of report....

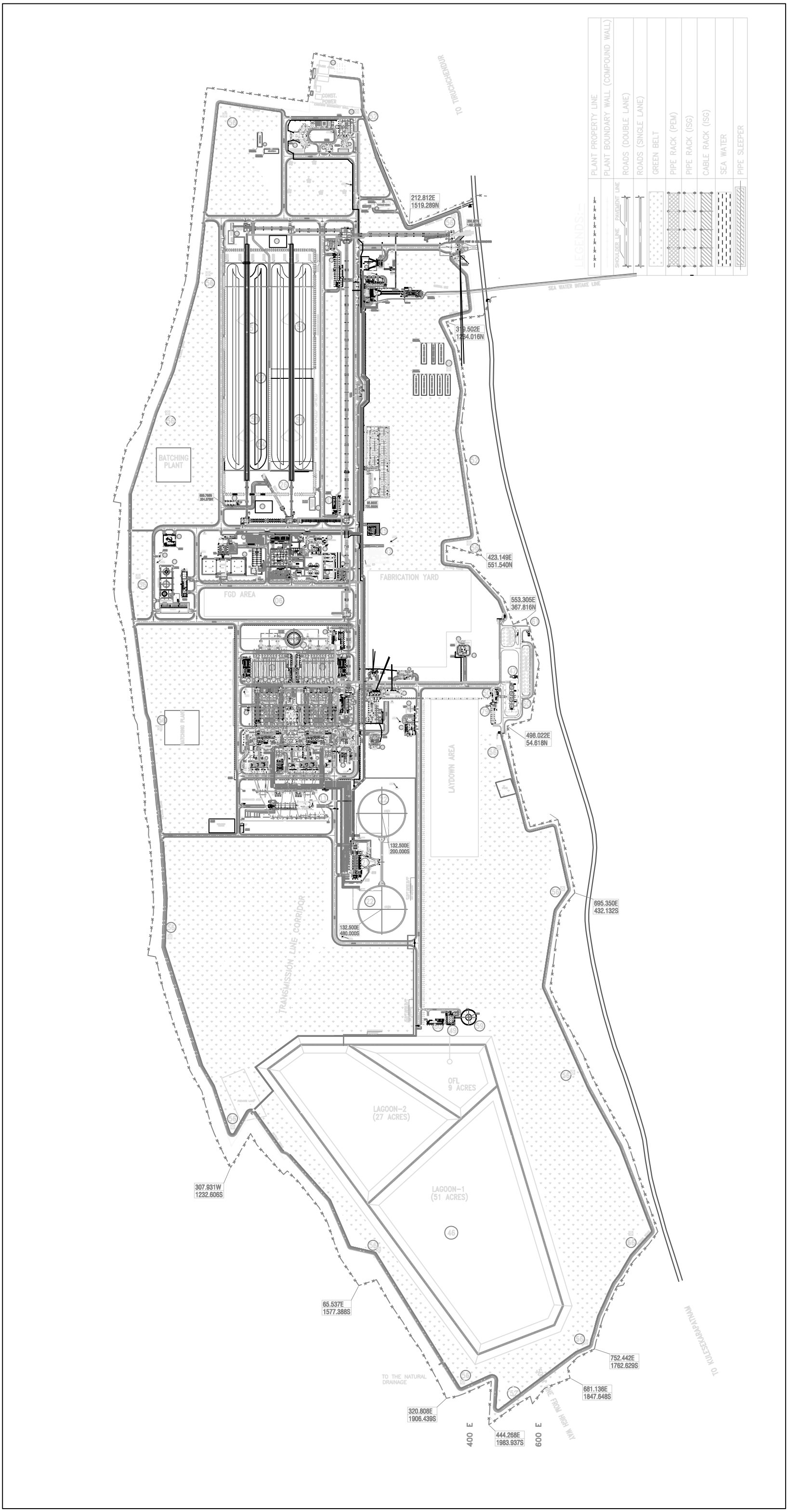
S. 12/8/24
S.Dharani
Quality Manager
Verified by

ABC TECHNO LABS INDIA PVT. LTD. CHENNAI 600 098

A. Robson Chinnadurai
Technical Manager-Lab
Authorised Signatory

Annexure - V

Layout Plan


LEGENDS
PLANT PROPERTY LINE
PLANT BOUNDARY WALL (COMPOUND WALL)
ROADS (DOUBLE LANE)
ROADS (SINGLE LANE)
GREEN BELT
PIPE RACK (PEM)
PIPE RACK (ISG)
CABLE RACK (ISG)
SEA WATER
PIPE SLEEPER
SHOULDER LINE
PAVEMENT LINE
TO TRUCHCHENDUR
CONST. POWER
212.812E
1519.289N
SEA WATER INTAKE LINE
312.502E
1234.016N
BATCHING PLANT
FGD AREA
FABRICATION YARD
423.149E
551.540N
553.305E
367.816N
498.022E
54.618N
LAYDOWN AREA
132.500E
200.000S
695.350E
432.132S
132.500E
490.000S
TRANSMISSION LINE CORRIDOR
OFL
9 ACRES
LAGOON-2
(27 ACRES)
LAGOON-1
(51 ACRES)
307.931W
1232.606S
65.537E
1577.388S
TO THE NATURAL DRAINAGE
320.808E
1906.439S
444.268E
1983.937S
400 E
600 E
50M LINE FROM HIGH WAY
752.442E
1762.629S
681.136E
1847.648S
TO KULESEKARAPATNAM

Annexure - VI

Coal Analysis Report

MONARCH NUCLEAR COUNTING LABORATORY

A UNIT OF MONARCH BIOTECH PRIVATE LIMITED

Accredited by AERB, Recognized By BIS & Notified by FSSAI

TEST REPORT

ORIGINAL

Test Report No: MBT / TR / 5596 / 2024 – 2025 **Date: 20.09.2024**

Office of the C.E / Projects TNPGCL 17 OCT 2024 Chennai-2

PARTICULARS OF SAMPLE SUBMITTED

*Sample Described by customer as	:	DOMESTIC COAL
*Customer Name	:	CHIEF ENGINEER/PROJECTS II TNPGCL
*Customer Address	:	5th Floor, NPKRR Maaligai, 144, Anna Salai, Chennai, 600 002, Tamil Nadu, India.
*Customer Reference	:	Lr.No. CE/Prj-II/SE/C/P&E/EE/C/EMC-i/AEE/C/F.Udangudi STPP/D.481/24 & Dt.31.8.2024
Sample Code No	:	M2409010
Sample Type	:	DOMESTIC COAL
Sample Received Date	:	09.09.2024
Sample Qty. Recd.	:	200gm
Reference to sampling procedure	:	Not applicable
Any Deviation from the test methods	:	NIL
Test Commenced On	:	09.09.2024
Test Completed On	:	20.09.2024

Note: *Information provided by customer

TEST RESULTS

S. No	Test Parameters	Test Method	Result	Unit
1	Sulphur Content	IS 1350 (Part-3): 1969	3.10	%
2	Ash Content	IS 1350 (Part-1): 1984	43.5	%
Heavy Metals:				
1	Lead as Pb	MBT/CL/SOP/091	7.29	mg/kg
2	Arsenic as As		BLQ(LOQ:0.01)	mg/kg
3	Chromium as Cr		10.16	mg/kg
4	Mercury as Hg.		BLQ(LOQ:0.01)	mg/kg

Note: BLQ: Below Limit of Quantification; **LOQ:** Limit of Quantification.

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

Reviewed by,
P. Nagarajan.

K. Senthilnathan,
Lab Manager,
Authorized Signatory.

Regd. Office & Sample Collection Centre : New No. 17/1, Sadullah Street, T. Nagar, Chennai - 600 017 Tamilnadu, INDIA
Phone : 044 - 2681 0052 / 2431 2759 Email: monarchblo@gmail.com / info@monarchtestinglab.com; website: www.monarchtestinglab.com
LAB : 37-A,SIDCO Industrial Estate, Thirumazhisai, Chennai 600 124, Tamilnadu, INDIA. Ph: 91- 44- 2681 0052

MONARCH NUCLEAR COUNTING LABORATORY
A UNIT OF MONARCH BIOTECH PRIVATE LIMITED

TC-6206

TEST REPORT

ORIGINAL

RADIOACTIVITY MEASUREMENT / TEST REPORT

ULR-TC620624000040283F
Discipline: Radiological
Group: Environment (Radioactive Contaminants)
Test Report No : MBT / RL / 35192 / 2024-2025

Date: 09 / 10 / 2024

Office of the C.E / Projects TNPGCL 17 OCT 2024 Chennai-1

Sample Identification No	:	35192
*Sample received from	:	THE CHIEF ENGINEER / PROJECTS II TNPGCL, 5th Floor, NPKRR Maaligai, 144, Anna Salai, Chennai – 600 002, Tamil Nadu, India.
*Customer Reference No.	:	CE/Prj-II/SE/C/P&E/EE/C/EMC-I/AEE/C/F.Udangudi STPP/D.481/24 Dt.31.08.2024
*Nature of sample	:	DOMESTIC COAL
Laboratory sample No	:	2409092
Volume / weight	:	2 kg
Sample received on	:	09 / 09 / 2024
Testing completed on	:	09 / 10 / 2024

S.No	Nuclides Analyzed	Activity Determination Limit Of Instrument MDA (3σ)	Method of Testing	Result (Bq / kg)	Exemption levels as per IAEA BSS
1.	Nat Thorium-232	12.86 Bq/kg	AERB – Standard Analytical method (Clause 4.3.4 : 2003)	56.36 ± 12.63	1000 Bq/kg
2.	Nat. Uranium-238	12.73 Bq/kg	AERB – Standard Analytical method (Clause 4.3.4 : 2003)	45.12 ± 12.75	1000 Bq/kg
3.	K - 40	58.08 Bq/kg	AERB – Standard Analytical method (Clause 4.3.4 : 2003)	91.62 ± 58.08	10,000 Bq/kg

Note : 1. BDL: Below Detectable Level, MDA: Minimum Detectable Activity & Bq: Becquerel
2.* This information was provided by customer

Remarks: The above sample was analyzed for the radioactivity content. This is to certify that the activity levels of Natural Thorium-232, Natural Uranium-238 and K-40 in the sample were found to be below the IAEA Basic safety series limits.

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

Customer Name & Address:-
THE CHIEF ENGINEER / PROJECTS II
TNPGCL,
Chennai – 600 002, Tamil Nadu, India.

Reviewed By

S. SARASWATHI
Junior Scientist

MONARCH NUCLEAR COUNTING LABORATORY A UNIT OF MONARCH BIOTECH PVT LTD CHENNAI 600 124

Dr.G.SANKARAN PILLAI,
Technical Manager – Radiological,
Authorized Signatory.

Regd. Office & Sample Collection Centre : New No. 17/1, Sadullah Street, T. Nagar, Chennai - 600 017 Tamilnadu, INDIA
Phone : 044 - 2681 0052 / 2431 2759 Email: monarchbio@gmail.com / info@monarchtestinglab.com; website: www.monarchtestinglab.com
LAB : 37-A,SIDCO Industrial Estate, Thirumazhisai, Chennai - 600 124, Tamilnadu, INDIA. Ph: 91- 44- 2681 0052

MONARCH NUCLEAR COUNTING LABORATORY

A UNIT OF MONARCH BIOTECH PRIVATE LIMITED

Accredited by AERB, Recognized By BIS & Notified by FSSAI

TEST REPORT

ORIGINAL

Test Report No: MBT / TR / 5597 / 2024 – 2025 **Date: 20.09.2024**

Office of the C.E./Projects TNPGCL 17 OCT 2024

PARTICULARS OF SAMPLE SUBMITTED

*Sample Described by customer as	:	IMPORTED COAL
*Customer Name	:	CHIEF ENGINEER/PROJECTS II TNPGCL
*Customer Address	:	5th Floor, NPKRR Maaligai, 144, Anna Salai, Chennai-2 Chennai, 600 002, Tamil Nadu, India.
*Customer Reference	:	Lr.No. CE/Prj-II/SE/C/P&E/EE/C/EMC-I/AEE/C/F.Udangudi STPP/D.481/24 & Dt.31.8.2024
Sample Code No	:	M2409011
Sample Type	:	IMPORTED COAL
Sample Received Date	:	09.09.2024
Sample Qty. Recd.	:	200gm
Reference to sampling procedure	:	Not applicable
Any Deviation from the test methods	:	NIL
Test Commenced On	:	09.09.2024
Test Completed On	:	20.09.2024

Note: *Information provided by customer

TEST RESULTS

S. No	Test Parameters	Test Method	Result	Unit
1	Sulphur Content	IS 1350 (Part-3): 1969	0.52	%
2	Ash Content	IS 1350 (Part-1): 1984	8.09	%
Heavy Metals:				
1	Lead as Pb	MBT/CL/SOP/091	9.16	mg/kg
2	Arsenic as As		BLQ(LOQ:0.01)	mg/kg
3	Chromium as Cr		3.18	mg/kg
4	Mercury as Hg		BLQ (LOQ:0.01)	mg/kg

Note: BLQ: Below Limit of Quantification; LOQ: Limit of Quantification.

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

P. Nagarajan
Reviewed by,
P. Nagarajan.

MONARCH NUCLEAR COUNTING LABORATORY A UNIT OF MONARCH BIOTECH PVT. LTD. CHENNAI 600 124

K. Senthilnathan,
Lab Manager,
Authorized Signatory.

Regd. Office & Sample Collection Centre : New No. 17/1, Sadullah Street, T. Nagar, Chennai - 600 017 Tamilnadu, INDIA
Phone : 044 - 2681 0052 / 2431 2759 Email: monarchbio@gmail.com / info@monarchtestinglab.com; website: www.monarchtestinglab.com
LAB : 37-A,SIDCO Industrial Estate, Thirumazhisai, Chennai 600 124, Tamilnadu, INDIA. Ph: 91- 44- 2681 0052

MONARCH NUCLEAR COUNTING LABORATORY
A UNIT OF MONARCH BIOTECH PRIVATE LIMITED

TC-6206

TEST REPORT

ORIGINAL

RADIOACTIVITY MEASUREMENT / TEST REPORT

ULR-TC620624000040284F
Discipline: Radiological
Group: Environment (Radioactive Contaminants)
Test Report No : MBT / RL / 35193 / 2024-2025

Date: 09 / 10 / 2024

Office of the C.E / Projects TNPGCL 17 OCT 2024 Chennai-3

Sample Identification No	:	35193
*Sample received from	:	THE CHIEF ENGINEER / PROJECTS II TNPGCL, 5th Floor, NPKRR Maaligai, 144, Anna Salai, Chennai – 600 002, Tamil Nadu, India.
*Customer Reference No.	:	CE/Prj-II/SE/C/P&E/EE/C/EMC-I/AEE/C/F.Udangudi STPP/D.481/24 Dt.31.8.2024
*Nature of sample	:	IMPORTED COAL
Laboratory sample No	:	2409093
Volume / weight	:	2 kg
Sample received on	:	09 / 09 / 2024
Testing completed on	:	09 / 10 / 2024

S.No	Nuclides Analyzed	Activity Determination Limit Of Instrument MDA (3σ)	Method of Testing	Result (Bq / kg)	Exemption levels as per IAEA BSS
1.	Nat.Thorium-232	17.19 Bq/kg	AERB – Standard Analytical method (Clause 4.3.4 : 2003)	BDL	1000 Bq/kg
2.	Nat. Uranium-238	17.0 Bq/kg	AERB – Standard Analytical method (Clause 4.3.4 : 2003)	BDL	1000 Bq/kg
3.	K - 40	73.59 Bq/kg	AERB – Standard Analytical method (Clause 4.3.4 : 2003)	BDL	10,000 Bq/kg

Note : 1. BDL: Below Detectable Level, MDA: Minimum Detectable Activity & Bq: Becquerel
2.* This information was provided by customer

Remarks: The above sample was analyzed for the radioactivity content. This is to certify that the activity levels of Natural Thorium-232, Natural Uranium-238 and K-40 in the sample were found to be below the IAEA Basic safety series limits.

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

Customer Name & Address:-
THE CHIEF ENGINEER / PROJECTS II
TNPGCL,
Chennai – 600 002, Tamil Nadu, India.

Reviewed By

S. SARASWATHI
Junior Scientist

MONARCH NUCLEAR COUNTING LABORATORY A UNIT OF MONARCH BIOTECH PVT LTD CHENNAI 600 124

Dr.C.SANKARAN PILLAI,
Technical Manager – Radiological,
Authorized Signatory.

Regd. Office & Sample Collection Centre : New No. 17/1, Sedullah Street, T. Nagar, Chennai - 600 017 Tamilnadu, INDIA
Phone : 044 - 2681 0052 / 2431 2759 Email: monarchbio@gmail.com / info@monarchtestinglab.com; website: www.monarchtestinglab.com
LAB : 37-A,SIDCO Industrial Estate, Thirumazhisai, Chennai - 600 124, Tamilnadu, INDIA. Ph: 91- 44- 2681 0052

Annexure - VII

Coal Linkage

Powering Tamil Nadu's Progress...

From
Vikram Kapur,I.A.S.,
Principal secretary &
Chairman & Managing Director,
Tamil Nadu Generation and Distribution Corporation Ltd,
10th Floor, NPKRR Maaligai,
144, Anna Salai, Chennai – 600 002.

To
The Additional Secretary &Chairman /Standing Linkage Committee(Long Term),
Ministry of Coal,
Shastri Bhawan,
New Delhi -110001.

Lr.No.CE/M/Mines/EE/A3/F.LT Linkage/D 21 /19 DT.12.02.2019.

Sir,

Sub: TANGEDCO – based Udangudi Thermal Power Project stage -I of capacity (2x660 MW) - Bridge linkage application as per the recommendation of SLC/LT No.5/2018 held on 21.12.2018 –.Submission –Reg.

Ref: 1. Standing Linkage Committee (Long Term) meeting for Power Sector – SLC/LT No.5/2018 held on 21.12.2018
2. Lr.No.CE/M/Mines/EE/A3/F.LT Linkage/D141 /18 DT.26.06.2018.

****

TANGEDCO is establishing a coal based Udangudi Thermal Power Project stage -I of capacity (2x660 MW) to meet out the growing power demand of Tamil Nadu. The LOI for EPC contract was issued to M/s.BHEL for the above project on 07.12.2017 . Earth Work for Chimney Foundation is under progress. Engineering and other civil works are under progress. The work of Establishment of Captive Coal Jetty has been awarded on 13.2.18 and the works are under progress .

The expected date of commissioning of this project is 2021-22.

The Ministry of Coal has allotted Chandrabila Coal Block in the State of Odisha to TANGEDCO on 24.02.2016 for the following end use Thermal Power projects.

1.ETPS Expansion Thermal Power Project (1 x 660 MW)
2.Ennore SEZ Thermal Power Project (2 x 660 MW)
3.Udangudi Thermal Power Project Stage-I (2 x 660 MW).

The time line for obtaining the grant of opening of mine permission falls on the 66th month from the month of April 2016 i.e., approximately end of 2021,in normal course of action ,which means the starting of mining. However, there is delay in the development of the block due to delay in the allotment of additional area for dumping over burden and the non issuance of forest clearance for prospecting in the forest area. The production from the mine is expected during 2023-24.

TANGEDCO has already applied to the Ministry of Power for grant of Long Term coal linkages for this project vide this office letter dt. 26.06.2018.

Due to constraints in obtaining coal linkage at the time of conceiving this project, the boilers were designed for utilizing indigenous coal for 50% of PLF. Hence TANGEDCO has been requesting to approve linkage for 50% PLF. The balance requirement will be met through imported coal for the above unit .

During the meeting of the Standing Linkage Committee (Long Term) for Power Sector –SLC/LT No.5/2018 held on 21.12.2018, Joint Secretary/MoC has informed that bridge linkage may be applied for the End use plants of Chandrabila Coal block with the requisite fee. The Bridge linkage for Udangudi Thermal Power Project stage -I will be required from 2021-22. Since, the Talcher coal transported through Paradip Port is very economical to TANGEDCO, it is requested that the Bridge Linkage may be allotted from Talcher coalfields of Mahanadi Coalfields Limited.

The requirement of indigenous coal for Udangudi Thermal Power Project stage-I at 50% PLF (3450 K.Cal./Kg) is 3.647 MTPA.

The duly filled in application form in triplicate for the bridge linkage for the Udangudi Thermal Power Project stage -I (2x660MW) along with Demand draft for a sum of Rs.5,00,000/- (Rupees Five Lakhs only) towards the application fee is submitted herewith for early allocation of Bridge linkage please.

Yours faithfully,

(M.CHANDRASEKAR)
DIRECTOR/GENERATION
For CMD/TANGEDCO

4/2/19

Encl:1. Demand Draft No.854577 dt,11.02.2019 for Rs.5,00,000/-(Rs.Five Lakhs only) Canara Bank, Chennai-02 drawn in favour of Pay and Accounts Officer,Ministry of Coal Payable at New Delhi.

2. Application form in Triplicate.

Copy to the Joint Secretary/Thermal,Ministry of Power,Shram Shakthi Bhawan, RAFI MARG,New Delhi -110001.

Copy to the Chief Engineer/ TPPD/ CEA, Sewa Bhawan,R.K.Puram, New Delhi-110066.

Copy to the Chief Engineer/Project-II

PROFORMA FOR SEEKING 'BRIDGE LINKAGE' TO SPECIFIED END USE PLANT OF CENTRAL AND STATE PUBLIC SECTOR UNDERTAKINGS WHICH HAVE BEEN ALLOTTED COAL MINES/ BLOCKS (TO BE SUBMITTED IN TRIPLICATE)

Bridge linkage application for Udangudi Thermal Power Project stage -I (2x660MW) -one of the End use plant of Chandrabila coal block.

Sl No	ITEM	DETAILS
1	Name of the Allottee PSU Company and whether Central or State or JV (if JV, the name and respective equity shares of partners of the JV/Consortium may be indicated)	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LTD. (TANGEDCO)
2	Name of the coal mine/ block allotted and date of allotment (Please attach a copy of allotment order/allotment letter)	CHANDRABILA COAL BLOCK DATE OF ALLOTMENT : 24.02.16.
3	Details of specified end use Plant (including units)	Udangudi super critical Thermal Power Project Stage-I (2x660MW).
4	Location of specified end use plant (Place/District/State)	Udangudi village, Thiruchendur taluk/ Tuticorin District/ Tamil Nadu State.
5	Capacity of the End Use Plant for which "Bridge Linkage" is required as submitted in the application of coal mine/ block allotment	Udangudi super critical Thermal Power Project Stage-I (2x660MW).
6	Scheduled date of start of coal production from mine/ block as per the Coal Mines Development and Production Agreement / Coal Block Development and Production Agreement (Please attach a copy of the agreement)	Grant of opening of mine permission is scheduled during the end of the year 2021.
7	Expected date of start of coal production	During 2023-24.
8	Actual/Expected date of commissioning of Specified End Use Plant	Udangudi Stage-I super critical Thermal Power Project : 2021-2022
9	Pithead/Load Centre/Coastal and Nearest Railway Station	Udangudi Stage-I Project:Coastal
10	Year-wise requirement of coal under Bridge Linkage (subject to quantification by CCO)	Quantity of indigenous coal required in Million Tonnes per Annum
		2020-21 | 2021-22 | 2022-23
		Nil | 1.000 | 3.647
11	Whether the Specified EUP is new or expansion of existing Projects?	Proposed is new project as 2 X 660 MW as Udangudi Stage-I and also proposed Stage- II & III each having capacity of 2 X 660 MW
12	Details of Power Purchase Agreement with DISCOMS (alongwith % of PPA),if any.	Does not arise since this Project is proposed under State sector.

13	Preferred Source of "Bridge linkage" & Grade ofCoal (with range of GCV)	Talcher Coalfields, MCL.GCV: 3400 to 4000 Kcal/Kg.
14	Mode of Transportation of coal, (Rail, Road, Rail cum-Sea, MGR, Belt etc.)	Rail cum Sea route upto Udangudi port. Udangudi site is located at a distance of about 1.2km from seafront and coal will be transported through the proposed Captive jetty with Unloading facilities and Pipe conveyer system to the plant site.
15	Present Status of Power Project in brief	The total project cost including interest during construction is Rs. 13076.705 Crores. After the Hon'ble High Court, Madras disposed the writ petition filed by one of the bidders, in favour of TANGEDCO vide judgment dated 07.12.2017, Contract was awarded to M/s. BHEL for Design, Engineering, Manufacture, Supply, erection, testing and commissioning of complete thermal power project, on Engineering Procurement and Construction basis for a value of Rs 7359 Crores on 07.12.17. **MAIN PLANT** Topographical survey and Geo Technical Investigation have been completed. Construction of compound wall is under progress. Earth Work for Chimney Foundation is under progress. Engineering and other civil works are under progress. **Captive Coal Jetty** The work of Establishment of Captive Coal Jetty has been awarded on 13.2.18 to M/s ITD Cementation India Ltd for a value of Rs 1902.87 Crores. Topographical survey and Bathymetric survey have been completed. Geo- technical investigation is under progress. (Land investigation has been completed. Marine investigation has commenced on 21.10.18). Test piling has been completed and Working Pile & Pile cap is under progress in On-shore area. Off-shore construction activities are under progress. The expected date of commissioning of this project is 2021-22.

16	Details of existing long term coal linkage/"Letter of Assurance" if granted/issued with capacity of the EUP with the name of source Coal Company.	NIL
17	Whether earlier applied for grant of normal coal linkage/tapering linkage? If yes, furnish documents of the same along with Demand Draft No. and the amount.	Yes. applied for the Long Term Coal Linkages (LTCL) for Udangudi Stage-I Project vide Lr.No.CE/Mines/ EE/A3/F.LT Linkage/D141/18 dt.26.06.2018. However no Demand Draft has been furnished.
18	Demand Draft No., date, bank and submitted with this application amount	Demand Draft No.854577 dt,11.02.2019 Canara Bank ,Mount Raod, Chennai-600002.
19	Any other information not covered above	The Ministry of Coal has allotted Chandrabila Coal Block in the State of Odisha to TANGEDCO on 24.02.2016 for the following end use Thermal Power projects. 1.ETPS Expansion Thermal Power Project (1 x 660 MW) 2.Ennore SEZ Thermal Power Project (2 x 660 MW) 3.Udangudi Thermal Power Project Stage-I (2 x 660 MW). Since, the Bridge Linkage is for a restricted period ,TANGEDCO has applied for Long Term Coal Linkages (LTCL) to MoP for the three end use plants including Udangudi Thermal Power Project Stage-I associated with Chandrabila coal block. Further there is some delay in the developmental activities of the block due to delay in the allotment of additional area for dumping over burden. The forest clearance for prospecting in the forest area is also not yet issued by Forest & Environment dept./Govt of Odisha.

It is certified that the above information is true to the best of my knowledge and nothing has been concealed therein.

12/2/19

Director/Generation

20/2/19

Place: Chennai-02.
Date ; .02.2019.

Annexure - VIII

Port Approval

ABSTRACT

Minor Ports – Declaration of Port limits- Udangudi Port in Thoothukudi District- Extending the provision of the Indian Ports Act 1908 (Central Act XV of 1908) and Tamil Nadu Maritime Board Act 1995-Orders-Issued

Highways & Minor Ports(HF2) Department

G.O.Ms.No.282 Dated 16-9-2010
(Aavani-31, Thiruvalluvar Aandu-2041)

Read:

From the Vice Chairman & Chief Executive officer, Tamil Nadu Maritime Board Letter No.3506/S1/09, dated 08.06.2010.

ORDER:

The Vice Chairman & Chief Executive officer, Tamil Nadu Maritime Board in the letter read above has stated that the Tamil Nadu Maritime Board in its 56th Meeting held on 27.05.2010 has resolved to declare the Udangudi Port in Thoothukudi District as captive minor port and to request the Government to issue necessary notifications under the Indian Ports Act, 1908, (Central Act XV of 1908) in this regard.

2. The Government have examined the proposal of the Vice Chairman & Chief Executive officer, Tamil Nadu Maritime Board and decided to accept the same and declare the Udangudi port in Thoothukudi District as minor port for the captive use of M/s Udangudi Power Corporation Limited for handling coal by extending the provisions of the Indian Ports Act, 1908 (Central Act XV 1908) and the Tamil Nadu Maritime Board Act 1995 (Tamil Nadu Act 4 of 1996) with port limits as specified in Notification-I appended to this order.

3. The notifications appended to this order will be published in the next issue of the Tamil Nadu Government Gazette and in the Thoothukudi District Gazette.

4. The Works Manager, Government Central Press, Chennai is requested to send 50 copies of Notification, on publication, to Government.

(By order of the Governor)

G Santhanam,
Secretary to Government

To
The Works Manager, Government Central Press,Chennai-600079
The District Collector, Thoothukudi.
The Vice Chairman & Chief Executive officer, Tamil Nadu Maritime Board. Chennai-600017.
The Secretary to Government, Energy Department, Chennai-600009.

The Secretary to Government of India, Ministry of Finance Department of Revenue, New Delhi.
The Secretary to Government, Ministry of Shipping, New Delhi.
The Commissioner of Customs and Central Excise, Williams Road, Trichy-1.
The Accountant General, Chennai-18/35 (by name)

Copy to:-
The Secretary to Hon'ble Chief Minister, Chennai-600009.
The Special PA to Minister (Highways & Minor Ports) Chennai-600009.
The Law Department , Chennai-600009.

Forwarded/By Order

S. Saravanan 17/9/10
SECTION OFFICER

17.9.10

NOTIFICATION-I

In exercise of the powers conferred by Clause (a) of sub-section (1) of section 4 of the Indian Ports Act, 1908 (Central Act XV of 1908), the Governor of Tamil Nadu hereby makes the following amendment to the Highways and Minor Ports Department Notification No.II (2)/HWMP/359/2009 published at Pages 232 – 234 of Part-II Section-2 of the Tamil Nadu Government Gazette, dated: the 22nd July 2009.

AMENDMENT

In the said Notification in the Schedule, under the heading – "THOOTHUKUDI DISTRICT", after Serial Number 14 in column (1) and the corresponding entries in columns (2) and (3) thereof, the following entries shall, respectively, be inserted namely:-

"14-A. UDANGUDI	(1) Latitude 08 26' 21" N Longitude 78 04' 45"E
	(2) Latitude 08 23' 27" N Longitude 78 09' 29"E
	(3) Latitude 08 22' 31" N Longitude 78 08' 57"E
	(4) Latitude 08 26' 06" N Longitude 78 04' 33"E."

G.Santhanam,
Secretary to Government

/True copy/

S. Saraswathy 17/9/10.
SECTION OFFICER

17.9.10

NOTIFICATION-II

In exercise of the powers conferred by sub-section (1) of section 7 of the Indian Ports Act, 1908 (Central Act XV of 1908), the Governor of Tamil Nadu hereby makes the following amendment to the Highways Department Notification No.II (2)/HW/771 (c-1)/2004 published at Pages 1 - 2 of Part-II - Section-2 of the Tamil Nadu Government Gazette, dated: the 25th August 2004.

AMENDMENT

In the said Notification, in THE SCHEDULE, after the entry "(ii) Manappad" in column (2) and the corresponding entry in column (3) thereof, against the entry "5. Thoothukudi" in column (1), the following entries shall, respectively, be inserted namely:-

"(iii) Udangudi	Port Conservator, Udangudi".

G.Santhanam,
Secretary to Government.

/True copy/

S Saraswathy 17/9/10.
SECTION OFFICER

17.9.10

Annexure - IX

ToR

सत्यमेव जयते

File No: J-13012/19/2008-IA.II(T)
Government of India
Ministry of Environment, Forest and Climate Change
IA Division
***

Dated **29/07/2024**

To,

SH. GNANAPALAN PACKIADHAS
M/s Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
144, Anna Salai, Chennai , Chennai, CHENNAI, TAMIL NADU, 5B Block, First Floor, No.144, Anna Salai, 600002
E-mail: cepr@tnebnet.org

Subject: **Proposal of 2x660 MW Udangudi Supercritical Thermal Power Project Stage-1, located at Udangudi Village, Tiruchendur Taluk, Tuticorin District, State Tamil Nadu by M/s Tamil Nadu Generation and Distribution Corporation (TANGEDCO) – Grant of Terms of Reference - regarding**.

Sir/Madam,

This is in reference to your application for Grant of Terms of Reference under the provision of the EIA Notification 2006-regarding in respect of project Ongoing 2x660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village, Tiruchendur Taluk, Tuticorin District, Tamil Nadu submitted to Ministry vide proposal number IA/TN/THE/468592/2024 dated 14/06/2024.

2. The particulars of the proposal are as below :

(i) TOR Identification No.	TO24A0601TN5897590N
(ii) File No.	J-13012/19/2008-IA.II(T)
(iii) Clearance Type	TOR
(iv) Category	A
(v) Project/Activity Included Schedule No.	1(d) Thermal Power Plants,1(d) Thermal Power Plants
(vi) Sector	Thermal Projects
(vii) Name of Project	Ongoing 2x660 MW Udangudi Supercritical Thermal Power Project Stage-1 at Udangudi Village, Tiruchendur Taluk, Tuticorin District, Tamil Nadu
(viii) Name of Company/Organization	TANGEDCO
(ix) Location of Project (District, State)	TUTICORIN, TAMIL NADU
(x) Issuing Authority	MoEF&CC
(xii) Applicability of General Conditions	yes

(xiii) Applicability of Specific Conditions no

3. M/s Tamil Nadu Generation and Distribution Corporation (TANGEDCO) has made an application online vide proposal no IA/TN/THE/468592/2024 dated 14.06.2024 in the prescribed format (Form-I) and submitted a pre-feasibility report for undertaking a detailed EIA study as per the EIA Notification, 2006 for grant of Terms of Reference (ToR) to the proposed project of 2x660 MW Udangudi Supercritical Thermal Power Project Stage-1, located at Udangudi Village, Tiruchendur Taluk, Tuticorin District, State Tamil Nadu.

4. The project/activity is covered under category A of item 1(d) 'Thermal Power Plants' of the Schedule to the Environmental Impact Assessment (EIA) Notification, 2006, as amended as the power generation capacity of proposed expansion is beyond the threshold capacity of 500MW i.e. 2x660 MW and requires appraisal at Central level.

5. The instant proposal was considered in the 11th EAC (Thermal) meeting held on 27-28th June 2024. The minutes of the meeting and all the project documents are available on PARIVESH portal which can be accessed at https://parivesh.nic.in.

Details submitted by the project proponent

i. The proposal is for ToR to the project for Ongoing 2x660 MW Udangudi Supercritical Thermal Power Project Stage-1 located at Udangudi Village, Tiruchendur Taluk, Tuticorin District, Tamil Nadu by M/s. Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO).

ii. The EC had been obtained for the 2 x 800 MW (1600 MW) Udangudi Super Critical with Imported Coal based Thermal Project and amended to 2 x 660 MW MoEF&CC vide MOEF/GOI's Lr.No.13012/199/2008—IA II(T), dt 26.04.2017. The validity of EC was extended through subsequent validity extension and finally all the projects on account of Covid-19 pandemic (vide MoEF&CC OM F.No.22-25/2020-IA.III dated: 18.1.2021), the validity of EC for Udangudi Super Critical Thermal Power Plant is deemed to be valid till 13.10.2024. Presently, the physical work progress is completed to the tune of 82.85% for which EC was granted. As the validity of EC is nearing completion, it is planned to obtain fresh EC for the project.

iii. Further, TANGEDCO had planned to reduce the imported coal according to guidelines issued by MoEF&CC OM's issued vide circular. No. J13012/8/2009-IA. II (T), dt.6.12.2023. which is also planned to be sought in this fresh EC. In view EC nearing to completion, a fresh ToR is proposed to be obtained for ongoing 2 x 660 MW Supercritical Thermal Power Project stage-1 at Udangudi village, Thoothukudi District, Tamil Nadu.

iv. The salient features of the project are as under: -

• EAC Meeting Details:

Date of earlier EAC meetings	January 11-12, 2010, April 30-May 01, 2010 and May 20-21,2013 (for issuing Original EC), 4th meeting held on 16.3.2017 (for issuing EC amendment) and meeting on 28.7.2020 (for EC Extn.)

• Category details:

Category of the project	A
Capacity	2x660 MW
Attracts the General Conditions (Yes/No)	Yes
Additional information (if any)	The Public Hearing was conducted on 07.02.2009 at Tiruchendur for the proposed 2x800 MW super critical thermal power project at Udangudi. Presently, the work is completed more than 82.85% and the project proponent is planned to obtain fresh EC for the ongoing 2x660 MW thermal power plant, the fresh Public Hearing would not be required as per OM notification dt. 18.03.2021 by MoEF&CC. Hence, it is requested to exempt the Public Hearing for the project. As stated earlier, it is planned to prepare fresh Rapid Terrestrial EIA report based on one season monitoring. The baseline data pertaining to

	Marine environment was carried out during the year June – September, 2021 and having the validity upto 3 years (i.e. September 2024). Hence, permission may please be given to use the same data in the EIA report planned for the project.

• **Project details**:

Location of TPP	
Village:	Udangudi
Taluk:	Tiruchendur Taluk
District:	Tuticorin
State:	Tamil Nadu
Co-ordinates of all four corners:	South Side - 8°25’ 20.50” N 78°03’ 05.85” E North Side - 8°26’ 49.26” N 78°04’ 13.07” E East Side - 8°26’ 04.94” N 78°03’ 51.40” E West Side - 8°26’ 23.62” N 78°03’ 27.27” E
Average height of (a) TPP site	23 m above MSL
(b) ash pond site	24 m above MSL
(c) Township	26 m above MSL
Accredited Consultant and certificate no.	ABC Techno Labs India Private Limited NABET/EIA/2225/RA 0290
Inter-state issue involved	No
Seismic zone	Zone II (Low risk Zone)

• **Land Area Breakup**:

Land requirement	
a. TPP Site	164.38
b. Ash Pond	48.562
c. Township	Nil
d. Railway siding & Others	Nil
e. Raw water Reservoir	Nil
f. Green belt	167.058
g. Others	Nil
Total (if expansion state additional land requirement)	**380**
Status of land Acquisition:	Completed under the possession of TANGEDCO.
Status of the project: If under construction phase: please specifythe reasons for delay, works completed tilldate and balance works along withexpected date of completion.	Presently, the work is completed more than 82.85% and the project proponent is planned to obtain fresh EC for the ongoing 2x660 MW thermal power plant. Expected date of completion is 14/10/2027.
Break-up of Land-use of TPP site:	
a. Total land required for project components	
b. Private land	Nil
c. Government land	380
d. Forest land	Nil
Whether the project is in the Critically Polluted Area (CPA) or within 10 km of CPA. If so, the details thereof:	Nil
CRZ Clearance	CRZ clearance is not applicable for Main plant side. However,

	interlinked project of coal Jetty had separate EC + CRZ Clearance MoEF&CC vide EC ID - EC22A004TN156490, and File No. 10-66/2020 -IA.III dt. 03.08.2022.
Whether the project is in the Critically Polluted Area (CPA)/Severally Polluted Area (SPA) or within 10 km of CPA. If so, the details thereof:	No,

• **Presence of Environmentally Sensitive areas in the study area**:

Forest Land/ Protected Area/ Environmental Sensitivity Zone	Yes/No	Details of Certificate / letter / Remarks
Reserve forest / Protected Forest Land	Yes	Kuthiraimozhi Theri R.F – 7.8 km. During EC, letter will be obtained.
National Park	No	Nil within 10 km radius
Wildlife Sanctuary	No	Nil within 10 km radius
Archaeological sites monuments/historical temples etc	Yes	1.Archaeological site - Nil within 10 km radius 2.Monuments – Nil 3. Historical temples – Tirchendhur Temple,Tuticorin - 8 km
Names & distance of National parks, Wildlife sanctuaries, Biosphere reserves, Heritage sites Rivers, Tanks, Reserve Forests etc.Located within 10 Km from the plant boundary:	Yes	Biosphere reserves - Kuthiraimozhi Theri R.F – 7.8 km (NW)
Availability of Schedule-I species in study area	Yes	Indian Peafowl (Pavo cristatus), and avifaunal species such as Black Kite (Milvus migrans), Shikra (Accipiter badius), and Brahminy kite (Halisterindus) belonging to the family, Accipitridae under Schedule-I of the Indian Wildlife Protection Act 1972 were recorded from the study area.

• **Project description**:

If expansion, the details of ECs(including amendments and extension of validity) of existing Units etc.	Not applicable
Amendments granted, if Yes details	Yes. TANGEDCO obtained amendment to the above mentioned Environmental Clearance for reduction of unit sizes from 2 x 800 MW to 2 x 660 MW, vide MOEF/GOI's Lr.No.13012/199/2008—IA II(T), dt 26.04.2017.
Expansion / Green Field (new): (IPP / Merchant / Captive):	New
If expansion, the date of latest monitoring done by the Regional Office (R.O) of MoEF&CC for compliance of the conditions stipulated in the environmental and CRZ clearances of the previous phases.	Not applicable
Specific web page address where all EC related documents (including monitoring and compliance related reports/documents) of the specific project under consideration are/will be available. Also contact details of PP's officer responsible for updating this webpage/information.	https://www.tnebnet.org
Cost of the Project (As per EC and revised);	Rs.13,076.705 Crore
Employment Potential for entire project/plant and employment potential for the proposed amendment (specify	The Project will require direct employment of about 114 persons (permanent) and contractual workers of about 500

number of persons and quantitative information).	persons during construction period for supervision and execution. After construction of the project, plant will require about 545 persons for operation and maintenance of the plant.
Benefits of the project (specify quantitative information)	The ongoing 2 X 660 MW Power plant will result in improvement of infrastructure as well as up-liftment of social infrastructure in the area. The people residing in the nearby areas will be benefited directly and indirectly through employment opportunity likely to be arise due to the project. It will also help in sustainable development of this area including development of physical Infrastructural facilities such as road transport facilities, educational facilities and water supply and sanitation. It is anticipated that the ongoing power plant will provide benefits to the locals in two phases i.e. during construction phase as well as during operational stage of the plant.
Status of other statutory clearances	CTE for Air and Water act valid upto 13.10.2024
R&R details	R&R is not applicable.

• Electricity generation capacity:

Capacity & Unit Configurations:	1320 MW
Generation of Electricity Annually	87,12,000 MW

• Details of fuel and Ash disposal:

Fuel to be used:	**Coal**
Quantity of Fuel required per Annum:	Imported coal is 2.246 MTPA from Indonesia and Indigenous coal is 3.647 MTPA from Odisha.
Coal Linkage / Coal Block: (If Block allotted, status of EC & FC of the Block)	Quantity and details of Linkage available: TANGEDCO considered imported/indigenous coal from Indonesia/Odisha (Talcher) as the primary fuel for the ongoing plant. TANGEDCO has entered agreement with MMTC for the supply of imported coal from Indonesia. As per MoEF&CC requirement, calorific value of imported coal will be minimum 6000 kcal/kg. TANGEDCO is approaching MoEF&CC for necessary modification in the MoEF&CC clearance for blending of coal planned to be used for the project. The method of obtaining remaining coal: Ash content in coal 26(%) Sulphur in coal 0.515% Moisture 16.25% GCV in coal 4350 Kcal/Kg
Details of mode of transportation of coal from coal source to the plant premises along with distances	Udangudi site is located at a distance of about 1.2km from sea front and coal will be transported through a captive jetty and conveyed to the plant site by the pipe conveyors.
Fly Ash Disposal System Proposed	High concentration slurry. Ratio of water and ash - 1:8
a. Ash Pond / Dyke: (Area, Location & Co-ordinates) Average height of area above MSL (m)	Area – 48.562 Ha Location – Udangudi village Co-ordinates-8°25'40.81"N78°3'18.63"E Average height of area – 24 m above MSL
b. Space left in ash dyke area	Entire area is used for ash dyke.

Quantity of Fly Ash to be generated	1.054 million TPA
b. Bottom Ash to be generated:	0.26 million TPA
Fly Ash utilization percentage with details in last 5 years :	Plant yet to be started
Stack Height (m) & Type of Flue	275 m (new or existing) Multiple flue

• **Water Requirement**:

Source of Water:	Sea (Bay of Bengal) (Downstream) HFL –3.77 km Karumeni river
Quantity of water requirement:	13,063 m^3/hr
Distance of source of water from Plant:	1.2 km
Whether barrage/ weir/ intake well/ jack well/ others proposed:	Nil
Mode of conveyance of water:	Pipe line from desalination plant located at plant site.
Status of water linkage:	Nil
(If source is Seawater) Desalination Plant Capacity	16 MLD
Mode / Management of Brine:	No treatment is necessary as the TDS is of brine is higher than 45,000 mg/l – Disposed to Sea
Cooling system	Natural Draft Cooling system

• **Court case details/violation**:

Any litigation/Court Case pertaining to the project	Nil
Is the proposal under any investigation? If so, details thereof.	No
Any violation case pertaining to the project on following: i. The Environment Protection Act, 1986 ii. The Forest (Conservation)Act, 1980. iii. The Wild Life (Protection)Act, 1972	No
Additional information (if any)	Nil

v. The estimated project cost is Rs.13,076.705 Crore. Total capital cost earmarked towards environmental pollution control measures is Rs. 393 Crore and the Recurring cost (operation and maintenance) will be about Rs. 48.8 Crore per annum.

vi. Total Employment will be 545 persons as direct & indirect after expansion. Industry proposes to allocate Rs. 32.694 @ of 0.25 % towards CER.

vii. Effluent of 720 KLD quantity will be treated through ETP and 40 KLD of sewage will be treated by STP.

viii. Power requirement after commissioning will be 92 MW which will be supplied by plant.
ix. Proposed unit has 2340 TPH coal fired boiler. Multi cyclone separator/ bag filter with a stack of height of 275 m will be installed for controlling the particulate emissions within the statutory limit for the proposed boilers.

x. Details of Solid waste/Hazardous waste generation and its management:

Solid waste: Ash will be the major solid waste generated from the power project. An ash management scheme will be implemented consisting of dry collection of ash, supply of ash to entrepreneurs for utilization and promoting ash utilization to maximum extent and safe disposal of unused ash. Unlike other process industries, power project does not handle and generate any major flammable materials (Class A and Class B Flammable material) except small quantities of furnace oil for boiler start up conditions. Other hazardous materials that will be handled at the power plant will be small quantities of Chlorine used as biocide in the cooling tower. In general, about 2 to 5ppm of Chlorine is doped in the cooling water circulation line for this purpose. Both Hydrochloric acid and Sodium Hydroxide will be used for regeneration of the

De-Mineralization Plant resin beds. The solid waste (effluent) generated in DM & PT plant shall be disposed of in ash disposal area.

Solid waste generation

Description	Ash Generation
Total Ash generation for two units	175.2 T/h
Annual ash generated for two units	1.31 million TPA
Annual Bottom ash generated for two units	0.26 million TPA
Annual Fly ash generated for two units	1.054 million TPA

The estimated Municipal solid waste is about 109 kg/day. Out of this, 40% that is about 43.6 kg/day is Bio-degradable waste. The non Bio-degradable waste 60% is estimated to be 65.4 kg/day. As the plastic waste recirculation is maximized and usage of plastic is reduced the expected plastic waste is about 20% of 65.4 kg/day that is 13.08 kg/day.

Hazardous waste: Hazardous material to be stored at site during construction include petrol, diesel welding gas, weld inspection material, radiographic material, paints, chemicals, DM plant chemicals etc. These materials will be stored in accordance with prescribed safety norms in ventilated enclosures. Safety instructions and signage will prominently be displayed at appropriate points/locations.

Name of the waste	Source	Qty (TPA)	Mode of disposal	Mode of transport
Resin	DM Plant	2	TSDF site	Road
Glass Wool	Overhauling	1.3	TSDF site	Road
Waste oil	Maintenance	1.6	TSDF site	Road

xi. Public Hearing for the proposed project has been conducted by the State Pollution Control Board on 7.2.2009.

i. Advertisement for PH with date	31.12.2008
ii. Details of newspaper published:	THINA THANTHI
Date of PH	7.2.2009
Venue	Arulmigu Senthil Aandavar government boys higher secondary school, Tiruchendur, Tuticorin – 628 215
Chaired by	District Collector

xii. The total water requirement for boiler and cooling water for the proposed plant would be about 13,063 m3 /hr and the source is seawater. Water requirement for the operation phase will be met through captive desalination plant of 16 MLD capacity. The RO reject from the desalination plant will be about 36840 m3 /day. This reject will be diluted with blow down water and let into the sea.

xiii. Details of Coal Linkage: The present coal linkage of proposed thermal power plant is from Indonesia. MOU/permission for 2.246 MTPA of coal has been obtained. Balance of about 3.647 MTPA from Odisha. TANGEDCO considered imported/indigenous coal from Indonesia/Odisha (Talcher) as the primary fuel for the ongoing plant. TANGEDCO has entered agreement with MMTC for the supply of imported coal from Indonesia. As per MoEF&CC requirement, calorific value of imported coal will be minimum 6000 kcal/kg. TANGEDCO is approaching MoEF&CC for necessary modification in the MoEF&CC clearance for blending of coal planned to be used for the project.

Deliberations by the Committee

6. The committee noted the following

i. The EAC noted that the proposal for grant of Terms of Reference to the 2x660 MW Udangudi Supercritical Thermal Power Project Stage-1, located at Udangudi Village, Tiruchendur Taluk, Tuticorin District, State Tamil Nadu by TANGEDCO.

ii. The committee noted that EC had been obtained from MoEF&CC vide letter dated 14.10.2013 & amended and validity extended till 13.10.2018. Since the validity of the existing EC is nearing completion TANGEDCO envisages to obtain a fresh EC for the project. Additionally, the coal jetty is located at about 7.5km from shore and possess a separate EC and CRZ clearance from MoEF&CC vide Lr. No. - EC22A004TN156490, 10-66/2020-IA.III dt. 03.08.2022.

iii. It was observed by the EAC that currently the work is completed more than 82.85% and the project proponent is planned to obtain fresh EC for the ongoing 2x660 MW thermal power plant and requested to exempt the fresh Public Hearing under the provision of Notification dt. 18.03.2021 by MoEF&CC. The Public Hearing was conducted on 07.02.2009 at Tiruchendur for the ongoing 2x800 MW super critical thermal power project at Udangudi. Committee deliberated on the PP request regarding exemption of Public Hearing and referred to following provision in the Ministry's notification dated 18.03.2021:

"…the projects where construction and commissioning of proposed activities have not been completed within the validity period of the Environmental Clearance (EC) and a fresh application for EC has been submitted due to expiry of the said period of the EC, the concerned Expert Appraisal Committee or State Level Expert Committee, as the case may be, may exempt the requirement of public hearing subject to the condition that the project has been implemented not less than fifty percentage in its physical form or construction."

In view of the above provision and considering the construction work completed more than 82.85%, Public Hearing is exempted, however, PP shall obtain responses in writing from other concerned persons having a plausible stake in the environmental aspects of the project or activity by publicizing the draft EIA/EMP report/Summary on the SPCB website, following the provisions mentioned in the EIA Notification, 2006 and as amended. Further, incase no or few response is received, PP shall also do the need base assessment survey and based on the survey, PP is required to take up physical activities in time bound manner.

iv. The EAC observed that EC obtained during 2013 was planned with 100% imported coal now TANGEDCO proposes to use indigenous coal and imported coal for the ongoing power plant. The total coal requirement for the Udangudi Super critical power project is 5.893 MTPA. TANGEDCO is planning to use Imported Coal verses Indigenous Coal in the ratio of 50:50 based on efficiency which is amounting to 2.246 MTPA of imported coal and 3.647 MTPA of indigenous coal. The present coal linkage of proposed thermal power plant is from Indonesia. MOU/permission for 2.246 MTPA of coal has been obtained. Balance of about 3.647 MTPA from Odisha. On coal source change, EAC observed that detailed Impact assessment shall be carried out due to change in source of coal along with proper mitigation measure and EMP budget.

v. The EAC noted that the PP has informed in Form 1 about court case details but during the meeting it was noted that there is no court case is pending for power plant. Also noted that the total land requirement for the project site is of 380 Ha and fully utilized for construction of Udangudi power station facilities, including 44% for greenbelt which is amounting to 167.058 Ha.

vi. The committee observed that as per MoEF&CC Notification S.O. 5481(E) dated 31.12.2021 and amendments stipulated ash pond area for thermal power plant 0.1 hectare per Mega Watt (MW), which works out to 132 Ha for proposed project. The proposed power plant has total ash pond area 48.652 Ha i.e. 12.77 % of the total project area 380 Ha. Total ash pond area is required for the proposed plant is within the stipulated norms dated 31.12.2021.

vii. The total water consumption for thermal power plants as per MoEF&CC vide Notification S.O. 3305 (E) dated 07.12.2015 for all existing CT based plants upto maximum of 3.5 m3/MWh and as per MoEF&CC stipulated norms vide Notification GSR 593 (E) dated 28.06.2018 water allocated to the thermal power plant is 3 m3/MWhr for new plants installed after the 1st January, 2017. However, TPP using sea water, water consumption limit is not applicable as per notification dated 28.06.2018. The total water requirement for boiler and cooling water for the proposed plant would be about 13,063 m3/hr and the source is seawater.

Recommendations of the Committee:

7. The EAC after detailed deliberation on the information submitted and as presented during the meeting recommended the proposal for grant of Standard ToR for conducting an EIA study without Public Hearing but Public Consultation through written submission, to the project, for the construction of the 2x660 MW Udangudi Supercritical Thermal Power Project Stage-1, located at Udangudi Village, Tiruchendur Taluk, Tuticorin District, State Tamil Nadu by **M/s Tamil Nadu Generation and Distribution Corporation (TANGEDCO)**, under the provisions of the EIA Notification, 2006, as amended along with the following additional/specific ToR (**Annexure-1**).

8. In accordance with the provisions contained in the Environment Impact Assessment (EIA) Notification, 2006 & further amendments thereto and based on the recommendations of the EAC, the Ministry hereby accords Terms of Reference

(ToR) to M/s Tamil Nadu Generation and Distribution Corporation (TANGEDCO) the construction of the 2x660 MW Udangudi Supercritical Thermal Power Project Stage-1, located at Udangudi Village, Tiruchendur Taluk, Tuticorin District, State Tamil Nadu under EIA Notification, 2006 (as amended) with the specific ToRs in addition to generic/standard ToR as per **Annexure 1**.

9. The EIA/EMP report should contain the information in accordance with provisions & stipulations as given in the specific and standard ToR.

10. You are required to submit the final EIA/EMP prepared as per TORs to the Ministry within 4 years as per this Ministry's Notification vide dated 25.07.2022 for considering the proposal for environmental clearance.

11. The consultants involved in the preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other organization(s)/laboratories including their status of approvals etc.

12. The Ministry reserves the right to stipulate additional ToR, if found necessary.

13. The Terms of Reference to the aforementioned project is under provisions of EIA Notification, 2006. It does not tantamount to approvals/consent/permissions etc. required to be obtained under any other Act/Rule/regulation. The Project Proponent is under obligation to obtain approvals /clearances under any other Acts/ Regulations or Statutes, as applicable, to the project.

14. This issues with the approval of the Competent Authority.

Yours faithfully,

(Sundar Ramanathan)
Scientist 'E'/Additonal Director
Tel: 011- 20819378
Email- r.sundar@nic.in

Copy To

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi 110001.
2. The Chairman, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.
3. Deputy Director General of Forests (C), Ministry of Environment, Forest and Climate Change, Integrated Regional Office, 3rd Floor, Room No. 309, Aranya Bhawan, Opp. RBI, Safiabad – 500004, Hyderabad, Telangana.
4. The Chairman, Telangana State Pollution Control Board, A-3, Paryavaran Bhavan, Sanath Nagar Rd, Sanath Nagar Industrial Estate, Sanath Nagar, Hyderabad, Telangana 500018.
5. The Member Secretary, Telangana State Pollution Control Board, A-3, Paryavaran Bhavan, Sanath Nagar Rd, Sanath Nagar Industrial Estate, Sanath Nagar, Hyderabad, Telangana 500018.
6. The District Collector, Tuticorin, State Government of Telangana.
7. Guard file/Monitoring file/PARIVESH Portal.

Annexure 1

Specific Terms of Reference for (Thermal Power Plants)

1. [A] Environmental Management And Biodiversity Conservation

S. No	Terms of Reference
1.1	PP is advised to implement the 'Ek Ped Maa Ke Naam' Campaign which was launched on 5th June 2024 on the occasion of the World Environment Day to increase the forest cover across the Country. This plantation drive is other than Green belt development. An action plan in this regard shall be submitted.
1.2	Detailed Impact assessment shall be carried out due to change in source of coal along with proper mitigation measure and EMP budget.
1.3	Impact of release of cooling tower water on marine life need to be studied by reputed govt. institute and measures implemented.
1.4	Brine disposal and Management plan shall be studied and to be incorporated in EIA/EMP study.
1.5	Radioactivity studies along with coal analysis to be provided (sulphur, ash percentage and heavy metals including Pb, Cr, As and Hg). Details of auxiliary fuel, if any including its quantity, quality, storage, etc should also be given.
1.6	A comparative chart shall be prepared with changes observed from the previous baseline study and present baseline study.
1.7	Certified compliance report shall be submitted along with ATR and comments of RO on the existing EC.
1.8	PP should submit the detailed plan in tabular format (year-wise for the life of the project) for concurrent afforestation and green belt development in and around the project site. The PP should submit the number of saplings to be planted, names of native species, area to be covered under afforestation & green belt, location of plantation, target for survival rate and budget earmarked for the afforestation & green belt development. In addition to this, PP should show on a surface plan (5- year interval for life of project) of suitable scale the area to be covered under afforestation & green belt clearly mentioning the latitude and longitude of the area to be covered during each 5 years. The capital and recurring expenditure to be incurred needs to be submitted. Plantation plan should be prepared in such a way that 80% of the plantation to be carried out in first 5 years and for the remaining years the proposal for gap filling. The seedling of height not less than 2 meters to be selected and accordingly cost of plantation needs to be decided. In addition to this, plantation in the safety zone at project boundary the plantation should be planned in such a way that it should be completed within 2 years only.
1.9	Action plan for development of Three tier plantation programme (33% of total project cover area) along the periphery of the project boundary shall be provided. Plan shall be dully approved by the local forest department.
1.10	A detailed plan need to be submitted for undertaking extensive green plantation within 10 km radius of the plant focusing on water reservoir, school, hospital and other institutional area and same need to be incorporated in EIA/EMP report.
1.11	Detailed action plan shall be prepared for maintenance of air pollution control equipment for proposed and existing units and shall be incorporated in EIA/EMP report.
1.12	Details of Ash management of 5-year plan for 100 % ash utilization for proposed project shall be submitted. MoU signed for ash utilization with companies shall be submitted.

S. No	Terms of Reference
1.13	Details of Dry Ash handling system along with the supplementary coal handling system shall be submitted.
1.14	Proper protection measures like HDPE lining, appropriate height of bund and adequate distance between the proposed Ash pond and water body (minimum 60 meters) etc. shall be planned to reduce the possibility of mixing leachate with any freshwater body for under-construction ash pond. A high-density Slurry disposal plan shall be prepared.
1.15	Pond and ground water quality (10 locations within 2 km radius of the plant boundary) shall be studied and report be submitted along with EIA/EMP. Action plan for Ground water monitoring stations on all hotspots like schools/hospitals within 2 km radius of the plant boundary be submitted. Baseline Study for Heavy metals in Groundwater, Surface water and soil to be carried out and incorporated in EIA/EMP report.
1.16	Details pertaining to water source, treatment and discharge should be provided.
1.17	Liquid Discharge plan shall be submitted so as treated water can be use by the nearby people.
1.18	PP shall submit action plan for using treated Sewage/Domestic wastewater for its operations.
1.19	Project Proponent to conduct Environmental Cost Benefit Analysis for the project in EIA/EMP Report.
1.20	An action plan shall be prepared for Water shed development within 10 km radius of the plant boundary in consultation with reputed government institution and incorporated in EIA/EMP report.
1.21	PP should clearly bring out that what is the specific diesel consumption ~ (Liters/Tonne of total material handled) and steps to be taken for reduction of the same. The year-wise target for reduction in the specific diesel consumption needs to be submitted. PP shall also explore the possibility of using e-vehicles/LNG/CNG-based machinery and trucks for the operation and transportation of Coal and ash.
1.22	PP shall provide the details of transportation of flyash from the plant, transportation route etc. Further, carry out a traffic study for at least one month and provide the impact of transportation along with the mitigation measures.
1.23	PP shall submit the action plan to adhere to the Plastic Waste Management Rules 2016 and to adhere Ministry's OM dated 18/07/2022.
1.24	Details on renewable energy (solar plant) proposed to be installed as energy conservation measures shall be submitted.
1.25	PP shall provide the details of wastewater treatment facilities to be installed within its capacity, timeline and budget.
1.26	A Cumulative Environmental Impact Assessment study of all the existing and proposed projects in the 10-km radius of the proposed project shall be conducted and the same shall be included the in EIA/EMP report. Details of industrial units present in 10 Km radius of the power plant shall be submitted

S. No	Terms of Reference
1.27	A Disaster Management Plan shall be prepared and incorporated in the EIA/EMP report

2. [C] Socio-economic Study

S. No	Terms of Reference
2.1	Public consultation (Written submission only) shall be conducted as per the provisions of EIA Notification, 2006 and as amended i.e PP shall obtain responses in writing from other concerned persons having a plausible stake in the environmental aspects of the project or activity by publicizing the draft EIA/EMP report/Summary on the SPCB website, following the provisions mentioned in the EIA Notification, 2006 and as amended.
2.2	As per the Ministry's OM dated 30.09.2020/20.10.2020, to address the concern submitted against the written submission, the Project Proponent is required to submit the detailed activities proposed with year-wise budgetary provision (Capital and recurring) for 10 years. Activities proposed shall be part of EMP
2.3	Further, incase no or few response is received, PP shall also do the need base assessment survey. Based on the survey, PP is required to take up physical activities in time bound manner with year-wise budgetary provision (Capital and recurring). Activities proposed shall be part of EMP.
2.4	A need based Social Impact Assessment Study shall also be carried out and an action plan on its recommendations may also be submitted with budgetary provisions.
2.5	Demographic details in 10 km area shall be submitted
2.6	The Public Health Delivery Plan including the provisions for drinking water supply for the local population shall be in the EIA/EMP Report. The status of the existing medical facilities in the project area shall be discussed. Possibilities of strengthening of existing medical facilities, construction of new medical infrastructure etc. will be explored after assessing the needs of the labour force and local populace

3. [D] Miscellaneous

S. No	Terms of Reference
3.1	Plot the wind rose diagram using the typical meteorological year (TMY) data for the period considered for the study. The monitoring units shall be deployed in the field based on the coverage area ratio and direction of the wind. A mathematical model shall be developed for the local site rather than using the standard model available in software for both air & water quality modelling.
3.2	PP shall align its activities to one/few of the Sustainable Development Goals (SDG) and start working on the mission of net zero by 2050. PPs shall update the same to the EAC.
3.3	PP shall submit the EIA/EMP report after the plagiarism check using authenticated plagiarism software.
3.4	Detailed description of all the court cases including all directions given by the apex and currents

S. No	Terms of Reference
	status of them shall submit.
3.5	PP should provide in the EIA Report details of all the statutory clearances, permissions, no objection certificates, consents etc. required for this project under various Acts, Rules and regulations and their status or estimated timeline after grant of EC.
3.6	The PP should submit the photograph of monitoring stations & sampling locations. The photograph should bear the date, time, latitude & longitude of the monitoring station/sampling location. In addition to this PP should submit the original test reports and certificates of the labs which will analyze the samples.
3.7	PP should clearly bring out the details of the manpower to be engaged for this project with their roles /responsibilities/designations. In addition to this PP should mention the number and designation of persons to be engaged for the implementation of environmental management plan (EMP). The capital and recurring expenditure to be incurred needs to be submitted.
3.8	PP should submit the year-wise, activity wise and time-bound budget earmarked for EMP, occupational health surveillance, and activities proposed to address the issues raised during Public Hearing. The capital and recurring expenditure to be incurred needs to be submitted.
3.9	Activities shall be prepared based on the issues arise during previous public hearing conducted and fresh written submission with defined timeline and budgetary provisions.
3.10	Aerial view video of project site and transportation route proposed for this project shall be recorded through drone and be submitted.
3.11	The PP should ensure that only NABET-accredited consultants shall be engaged for the preparation of EIA/EMP Reports. PP shall ensure that the accreditation of the consultant is valid during the collection of baseline data, preparation of EIA/EMP report and the appraisal process. The PP and consultant should submit an undertaking the information and data provided in the EIA Report and submitted to the Ministry are factually correct and the PP and consultant are fully accountable for the same.
3.12	PP should provide in the EIA Report details of the statutory clearances, permissions, no objection certificates, consents etc. required for this project under various Acts, Rules and regulations and their status or estimated timeline after the grant of EC.
3.13	The budget to be earmarked for the various activities shall be decided after perusal of the Standard EC Conditions published by the Ministry.
3.14	All the certificates viz. Involvement of Forest land, distance from the protected area, and list of flora & fauna should be duly authenticated by the Forest Department. The Certificate should bear the name, designation, official seal of the person signing the certificate and dispatch number.

Standard Terms of Reference for (Thermal Power Plants)

1. Statutory Compliance

S. No	Terms of Reference
1.1	The proposed project shall be given a unique name in consonance with the name submitted to other Government Departments etc. for its better identification and reference.
1.2	Vision document specifying prospective long term plan of the project shall be formulated and submitted.
1.3	Latest compliance report duly certified by the Regional Office of MoEF&CC for the conditions stipulated in the environmental and CRZ clearances of the previous phase(s) for the expansion projects shall be submitted.

2. Details Of The Project And Site

S. No	Terms of Reference
2.1	The project proponent needs to identify minimum three potential sites based on environmental, ecological and economic considerations, and choose one appropriate site having minimum impacts on ecology and environment. A detailed comparison of the sites in this regard shall be submitted.
2.2	Executive summary of the project indicating relevant details along with recent photographs of the proposed site (s) shall be provided. Response to the issues raised during Public Hearing and the written representations (if any), along with a time bound Action Plan and budgetary allocations to address the same, shall be provided in a tabular form, against each action proposed.
2.3	Harnessing solar power within the premises of the plant particularly at available roof tops and other available areas shall be formulated and for expansion projects, status of implementation shall also be submitted.
2.4	The geographical coordinates (WGS 84) of the proposed site (plant boundary), including location of ash pond along with topo sheet (1:50,000 scale) and IRS satellite map of the area, shall be submitted. Elevation of plant site and ash pond with respect to HFL of water body/nallah/River and high tide level from the sea shall be specified, if the site is located in proximity to them.
2.5	Layout plan indicating break-up of plant area, ash pond, green belt, infrastructure, roads etc. shall be provided.
2.6	Land requirement for the project shall be optimized and in any case not more than what has been specified by CEA from time to time. Item wise break up of land requirement shall be provided.
2.7	Present land use (including land class/kism) as per the revenue records and State Govt. records of the proposed site shall be furnished. Information on land to be acquired including coal transportation system, laying of pipeline, ROW, transmission lines etc. shall be specifically submitted. Status of land acquisition and litigation, if any, should be provided.
2.8	If the project involves forest land, details of application, including date of application, area applied for, and application registration number, for diversion under FCA and its status should be provided along with copies of relevant documents.
2.9	The land acquisition and R&R scheme with a time bound Action Plan should be formulated and addressed in the EIA report.

S. No	Terms of Reference
2.10	Satellite imagery and authenticated topo sheet indicating drainage, cropping pattern, water bodies (wetland, river system, stream, nallahs, ponds etc.), location of nearest habitations (villages), creeks, mangroves, rivers, reservoirs etc. in the study area shall be provided.
2.11	Topography of the study area supported by toposheet on 1:50,000 scale of Survey of India, along with a large scale map preferably of 1:25,000 scale and the specific information whether the site requires any filling shall be provided. In that case, details of filling, quantity of required fill material; its source, transportation etc. shall be submitted.

3. Ecology Biodiversity And Environment

S. No	Terms of Reference
3.1	A detailed study on land use pattern in the study area shall be carried out including identification of common property resources (such as grazing and community land, water resources etc.) available and Action Plan for its protection and management shall be formulated. If acquisition of grazing land is involved, it shall be ensured that an equal area of grazing land be acquired and developed and detailed plan submitted.
3.2	Location of any National Park, Sanctuary, Elephant/Tiger Reserve (existing as well as proposed), migratory routes / wildlife corridor, if any, within 10 km of the project site shall be specified and marked on the map duly authenticated by the Chief Wildlife Warden of the State or an officer authorized by him.
3.3	A mineralogical map of the proposed site (including soil type) and information (if available) that the site is not located on potentially mineable mineral deposit shall be submitted.
3.4	The water requirement shall be optimized (by adopting measures such as dry fly ash and dry bottom ash disposal system, air cooled condenser, concept of zero discharge) and in any case not more than that stipulated by CEA from time to time, to be submitted along with details of source of water and water balance diagram. Details of water balance calculated shall take into account reuse and re-circulation of effluents.
3.5	Water body/Nallah (if any) passing across the site should not be disturbed as far as possible. In case any Nallah / drain is proposed to be diverted, it shall be ensured that the diversion does not disturb the natural drainage pattern of the area. Details of proposed diversion shall be furnished duly approved by the concerned Department of the State.
3.6	It shall also be ensured that a minimum of 500 m distance of plant boundary is kept from the HFL of river system / streams etc. and the boundary of site should also be located 500 m away from railway track and National Highways.
3.7	Hydro-geological study of the area shall be carried out through an institute/ organization of repute to assess the impact on ground and surface water regimes. Specific mitigation measures shall be spelt out and time bound Action Plan for its implementation shall be submitted
3.8	Detailed Studies on the impacts of the ecology including fisheries of the River/Estuary/Sea due to the proposed withdrawal of water / discharge of treated wastewater into the River/Sea etc shall be carried out and submitted along with the EIA Report. In case of requirement of marine impact

S. No	Terms of Reference
	assessment study, the location of intake and outfall shall be clearly specified along with depth of water drawl and discharge into open sea.
3.9	Source of water and its sustainability even in lean season shall be provided along with details of ecological impacts arising out of withdrawal of water and taking into account inter-state shares (if any). Information on other competing sources downstream of the proposed project and commitment regarding availability of requisite quantity of water from the Competent Authority shall be provided along with letter / document stating firm allocation of water.
3.10	Detailed plan for rainwater harvesting and its proposed utilization in the plant shall be furnished.In addition, wherever ground water is drawn, PP shall submit detailed plan of Water charging activity to be undertaken.
3.11	Feasibility of near zero discharge concept shall be critically examined and its details submitted.
3.12	Optimization of Cycles of Concentration (COC) along with other water conservation measures in the project shall be specified.
3.13	Plan for recirculation of ash pond water and its implementation shall be submitted.
3.14	Detailed plan for conducting monitoring of water quality regularly with proper maintenance of records shall be formulated. Detail of methodology and identification of monitoring points (between the plant and drainage in the direction of flow of surface / ground water) shall be submitted. It shall be ensured that parameter to be monitored also include heavy metals. A provision for long-term monitoring of ground water table using Piezometer shall be incorporated in EIA, particularly from the study area.
3.15	Hazards Characterization: Past incidents of hazard events within 10km radius of project area with detailed analysis of causes and probability of reoccurrence

4. Environmental Baseline Study And Mitigation Measures

S. No	Terms of Reference
4.1	One complete season (critical season) site specific meteorological and AAQ data (except monsoon season) as per latest MoEF&CC Notification shall be collected along with past three year's meteorological data for that particular season for wins speed analysisand the dates of monitoring shall be recorded. The parameters to be covered for AAQ shall include PM10, PM2.5, SO2, NOx, CO and Hg. The location of the monitoring stations should be so decided so as to take into consideration the upwind direction, pre-dominant downwind direction, other dominant directions, habitation and sensitive receptors. There should be at least one monitoring station each in the upwind and in the pre - dominant downwind direction at a location where maximum ground level concentration is likely to occur.
4.2	In case of expansion project, air quality monitoring data of 104 observations a year for relevant parameters at air quality monitoring stations as identified/stipulated shall be submitted to assess for compliance of AAQ Standards (annual average as well as 24 hrs).
4.3	A list of industries existing and proposed in the study area shall be furnished.

S. No	Terms of Reference
4.4	Cumulative impacts of all sources of emissions including handling and transportation of existing and proposed projects on the environment of the area shall be assessed in detail. Details of the Model used and the input data used for modelling shall also be provided. The air quality contours should be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any. The windrose and isopleths should also be shown on the location map. The cumulative study should also include impacts on water, soil and socio-economics.
4.5	Radio activity and heavy metal contents of coal to be sourced shall be examined and submitted along with laboratory reports.
4.6	Fuel analysis shall be provided. Details of auxiliary fuel, if any, including its quantity, quality, storage etc should also be furnished.
4.7	Quantity of fuel required, its source and characteristics and documentary evidence to substantiate confirmed fuel linkage shall be furnished. The Ministry's Notification dated 02.01.2014 regarding ash content in coal shall be complied. For the expansion projects, the compliance of the existing units to the said Notification shall also be submitted
4.8	Details of transportation of fuel from the source (including port handling) to the proposed plant and its impact on ambient AAQ shall be suitably assessed and submitted. If transportation entails a long distance it shall be ensured that rail transportation to the site shall be first assessed. Wagon loading at source shall preferably be through silo/conveyor belt.
4.9	For proposals based on imported coal, inland transportation and port handling and rail movement shall be examined and details furnished. The approval of the Port and Rail Authorities shall be submitted.
4.10	Details regarding infrastructure facilities such as sanitation, fuel, restrooms, medical facilities, safety during construction phase etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase should be adequately catered for and details furnished.

5. Environmental Management Plan

S. No	Terms of Reference
5.1	EMP to mitigate the adverse impacts due to the project along with item - wise cost of its implementation in a time bound manner shall be specified.
5.2	A Disaster Management Plan (DMP) along with risk assessment study including fire and explosion issues due to storage and use of fuel should be prepared. It should take into account the maximum inventory of storage at site at any point of time. The risk contours should be plotted on the plant layout map clearly showing which of the proposed activities would be affected in case of an accident taking place. Based on the same, proposed safeguard measures should be provided. Measures to guard against fire hazards should also be invariably provided. Provision for mock drills shall be suitably incorporated to check the efficiency of the plans drawn.
5.3	The DMP so formulated shall include measures against likely Fires/Tsunami/Cyclones/Storm Surges/ Earthquakes etc, as applicable. It shall be ensured that DMP consists of both On-site and

S. No	Terms of Reference
	Off-site plans, complete with details of containing likely disaster and shall specifically mention personnel identified for the task. Smaller version of the plan for different possible disasters shall be prepared both in English and local languages and circulated widely.
5.4	Details of fly ash utilization plan as per the latest fly ash Utilization Notification of GOI along with firm agreements / MoU with contracting parties including other usages etc. shall be submitted. The plan shall also include disposal method / mechanism of bottom ash along with monitoring mechanism.

6. Green Belt Development

S. No	Terms of Reference
6.1	Detailed scheme for raising green belt of native species of appropriate width (50 to 100 m) and consisting of at least 3 tiers around plant boundary not less than 2000 tree per ha with survival rate of more than 85%shall be submitted. Photographic evidence must be created and submitted periodically including NRSA reports in case of expansion projects. A shrub layer beneath tree layer would serve as an effective sieve for dust and sink for CO2 and other gaseous pollutants and hence a stratified green belt should be developed.
6.2	Over and above the green belt, as carbon sink, plan for additional plantation shall be drawn by identifying blocks of degraded forests, in close consultation with the District Forests Department. In pursuance to this the project proponent shall formulate time bound Action Plans along with financial allocation and shall submit status of implementation to the Ministry every six months

7. Socio-economic Activities

S. No	Terms of Reference
7.1	Socio-economic study of the study area comprising of 10 km from the plant site shall be carried out through a reputed institute / agency which shall consist of detail assessment of the impact on livelihood of the local communities.
7.2	Action Plan for identification of local employable youth for training in skills, relevant to the project, for eventual employment in the project itself shall be formulated and numbers specified during construction & operation phases of the Project.
7.3	If the area has tribal population, it shall be ensured that the rights of tribals are well protected. The project proponent shall accordingly identify tribal issues under various provisions of the law of the land.
7.4	A detailed CER plan along with activities wise break up of financial commitment shall be prepared in terms of the provisions OM No. 22-65/2017-IA.III dated 30.09.2020.CER component shall be identified considering need based assessment study and Public Hearing issues. Sustainable income generating measures which can help in upliftment of affected section of society, which is consistent with the traditional skills of the people shall be identified.
7.5	While formulating CER schemes it shall be ensured that an in-built monitoring mechanism for the schemes identified are in place and mechanism for conducting annual social audit from the nearest

S. No	Terms of Reference
	government institute of repute in the region shall be prepared. The project proponent shall also provide Action Plan for the status of implementation of the scheme from time to time and dovetail the same with any Govt. scheme(s). CERdetails done in the past should be clearly spelt out in case of expansion projects.
7.6	R&R plan, as applicable, shall be formulated wherein mechanism for protecting the rights and livelihood of the people in the region who are likely to be impacted, is taken into consideration. R&R plan shall be formulated after a detailed census of population based on socio economic surveys who were dependant on land falling in the project, as well as, population who were dependant on land not owned by them.
7.7	Assessment of occupational health and endemic diseases of environmental origin in the study area shall be carried out and Action Plan to mitigate the same shall be prepared.
7.8	Occupational health and safety measures for the workers including identification of work related health hazards shall be formulated. The company shall engage full time qualified doctors who are trained in occupational health. Health monitoring of the workers shall be conducted at periodic intervals and health records maintained. Awareness programme for workers due to likely adverse impact on their health due to working in non-conducive environment shall be carried out and precautionary measures like use of personal equipments etc. shall be provided. Review of impact of various health measures undertaken at intervals of two to three years shall be conducted with an excellent follow up plan of action wherever required.

8. Corporate Environment Policy

S. No	Terms of Reference
8.1	Does the company has a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.
8.2	Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.
8.3	What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions. Details of this system may be given.
8.4	Does the company has compliance management system in place wherein compliance status along with compliances / violations of environmental norms are reported to the CMD and the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism should be detailed in the EIA report.

9. Miscellaneous

S. No	Terms of Reference
9.1	All the above details should be adequately brought out in the EIA report and in the presentation to the Committee.

S. No	Terms of Reference
9.2	Details of litigation pending or otherwise with respect to project in any Court, Tribunal etc. shall invariably be furnished.
9.3	In case any dismantling of old plants are envisaged, the planned land use & land reclamation of dismantled area to be furnished.

10. Additional Tor For Coastal Based Thermal Power Plants Projects (Tpps)

S. No	Terms of Reference
10.1	Low lying areas fulfilling the definition wetland as per Ramsar Convention shall be identified and clearly demarcated w.r.t the proposed site.
10.2	If the site includes or is located close to marshy areas and backwaters, these areas must be excluded from the site and the project boundary should be away from the CRZ line. Authenticated CRZ map from any of the authorized agencies shall be submitted.
10.3	The soil levelling should be minimum with no or minimal disturbance to the natural drainage of the area. If the minor canals (if any) have to be diverted, the design for diversion should be such that the diverted canals not only drains the plant area but also collect the volume of flood water from the surrounding areas and discharge into marshy areas/major canals that enter into creek. Major canals should not be altered but their embankments should be strengthened and desilted.
10.4	Additional soil required for levelling of the sites should as far as possible be generated within the site itself in such a manner that the natural drainage system of the area is protected and improved.
10.5	Marshy areas which hold large quantities of flood water to be identified and shall not be disturbed.
10.6	No waste should be discharged into Creek, Canal systems, Backwaters, Marshy areas and seas without appropriate treatment. Wherever feasible, the outfall should be first treated in a Guard Pond and then only discharged into deep sea (10 to 15 m depth). Similarly, the Intake should be from deep sea to avoid aggregation of fish and in no case shall be from the estuarine zone. The brine that comes out from Desalinization Plants (if any) should not be discharged into sea without adequate dilution.
10.7	Mangrove conservation and regeneration plan shall be formulated and Action Plan with details of time bound implementation shall be specified, if mangroves are present in Study Area.
10.8	A common Green Endowment Fund should be created by the project proponents out of EMP budgets. The interest earned out of it should be used for the development and management of green cover of the area.
10.9	Impact on fisheries at various socio economic level shall be assessed.
10.10	An endowment Fishermen Welfare Fund should be created out of CER grants not only to enhance their quality of life by creation of facilities for Fish Landing Platforms / Fishing Harbour / cold storage, but also to provide relief in case of emergency situations such as missing of fishermen on duty due to rough seas, tropical cyclones and storms etc.

S. No	Terms of Reference
10.11	Tsunami Emergency Management Plan shall be prepared wherever applicable and Plan submitted prior to the commencement of construction work.
10.12	There should not be any contamination of soil, ground and surface waters (canals & village pond) with sea water in and around the project sites. In other words necessary preventive measures for spillage from pipelines, such as lining of Guard Pond used for the treatment of outfall before discharging into the sea and surface RCC channels along the pipelines of outfall and intake should be adopted. This is just because the areas around the projects boundaries could be fertile agricultural land used for paddy cultivation.

Annexure - X

Existing EC

Udangudi 1 - E.C dt.14.10.2013 upto 13.10.2018

C. 224

SPEED POST

J 13012/19/2008-IA.II (T)
Government of India
Ministry of Environment & Forests

Ph: 011-2436 4067
e-mail: sarojmoef@yahoo.com
Paryavaran Bhawan
CGO Complex, Lodi Road
New Delhi-110 003
Dated: October 14, 2013.

ACB/Udangudi

To

M/s. Udangudi Power Corporation Ltd.
TNEB Complex, 144, Anna Salai,
Chennai-600 002.
Tel: +91 44 28515511, 28544304/306
Fax: +91 44 28544305
E.mail: usctpp@gmail.com
Web: www.udangudipower.com

Sub: 2x800 MW Udangadi Super Critical Imported Coal Based TPP at village Udangudi, in Thiruchendur Taluk, in Thoothukudi district, in Tamil Nadu - reg. Environmental Clearance.

Sir,

The undersigned is directed to refer to your letters dated 18.12.2012, and 08.04.2013 on the subject mentioned above. The Ministry of Environment & Forests has examined the application.

2. The proposal is for setting up of 2x800 MW Udangadi Super Critical Imported Coal Based Thermal Power Plant at village Udangudi, in Thiruchendur Taluk, in Thoothukudi district, in Tamil Nadu. The land requirement will be 939 acres. The project is based on 100% imported coal from Indonesia. Imported Coal will be transported from Captive Coal Jetty by closed conveyor belt system over a distance of about 9.0 km. Bay of Bengal is at 1.2 Km in the East. Gulf of Mannar is at about 45 Kms in the north east. The specification of imported coal to be used will be: Ash content not exceeding 8%; sulphur content not exceeding 0.6%; and GCV of 6000 Kcal/Kg. MoU has been entered into with M/s MMTC (A Govt. of India undertaking) for supply of 4.50 MTPA of imported coal. The plant will be located within the co-ordinates 8°25'20.50" N to 8°26'49.26" N and 78°03'05.85" E to 78°04'13.07"E. The elevation of the site is 4.0 m above MSL. CRZ clearance for the captive jetty for the power project has been obtained. The Feasibility Report for establishment of Coal Jetty and Pipe Conveyor has been carried out by IIT-M, Chennai. The mathematical modeling studies for cooling water intake and out fall system and coal jetty have been carried out by National Institute of Oceanography, Goa. The comprehensive Marine Environmental Impact Assessment and Environmental Management Plan (Marine EIA & EMP) has been done by the

Institute of Ocean Management, Anna University, Chennai. The Centre of Advance Study in Marine Biology, Annamalai University has undertaken the Marine Environmental Survey for the project. Based on the above studies, the location of the cooling water intake and outfall pipelines are proposed at 5.4 km and 1.06 km respectively from the shore. No ash or ash water will be let into the sea. Since the power project is proposed with Cooling Towers for circulation water system, 13,790 m3/hr make up water will be drawn from Sea (including water for OM plant). About 7,800 m3/hr of blow down water will be let into the sea to maintain the cycle of concentration at 1.30. R.O. reject of about 1,090 m3/hr will be mixed and diluted with the blow down water and let into the sea. NIO, Goa has considered intake of 21000 m3/hr and outfall discharge of 13500 m3/hr for the model studies. CRZ mapping has been completed by IRS (Anna University, Chennai). There are no mangroves and sand dunes in the project area. There is no coral reef, pearl bank within 10 km from the disposal point. The power project will be located 1.4 kms from the sea shore. A 275 m high stack will be provided. Exit velocity of flue gas will be 22 m/s. There are no wildlife sanctuary, national parks, heritage site etc. with 10 kms of the site. While allotting the land to the project, Government of Tamil Nadu had consulted Chief Engineer, Public Works Department (PWD) and the Local Panchayat of the area. The Chief Engineer, PWD in its letter dated 28.11.2007 has stated that "a portion of the project site is adjacent to the Ellappanaicken tank surplus course. The Ellappanaicken tank is getting water from South Main channel under Thambiraparani irrigation system. After the water reaching the full tank level, it surpluses through the surplus course channel and travel to Kulasekarapattinam tharuvai kuttam and then it enters into sea". The chief Engineer has recommended the lands can be alienated to the project with a condition that necessary surplus course channel be formed so that the surplus water from Ellappanaicken tank as well as self-catchment water is drained in Kulasekarapattinam tharuvai. The Local Panchayat has also given consent in their meeting held on 27.02.2009. The Govt. of Tamil Nadu has accepted the recommendations of the Chief Engineer, PWD and issued orders alienating the land to the project vide G.O. NO. 125, dated 29.02.2008 and G.O. No 81, dated 23.02.2010 and directed the project authorities to form a peripheral drain to drain off the above surplus water and the rain water from the catchment area to Kulasekarapattinam Kuttam. Public hearing was conducted on 07.02.2009. Cost of the project will be Rs. 8500.0 Crores.

3. The project has been considered in accordance with the provisions of the EIA notification issued by the Ministry of Environment & Forests vide S.O. 1533 (E), dated September 14, 2006.

4. Based on the information submitted by you, as at Para 2 above and others and presentation made before the Expert Appraisal Committee (Thermal Power) in its 62nd, 69th Meeting and 74th Meeting held during January 11-12, 2010, April 30-May 01, 2010 and May 20-21, 2013 respectively, the Ministry of Environment and Forests in acceptance of the recommendation of the Expert Appraisal Committee hereby accords

environmental clearance to the above project under the provisions of EIA notification dated September 14, 2006, subject to the compliance of the following Specific and General conditions:

A. Specific Conditions:

(i) CRZ clearance for permissible activities in CRZ area shall be obtained prior to starting any activity in CRZ area.

(ii) In case source of fuel supply is to be changed at a later stage (now proposed on imported coal from Indonesia) the project proponent shall intimate the Ministry well in advance along with necessary requisite documents for its concurrence for allowing the change. In such a case the necessity for re-conducting public hearing may be decided by the Ministry in consultation with the Expert Appraisal Committee.

(iii) Surplus course channel shall be developed so that the surplus water from Ellappanaicken tank as well as self-catchment water is drained into Kulasekarapattinam tharuvai. Additionally peripheral drain to transport/convey above surplus water (including storm water from the catchment area) to Kulasekarapattinam Kuttam shall be developed.

(iv) Transportation of coal shall be strictly by tube conveyor system from the Port to the power plant site.

(v) Sulphur and ash contents in the coal to be used in the project shall not exceed 0.6 % and 8.0 % respectively at any given time. The GCV of the imported coal to be used shall not be below 6000 Kcal/kg. In case of variation of coal quality at any point of time, fresh reference shall be made to the Ministry for consideration.

(vi) Bi-flue stack of 275 m height shall be provided with continuous online monitoring equipments for SO_x, NO_x and Particulate Matter ($PM_{2.5}$ & PM_{10}). Exit velocity of flue gases shall not be less than 22 m/sec. Mercury emissions from stack shall also be monitored on periodic basis.

(vii) High Efficiency Electrostatic Precipitators (ESPs) shall be installed to ensure that particulate emission from the proposed plant does not exceed 50 mg/Nm^3.

(viii) Fly ash shall be collected in dry form and storage facility (silos) shall be provided. Unutilized fly ash shall be disposed off in the ash pond in the form of slurry form. Mercury and other heavy metals (As, Hg, Cr, Pb etc.) will be monitored in the bottom ash as also in the effluents emanating from the existing ash pond. No ash shall be disposed off in low lying area.

(ix) Ash pond shall be lined with HDPE/LDPE lining or any other suitable impermeable media such that no leachate takes place at any point of time. Adequate safety measures shall also be implemented to protect the ash dyke from getting breached.

(x) Fugitive emission of fly ash (dry or wet) shall be controlled such that no agricultural or non-agricultural land is affected. Damage to any land shall be mitigated and suitable compensation provided in consultation with the local Panchayat.

(xi) A long term study of radio activity and heavy metals contents on coal to be used shall be carried out through reputed institutes like AMD, Hyderabad, Central Power Research Institute, Bangalore, Mangalore University and report submitted to R.O of the Ministry from time to time.

(xii) No water bodies including natural drainage system in the area shall be disturbed due to activities associated with the setting up / operation of the power plant.

(xiii) The project proponent shall regenerate degraded water body (if any) located nearby within 5.0 km atleast.

(xiv) Suitable screens (in stages) shall be placed across intake channel to prevent entrainment of life forms including eggs, larvae, juvenile fish, plankton etc. during extraction of sea water.

(xv) Coastline stabilization in and around power project facilities shall be undertaken either by way of using capital dredging material or suitable method.

(xvi) The project proponent shall examine in detail the possibility to adopt NIOT technology for desalination of sea water through Low Temperature Thermal Desalination (LTTD) process. In case the same is not feasible detailed explanation shall be submitted.

(xvii) The water containing brine shall be discharged after cooling at ambient temperature in a guard pond such that the same meets the average salinity of sea water.

(xviii) No waste water should be discharged onto channel systems, backwaters, marshy areas and seas without treatment. The outfall should be first treated in guard pond and then discharge into deep sea (12 to 15 m depth). Similarly, the intake should be from deep sea to avoid aggregation of fish. The brine that comes out from desalinization plants should not be discharged directly into sea but it should be recycled and diluted to acceptable salinity level meeting near level of sea water salinity.

(xix) COC of atleast 1.25 shall be adopted and report submitted within 3 months of operation of the plant.

(xx) A well designed rain water harvesting system shall be put in place which shall comprise of rain water collection from the built up and open area in the plant premises.

(xxi) The leveling in plant area should be minimum with no or minimal disturbance to the natural drainage of the area. If the minor canals (if any) have to be diverted, the design for diversion should be such that the diverted canals not only drains the plant area but also collect the volume of flood water from the surrounding areas and discharge into marshy areas/major canals that enter into creek/nallah etc. Major canals should not be altered but their bunds should be strengthened and desilted.

(xxii) In the event the project entails acquisition of community fodder land, the project proponent shall ensure that alternative fodder farm is developed and handed over to the community in a time bound manner. Firm financial commitment along with details for development of fodder farm / grazing land shall be submitted within three months to the Ministry.

(xxiii) Degenerated mangrove located in the study area (if any) shall be adopted and regenerated in consultation with the concerned Dept. of the State Government.

(xxiv) Green Belt consisting of three tiers of plantations of native species around plant (except in areas not feasible such as gates and at least 100 m width shall be raised. Wherever 100 m width is not feasible a 20 m width shall be raised and adequate justification shall be submitted to the Ministry. Tree density shall not less than 2500 per ha with survival rate not less than 80 %.

(xxv) CSR schemes identified based on need based assessment shall be implemented in consultation with the village Panchayat and the District Administration starting from the development of project itself. As part of CSR the project proponent shall set up single teacher school in every village in the study area so that village boys and girls do not have to walk long distances. The project proponent shall also explore the feasibility of providing cycles to school going children/students to address school dropouts out of committed CSR budget. Report to this effect shall be submitted to the Ministry from time to time.

(xxvi) The project proponent shall adopt the fishing communities displaced / affected by the power plant and in particular those residing in and around the plant within 3.0 km radius. Accordingly basic amenities like development of roads, drinking water supply, primary health

centre, primary school etc shall be developed in co-ordination with the district administration.

(xxvii) It shall be ensured that vocation of traditional fishing community is not hampered due to the activities of the power project. The project proponent shall ensure that the fishing community is involved in developmental process and welfare schemes for traditional fishing community is drawn for sustainable implementation.

(xxviii) An amount of Rs 86.0 Crores as one time investment shall be earmarked for activities to be taken up under CSR during construction phase of the Project. Recurring expenditure for CSR thereafter shall be Rs 15.0 Crores per annum till the life of the plant. Social Audit by a reputed University or an Institute shall be carried out annually and details to be submitted to the Ministry besides putting it on the Company's website.

(xxix) A common **Green Endowment Fund** should be created by the project proponents out of EMP budgets. The interest earned out of it should be used for the development and management of green cover of the area.

(xxx) A **Fishermen Endowment Welfare Fund** should also be created not only to enhance the quality of life of fishermen community through creation of facilities for fish landing platforms / fishing harbour / cold storage, but also to provide relief in case of emergency situations such as missing of fishermen on duty due to rough seas, tropical cyclones and storms etc.

(xxxi) There should not be any contamination of soil, ground and surface waters (canals & village pond) with sea water in and around the project sites. In other words necessary preventive measures for spillage from pipelines, such as lining of guard pond used for the treatment of outfall before discharging in to the sea and surface RCC channels along the pipelines of outfall and intake should be adopted. This is just because in the areas around the projects boundaries there may be fertile agricultural land used for paddy or other crop cultivation

(xxxii) Marine biology shall not be disturbed due to any activity arising from the operation of the power plant. Continuous monitoring of the marine biology in the area shall be undertaken and assessed for any changes beyond the natural variability identified and records maintained and submitted to the Ministry from time to time.

(xxxiii) Continuous monitoring of marine biology during construction and operational period of power plant shall be undertaken by an institute of repute like Faculty of Marine Sciences, Annamalai University. In addition monitoring of surface water quality in the

vicinity of the power plant in and around 3.0 kms radius shall also be regularly conducted and records maintained. The monitored data shall be submitted to the Ministry regularly. Further, monitoring points shall be located between the plant and drainage in the direction of flow of ground water and records maintained. Monitoring for heavy metals in ground water shall be undertaken.

(xxxiv) An Environmental Cell comprising of atleast one expert in Marine biologist and an ecologist, shall be created at the project site itself and shall be headed by an officer of appropriate superiority and qualification. It shall be ensured that the Head of the Cell shall directly report to the head of the organization who would be accountable for implementation of environmental regulations and social impact improvement/mitigation measures.

B. General Conditions:

(i) Vision document specifying prospective plan for the site shall be formulated and submitted to the Regional Office of the Ministry within **six months**.

(ii) Harnessing solar power within the premises of the plant particularly at available roof tops shall be undertaken and status of implementation shall be submitted periodically to the Regional Office of the Ministry.

(iii) The treated effluents conforming to the prescribed standards only shall be re-circulated and reused within the plant. Arrangements shall be made that effluents and storm water do not get mixed.

(iv) A sewage treatment plant shall be provided (as applicable) and the treated sewage shall be used for raising greenbelt/plantation.

(v) Adequate safety measures shall be provided in the plant area to check/minimize spontaneous fires in coal yard, especially during summer season. Copy of these measures with full details along with location plant layout shall be submitted to the Ministry as well as to the Regional Office of the Ministry.

(vi) Storage facilities for auxiliary liquid fuel such as LDO/ HFO/LSHS shall be made in the plant area in consultation with Department of Explosives, Nagpur. Sulphur content in the liquid fuel will not exceed 0.5%. Disaster Management Plan shall be prepared to meet any eventuality in case of an accident taking place due to storage of oil.

(vii) First Aid and sanitation arrangements shall be made for the drivers and other contract workers during construction phase.

(viii) Noise levels emanating from turbines shall be so controlled such that the noise in the work zone shall be limited to 85 dB(A) from source. For people working in the high noise area, requisite personal protective equipment like earplugs/ear muffs etc. shall be provided. Workers engaged in noisy areas such as turbine area, air compressors etc shall be periodically examined to maintain audiometric record and for treatment for any hearing loss including shifting to non noisy/less noisy areas.

(ix) Regular monitoring of ambient air ground level concentration of SO_2, NOx, $PM_{2.5}$ & PM_{10} and Hg shall be carried out in the impact zone and records maintained. If at any stage these levels are found to exceed the prescribed limits, necessary control measures shall be provided immediately. The location of the monitoring stations and frequency of monitoring shall be decided in consultation with SPCB. Periodic reports shall be submitted to the Regional Office of this Ministry. The data shall also be put on the website of the company.

(x) Provision shall be made for the housing of construction labour (as applicable) within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.

(xi) The project proponent shall advertise in at least two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned within seven days from the date of this clearance letter, informing that the project has been accorded environmental clearance and copies of clearance letter are available with the State Pollution Control Board/Committee and may also be seen at Website of the Ministry of Environment and Forests at http://envfor.nic.in.

(xii) A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zila Parisad / Municipal Corporation, urban local Body and the Local NGO, if any, from whom suggestions/representations, if any, received while processing the proposal. The clearance letter shall also be put on the website of the Company by the proponent.

(xiii) The proponent shall upload the status of compliance of the stipulated environmental clearance conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MOEF, the respective Zonal Office of CPCB and the SPCB. The criteria pollutant levels namely; SPM, RSPM ($PM_{2.5}$ & PM_{10}), SO_2, NO_x (ambient levels as well as stack emissions) shall be displayed at a convenient location near the main gate of the company in the public domain.

(xiv) The environment statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of environmental clearance conditions and shall also be sent to the respective Regional Offices of the Ministry by e-mail.

(xv) **The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment and Forests, its Regional Office, Central Pollution Control Board and State Pollution Control Board. The project proponent shall upload the status of compliance of the environment of the environmental clearance conditions on their website and update the same periodically and simultaneously send the same by e-mail to the Regional Office, Ministry of Environment and Forests.**

(xvi) Regional Office of the Ministry of Environment & Forests will monitor the implementation of the stipulated conditions. A complete set of documents including Environmental Impact Assessment Report and Environment Management Plan along with the additional information submitted from time to time shall be forwarded to the Regional Office for their use during monitoring. Project proponent will up-load the compliance status in their website and up-date the same from time to time at least six monthly basis. **Criteria pollutants levels including NO_x (from stack & ambient air) shall be displayed at the main gate of the power plant.**

(xvii) Separate funds shall be allocated for implementation of environmental protection measures along with item-wise break-up. These cost shall be included as part of the project cost. The funds earmarked for the environment protection measures shall not be diverted for other purposes and year-wise expenditure should be reported to the Ministry.

(xviii) The project authorities shall inform the Regional Office as well as the Ministry regarding the date of financial closure and final approval of the project by the concerned authorities and the dates of start of land development work and commissioning of plant.

(xix) Full cooperation shall be extended to the Scientists/Officers from the Ministry / Regional Office of the Ministry / CPCB/ SPCB who would be monitoring the compliance of environmental status.

5. The Ministry of Environment and Forests reserves the right to revoke the clearance if conditions stipulated are not implemented to the satisfaction

of the Ministry. The Ministry may also impose additional environmental conditions or modify the existing ones, if necessary.

6. The environmental clearance accorded **shall be valid for a period of 5 years** to start operations by the power plant.

7. Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.

8. In case of any deviation or alteration in the project proposed including coal transportation system from those submitted to this Ministry for clearance, a fresh reference should be made to the Ministry to assess the adequacy of the condition(s) imposed and to add additional environmental protection measures required, if any.

9. The above stipulations would be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and rules there under, Hazardous Wastes (Management, Handling & Transboundary Movement) Rules, 2008 and its amendments, the Public Liability Insurance Act, 1991 and its amendments.

10. Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

Yours faithfully,

(Dr. Saroj)
Scientist 'F'

Copy to:

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi 110001.
2. The Secretary (Environment), Environment Department, Government of Tamil Nadu.
3. The Chairman, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.
4. The Chairman, Tamil Nadu State Pollution Control Board, No. 76, Mount Road, Mount Salai, Guindy, Chennai - 600 032
5. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi- 110032.

6. The Chief Conservator of Forests, Regional Office (SZ), Kendriya Sadan, 4th Floor E&F Wings 17th Main Road, 1 Block , Koranmangala, Bangalore -560 034.
7. The District Collector, Thoothukudi District, Govt. of Tamil Nadu.
8. Guard file.

(Dr. Saroj)
Scientist 'F'

Udangudi I E.C amendment dt. 26.04.2017 for2X660 MW

No. J-13012/19/2008 - IA.II (T)
Government of India
Ministry of Environment, Forest and Climate Change

Indira Paryavaran Bhawan,
3rd Floor, Vayu Wing
Jor Bagh Road,
New Delhi-110003

Dated: 26.04.2017

To

M/s. Udangudi Power Corporation Ltd.
TNEB Complex, 144, Anna Salai,
Chennai-600 002.
Tel: +91 44 28515511, 28544304/306
Fax: +91 44 28544305
E-mail: usctpp@gmail.com

Sub: ***2x800 MW Udangadi Super Critical Imported Coal Based TPP at village Udangudi, in Thiruchendur Taluk, in Thoothukudi district, in Tamil Nadu - reg. amendment in Environmental Clearance.***

Sir,

The undersigned is directed to refer to your online application dated 22.08.2016 and subsequent letter dated 9.2.2017 on the subject mentioned above. The Ministry of Environment & Forests has examined the application.

2. It has been noted that Environmental Clearance for setting up of 2x800 MW Udangadi Super Critical Imported Coal Based Thermal Power Plant at village Udangudi, in Thiruchendur Taluk, in Thoothukudi district, in Tamil Nadu has been accorded by the Ministry vide letter dated 14.10.2013. It has also been noted that an amendment in the said EC is requested for change in configuration from 2x800 MW to 2x660 MW and transfer of EC in the name of M/s Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO).

3. The proposal has been considered by the Re-constituted EAC (Thermal Power) in its 4th meeting held on 16.3.2017. In acceptance of the EAC recommendations and in view of information/clarifications submitted by you, the **Ministry hereby amends the Environmental Clearance dated 14.10.2013 for downsizing the capacity of the units from from 2x800 MW to 2x660 MW** subject to following additional conditions.

i. *MoEF&CC Notification S.O. 3305(E) dated 7.12.2015 shall be implemented with respect to specific water consumption, zero liquid discharge and revised emission standards.*

ii. *As per the Revised Tariff Policy notified by Ministry of Power vide dated 28.01.2016, project proponent shall explore the use of treated sewage water from the Sewage Treatment Plant of Municipality/ local bodies/ similar organization located within 50 km radius of the proposed power project to minimize the water drawl from River Godavari.*

iii. *Compliance of EC conditions, E(P) Act, 1986, Rules and MoEF&CC Notifications issued time to time shall be done by an environment officer to be nominated by the Project Head of the Company who shall be responsible for implementation and necessary compliance.*

4. All other conditions mentioned in this Ministry's letters of even no. dated 13.12.2012 shall remain the same, as applicable.

This issues with the approval of competent authority.

Yours faithfully,

(Dr. S. Kerketta)
Director

Copy to:

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi 110001.
2. The Chairman, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.
3. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi- 110032.
4. The Additional Principal Chief Conservator of Forests (C), Regional Office (SEZ), Ist and IInd Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai- 34.
5. The Principal Secretary, Environment and Forest Department, Government of Tamil Nadu, Fort St, George, Secretariat, Chennai-600009.
6. The Chairman, Tamil Nadu Pollution Control Board, No. 76, Mount Road, Mount Salai, Guindy, Chennai - 600 032
7. The District Collector, Thoothukudi District, Govt. of Tamil Nadu, Collectorate, Thoothukudi.
8. Guard file/Monitoring file.
9. Website of MoEF&CC.

(Dr. S. Kerketta)
Director

Udangudi I E.C Extension dt. 10.9.2018 upto 13.10.2020

No. J-13012/19/2008 - IA.II (T)
Government of India
Ministry of Environment, Forest and Climate Change

Indira Paryavaran Bhawan,
3rd Floor, Vayu Wing
Jor Bagh Road,
New Delhi-110003

Dated: 10.9.2018

To
The Chief Engineer (Projects-II)
M/s Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
5th Floor, Western Wing, NPKRR Maaligai,
144, Anna Salai, Chennai – 2.

Sub: ***2x800 MW Udangadi Super Critical Imported Coal Based TPP at village Udangudi, in Thiruchendur Taluk, in Thoothukudi district, in Tamil Nadu* by M/s Udangudi Power Corporation Ltd. - *reg. extension of validity of Environmental Clearance.***

Sir,

The undersigned is directed to refer to your online application **No. IA/TN/THE/18434/2013** dated 31.5.2018 on the above mentioned subject. It has been noted that you have requested for extension of validity of EC dated 14.10.2013 for further period of five years, i.e. till 13.10.2023.

2. It has been noted that Environmental Clearance for setting up of 2x800 MW Udangadi Super Critical Imported Coal Based Thermal Power Plant at village Udangudi, in Thiruchendur Taluk, in Thoothukudi district, in Tamil Nadu in favor of M/s Udangudi Power Corporation Ltd. has been accorded by the Ministry vide letter dated 14.10.2013. Further, an amendment in EC has been issued for change in configuration from 2x800 MW to 2x660 MW in favor of M/s Udangudi Power Corporation Ltd. vide Ministry's letter dated 26.4.2017. It has also been noted EAC (Thermal Power) in its 4th meeting held on 16.3.2017 suggested that Project Proponent may apply separately for transferring the EC in the name of M/s TANGEDCO as the amalgamation of the company is still under process.

3. The Ministry has examined the proposal. The validity of the EC dated 14.10.2013 is originally valid for a period of five years, i.e. till 13.10.2018. After the Ministry's EIA Amendment Notification vide S.O. 2944(E) dated 14.9.2016, the Environmental Clearance is valid for seven years. As the EC dated 14.10.2013 is valid on the date of publication of the S.O. 2944(E), the validity of the said EC is automatically extended to seven years, i.e. till 13.10.2020.

4. In view of the above, it is requested to apply for extension of validity of EC before its expiry, i.e.13.10.2020, if required. Further, it is requested to submit the application for transfer of EC in the name of M/s TANGEDCO.

This issues with the approval of competent authority.

Yours faithfully,

(Dr. S. Kerketta)
Director, IA.I

Copy to:

1. The Additional Principal Chief Conservator of Forests (C), Regional Office (SEZ), I[st] and II[nd] Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai- 34.
2. M/s. Udangudi Power Corporation Ltd., TNEB Complex, 144, Anna Salai, Chennai-600 002.
3. Guard file/Monitoring file.
4. Website of MoEF&CC.

(Dr. S. Kerketta)
Director, IA.I

Udangudi I - EC extension dt.25.09.2020 upto 13.10.2023

No. J-13012/19/2008 - IA.II (T)
Government of India
Ministry of Environment, Forest and Climate Change

Indira Paryavaran Bhawan,
3rd Floor, Vayu Wing
Jor Bagh Road,
New Delhi-110003

Dated: 25.09.2020

To
The Chief Engineer (Projects-II)
M/s Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
5th Floor, Western Wing, NPKRR Maaligai,
144, Anna Salai, Chennai – 600002.

Tel No: 28520878; **Fax No:** 28520878; **Email:** cepr@tnebnet.org;

Sub: ***2x660 MW Udangadi Super Critical Imported Coal Based TPP at village Udangudi, in Thiruchendur Taluk, in Thoothukudi district, in Tamil Nadu by M/s Tamil Nadu Generation and Distribution Corporation (TANGEDCO) - reg. extension of validity of Environmental Clearance.***

Sir,

The undersigned is directed to refer your online application **No. IA/TN/THE/16427/2020** dated 18.07.2020 regarding extension of validity of Environmental Clearance dated 14.10.2013 for further period of 3 years.

2. It has been noted that the Environmental Clearance for setting up of 2x800 MW Udangadi Super Critical Imported Coal Based Thermal Power Plant in Thiruchendur Taluk of Thoothukudi district, Tamil Nadu was initially accorded to M/s Udangudi Power Corporation Ltd. (a joint venture of M/s TANGEDCO and M/s BHEL) vide Ministry's dated 14.10.2013. Subsequently, the project capacity was revised from 2x800 MW to 2x660 MW vide Ministry's amendment letter dated 26.4.2017. The Environmental Clearance is valid for seven years, i.e. till 13.10.2020.

3. It has been informed that Tamil Nadu Govt. decided to execute the project and accordingly, the joint venture was terminated by purchasing all shares of BHEL and paying compensation of Rs. 64 Crores. Now M/s TANGEDCO is the sole owner of the project.

4. It is noted that the land requirement for the project is 939 acres. It has been informed that the Government of Tamil Nadu has alienated about 306.5455 Ha (757.47 acres) Power Plant cooling water corridor. Further, G.O No.31, dt.22.3.2010 was issued for acquisition of Patta lands of 114.75.5 Ha (283 acres). Government Poramboke Lands have been alienated and boundary has been demarcated. W.r.t. acquisition of Private Land, Gazette Notification has been issued under 3(2) and 3(1) clauses of the Tamil Nadu Industrial Purposes Act. The District Collector has issued

enter upon permission on 7.8.2013. Compensation amount for private lands have been deposited. The break-up of land for the project facilities is given as below:

Sl.No.	Description	Land required for 2x660 MW (Acres)
1.	Main Plant, Transformer Yard, Switch yard and FGD	65
2.	Coal Yard	65
3.	Cooling water system	43
4.	Fuel Oil system	4.2
5.	Water system including Chlorination system	19.23
6.	Ash Dyke	120
7.	Administration building and other Non-plant buildings	11.66
8.	Miscellaneous such as Corridor for CW piping, Ash piping, Intake & outfall, Silo & its utility building, Workshop, Stores, Roads etc.,	198.1
9.	Green Belt	412.81 (about 44% of total area)
10.	Total	939

5. Coal requirement is 3.87 MTPA with GCV 5700 kcal/kg based on imported coal. TANGEDCO has entered into a MOU dt.19.11.2012 with MMTC for supply of 4.5 Million Tonnes per Annum of imported coal from Indonesia. Water requirement is 13,790 m^3/h is to be sourced from Bay of Bengal through pipeline. Desalination Plant with capacity of 16 mld is proposed

6. It has been informed that physical progress of Main Plant Area (Boiler, ESP, Chimney, NDCT, Power House Building etc.) & Non Plant Area (Compound Wall, Site Grading, Sea water intake and outfall structures, CW pipe lines etc.,) has been achieved up to 39%. The amount of Rs.7,359 Crores has been spent till date towards project of the construction, out total revised project cost of Rs.13,076.705 Crores.

7. It has been informed that the funds have been earmarked for FGD installation to meet revised emission norm. At present, quotations have been received and the evaluation of techno-commercial bids is under process. It is expected to place the orders by October, 2020. The completion of project construction activities and the COD of first unit is expected by May, 2023. The COD of second unit is expected by June, 2023.

8. The proposal was appraised by Re-constituted EAC (Thermal) in its meeting held on 28.7.2020. In acceptance of the recommendations of the Re-constituted EAC (Thermal Power) in its meeting held on 28.7.2020 and in view of the information, clarifications, documents submitted by you, **the Ministry hereby extends the validity of the Environmental Clearance dated** 14.10.2013 **for further period of three years, i.e. w.e.f. 14.10.2020 till 13.10.2023** subject to following additional conditions:

i. The physical and financial progress of FGD and other pollution control measures to meet revised emission norms vide Notification dated 07.12.2015 shall be submitted as part of compliance report.

ii. Progress of construction of the project till the COD of both units achieved shall be furnished in the compliance report.

9. All other conditions mentioned in this Ministry's letter of even no. dated 14.10.2013, and the amendment letter dated 26.4.2017 shall remain the same, as applicable.

This issues with the approval of competent authority.

Yours faithfully,

(Dr. S. Kerketta)
Director, IA.I

Copy to:

1. The Secretary, Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi 110001.
2. The Chairman, Central Electricity Authority, Sewa Bhawan, R.K. Puram, New Delhi-110066.
3. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi- 110032.
4. The Additional Director General of Forests (C), Regional Office (SEZ), Ist and IInd Floor, Handloom Export Promotion Council, 34, Cathedral Garden Road, Nungambakkam, Chennai- 34.
5. The Principal Secretary, Environment and Forest Department, Government of Tamil Nadu, Fort St, George, Secretariat, Chennai-600009.
6. The Chairman, Tamil Nadu Pollution Control Board, No. 76, Mount Road, Mount Salai, Guindy, Chennai – 600032.
7. The District Collector, Thoothukudi District, Govt. of Tamil Nadu, National Highway 7A, PSP Nagar, Korampallam, Thoothukudi, Tamil Nadu 628101.
8. Guard file/Monitoring file.
9. Website of MoEF&CC.

Director, IA.I

Request letter for EC Extension for COVID-19 upto 13.10.2024

From
Er. N.Umadevi, B.E.,M.B.A.,
Chief Engineer/Projects-II,
TANGEDCO(A Subsidiary of TNEB) ,
5th Floor Western Wing , NPKRR Maaligai,
144, Anna salai,
Chennai – 600 002.

To
The Director ,
Ministry of Environment, Forests & Climate Change,
I.A Division –II(Thermal)
Vayu 303, Indira Paryavaran Bhawan,
Jor Bagh Road, Aliganj,
New Delhi-110 003

Lr.No.CE/Pr-2/SE/C/P&E/EE/EMC-I/AEE/C/ F.Udangudi STPP /D. 25 /23, dt.15.02.2023
Sir,

Sub: TANGEDCO - Udangudi Super Critical Thermal Power Project (2x 660 MW) Extention for Validity of Environmental Clearance for one year as per MoEF & CC Notification dated 18.01.2021– Requested - Reg.

Ref: 1) Environmental and CRZ Clearance for Captive Jetty vide MOEF/GOI's F.No.11-48/2009-IA.III, dt.6.6.2011
2) Environmental Clearance for Power Plant vide MOEF/GOI's Lr.No.J 13012/19/2008-IA.II(T), dt.14.10.2013
3) Environmental Clearance(amendment) issued for 2 x660 MW vide MOEF/GOI's Lr.No. J 13012/19/2008- 1A.II(T), Dt.26.04.2017.
4) Extension of Validity for CRZ Clearance issued vide MOEF/GOI's Lr.No. F.No.11-48/2009—IA.III(Pt.I), Dt.15.05.2018
5) Extension of validity of Environmental Clearance issued vide MOEF/GOI's Lr.No. J 13012/19/2008- 1A.II(T), Dt.10.09.2018
6) Extension of validity of Environmental Clearance issued vide MOEF/GOI's Lr.No. J 13012/19/2008- 1A.II(T), Dt.25.09.2020
7) MOEF & CC notification dated 18.01.2021

8) Fresh Environmental and CRZ Clearance(EC Identification No. EC22A004TN156490)for Captive Jetty vide MOEF/GOI's F.No.10-66/2020-IA.III, dt.3.8.2022

*****

Tamil Nadu Generation and Distribution Corporation (TANGEDCO) has obtained Environmental Clearance for the 2 x 800 MW Udangudi Super Critical Imported Coal based Thermal Project at Udangudi Village, Tiruchendur Taluk, Tuticorin District of Tamil Ndu, Vide MOEF/GOI, Lr. No.J 13012/19/2008—IA. II(T) , dt. 14.10.2013 (reference 2 cited). Subsequently, TANGEDCO obtained amendment to Environmental Clearance for reduction of unit sizes from 2x 800 MW to 2x660 MW, vide MOEF/GOI's Lr.No.13012/199/2008—IA II(T), dt 26.04.2017 (reference 3 cited). Originally Validity of EC given for 5 years. i.e., upto 13.10.2018. Thereafter Validity for EC extended for further two years, .ie., up to 13.10.2020 vide MOEF/GOI's Lr.No.MOEF/GOI's Lr. No. J.13012/19/2008 – IA. II (T) dt. 10.09.2018. (reference 5 cited). TANGEDCO obtained extension of EC for main plant for another three years i.e., up to 13.10.2023 vide MOEF/GOI's Lr.No. J 13012/19/2008- 1A.II(T), Dt.25.09.2020.

Further As a integrated project, Tamil Nadu Generation and Distribution Corporation (TANGEDCO) had also obtained Environmental and CRZ Clearance for establishing the captive coal jetty interlinked with 2 x 800 MW Udangudi Super Critical Imported Coal based Thermal Power Project at Udangudi village, Tiruchendur Taluk, Tuticorin District of Tamil Nadu, vide MOEF/GOI's F.No.11-48/2009-IA.III, dt.6.6.2011 (reference 1 cited). Extension of Validity for CRZ Clearance was obtained up to 05.06.2021 vide MOEF/GOI's Lr.No. F.No.11-48/2009—IA.III(Pt.I),dt. 15.05.2018.(reference 4 cited). Due to expiry of 10 years validity period of EC and CRZ clearances for the captive coal jetty and pipe conveyor system for the coal logistics required for the Udangudi Super Critical Thermal Power Project , fresh EC has been obtained by TANGEDCO vide MoEF/GOI's F.No.10-66/2020-IA.III , dt 03.08.2022(EC identification No.EC22A004TN156490) for further period of 10 years.

In order to establish the Project under single EPC (Engineering-Procurement-Construction) cum Debt Financing Basis, TANGEDCO floated International Competitive Bidding and opened the tenders on 19.7.2013. After detailed tender analysis, as it was noted that the bids suffered deficiencies and infirmities, TANGEDCO decided on 13.3.2015 to lodge the tender and call for fresh tender under single EPC and without Debt Financing.

Meanwhile, one of the bidders of the previous tender challenged the lodging the tender in the Hon'ble High Court of Madras and stayed for floating of fresh tenders. TANGEDCO filed writ appeal to vacate the stay. The Hon'ble High Court of Chennai passed orders on 30.10.2015 allowing TANGEDCO to process the fresh tender. The fresh tender was opened on 15.12.2015.

The work of EPC contract for the Udangudi Thermal Power Project Stage – I(2x660) was awarded to the bidder M/s. BHEL vide TANGEDCO'S LOA dated 7.12.2017. , New Delhi after obtaining final verdict dt.17.12.2017 from High Court of Madras in favour of TANGEDCO.

Further, The work of establishment of Captive Coal Jetty with unloading facilities and pipe Conveyor System for the Udangudi Thermal Power Project Stage – I(2x660) MW was awarded to M/s. ITD Cementation India Limited , Mumbai, vide TANGEDCO's LOA dated 13.02.2018.

Considering the slippages due to legal issues in tender processing , cyclones and Covid-19 lock down and other force majeure issues, commissioning of the project gets delayed. Progress achieved so far in the main plant construction works is 67% and for the coal jetty component is about 82%.

Now the Main plant progress is progressing well but about 33% work is yet to be completed.

Under these circumstances, it is informed that total validity period of ten years of EC for the Udangudi STPP Stage-I(2x660 MW) plant extended on 25.09.2020 by the MoEF & CC , New Delhi vide MOEF/GOI's Lr.No. J 13012/19/2008- 1A.II(T), Dt.25.09.2020 will expire on 13.10.2023. However as per the MoEF & CC notification, dt. 18.01.2021, due to COVID-19 pandemic condition, validity of E.C. shall not be counted from 01.04.2020 to 31.03.2021 for the purpose of calculation of validity. Hence validity of EC clearance of Udangudi STPP stage-I (2x660 MW) issued on 13.10.2013 by MoEF & CC, New Delhi shall be extended further one year from 13.10.2023 to 12.10.2024.

Hence it is requested that the EC for the Udangudi Super Critical Thermal Project Stage-I (2x660 MW) expires on 13.10.2023 may be extended up to 12.10.2024 (due to Covid-19) as per MoEF & CC notification, dt. 18.01.2021.

Encl: Copy of refs.

Yours faithfully,

Chief Engineer / Projects-II
TANGEDCO
144,Annasalai,Chennai-600 002.

Annexure - XI

CTE (Air & Water)

Category of the Industry :

RED

CONSENT ORDER NO. 2303250084899 DATED: 09/08/2023.

PROCEEDINGS NO.T2/TNPCB/F.0495TTN/RL/TTN/A/2023 DATED: 09/08/2023

SUB: TNPC Board-Consent for Establishment – EXTENSION -M/S UDANGUDI SUPER CRITICAL THERMAL POWER PROJECT , S.F. No. 594 -609,611-620,624-639,640(1),641(1),642-655,657-665,666(1),667-677,678(1),679(1),680-689,695-704,709-711,712(1),712(3),713-716,721-726,731-738,740,741,748(1),774(1),610,621(1),621(2A),621(2B),622,623(1),623(2),690-694,705-708,717-719(1,2,3),720,727(1,2),728(1,2),729-730,739,23(1,2,3),24(1A,1B,1C,2A,2B,2C),31(1A,1B1),32(2B,3,4)768(2),769(2),770,771(2A2,4B),772(1A2,2B),773(1,2),774(2),775(1-9),776(1,2),777(1-4),466(1A,1B,2A,2B,3A,4,5A,5B,6A,6B,7-10 ,12),467(1A,2A,2B,2C,2D1A,2D1B,3),468A(1-3),469(1-3),470(1,2A1A,2A1B,2A2,2B,3B,6A,6B,9A,9B),471(1B,3-6,7A,7B,8,9),472A(1,2A,2B), UDANGUDI Village, Tiruchendur Taluk, Thoothukkudi District- for the establishment or take steps to establish the industry 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. CTE Proc No.T4/F.6340/TNPCB/RL/TTN/W&A/2013 dated: 10.03.2014
2. CTE- Extn Proc No. T7/TNPCB/F.0495TTN/RL//TTN/W&A/2016 dated: 29.09.2016.
3. CTE- Revised Proc No. T4/TNPCB/F.0495TTN/RL//TTN/A/2021 dated: 25.03.2021
4. Unit's online application for CTE-Extn 50084899 dated. 17.2.2023
5. IR.No : F.0495TTN/RL/JCEE-M/TTN/2023 dated 01.08.2023
6. Minutes of 216th TSC meeting held on 3.8.2023 vide item No. 216-19

Consent to establish or take steps to establish was 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') to the Occupier of the unit of M/s.UDANGUDI SUPER CRITICAL THERMAL POWER PROJECT authorizing to establish or take steps to establish the industry in the site of S.F.No.594 -609,611-620,624-639,640(1),641(1),642-655,657-665,666(1),667-677,678(1),679(1),680-689,695-704,709-711,712(1),712(3),713-716,721-726,731-738,740,741,748(1),774(1),610,621(1),621(2A),621(2B),622,623(1),623(2),690-694,705-708,717-719(1,2,3),720,727(1,2),728(1,2),729-730,739,23(1,2,3),24(1A,1B,1C,2A,2B,2C),31(1A,1B1),32(2B,3,4)768(2),769(2),770,771(2A2,4B),772(1A2,2B),773(1,2),774(2),775(1-9),776(1,2),777(1-4),466(1A,1B,2A,2B,3A,4,5A,5B,6A,6B,7-10 ,12),467(1A,2A,2B,2C,2D1A,2D1B,3),468A(1-3),469(1-3),470(1,2A1A,2A1B,2A2,2B,3B,6A,6B,9A,9B),471(1B,3-6,7A,7B,8,9),472A(1,2A,2B),UDANGUDI village, Tiruchendur Taluk, Thoothukkudi District vide reference First cited with validity for Five years .

The unit has requested for extension of time limit for establishing the plant since they could not establish the plant within the period of Five years vide reference second cited.

The subject was placed before the committee meeting vide reference third cited and the committee decided to extend the validity of the Consent to establish for further period.

In view of the above, the validity of the Consent to establish is extended for further period upto **October 13, 2024** , or till the industry obtains consent to operate under Section 21 of the Air (Prevention and control of Pollution) Act, 1981, as amended in 1987 whichever is earlier subject to special and general conditions specified in the Consent for Establishment issued vide reference first cited.

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 comply with conditions stipulated in the CTE issued vide Bd. Proc. No. T4/F.6340/TNPCB/RL/TTN/A/2013 Dt: 10.03.2014, CTE extension issued vide Bd proc No. NO.T7/TNPCB/F.0495TTN/RL/TTN/A/2016 Dt: 29/09/2016 and CTE Revised issued Prco. No. NO.T4/TNPCB/F.0495TTN/RL//TTN/A/2021 Dt: 25/03/2021

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

To

CHIEF ENGINEER/PROJECTS,

M/s.UDANGUDI SUPER CRITICAL THERMAL POWER PROJECT,

TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION,

144, ANNA SALAI,

CHENNAI

Pin: 600002

Copy to:

1.The Executive Officer, UDANKUDI-Town Panchayat, Tiruchendur Taluk, Thoothukkudi District .

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

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

4. File

Category of the Industry :

RED

CONSENT ORDER NO. 2303150084899 DATED: 09/08/2023.

PROCEEDINGS NO.T2/TNPCB/F.0495TTN/RL//TTN/W/2023 DATED: 09/08/2023

SUB: TNPC Board-Consent for Establishment – EXTENSION -M/S UDANGUDI SUPER CRITICAL THERMAL POWER PROJECT , S.F. No. 594 -609,611-620,624-639,640(1),641(1),642-655,657-665,666(1),667-677,678(1),679(1),680-689,695-704,709-711,712(1),712(3),713-716,721-726,731-738,740,741,748(1),774(1),610,621(1),621(2A),621(2B),622,623(1),623(2),690-694,705-708,717-719(1,2,3),720,727(1,2),728(1,2),729-730,739,23(1,2,3),24(1A,1B,1C,2A,2B,2C),31(1A,1B1),32(2B,3,4)768(2),769(2),770,771(2A2,4B),772(1A2,2B),773(1,2),774(2),775(1-9),776(1,2),777(1-4),466(1A,1B,2A,2B,3A,4,5A,5B,6A,6B,7-10 ,12),467(1A,2A,2B,2C,2D1A,2D1B,3),468A(1-3),469(1-3),470(1,2A1A,2A1B,2A2,2B,3B,6A,6B,9A,9B),471(1B,3-6,7A,7B,8,9),472A(1,2A,2B), UDANGUDI Village, Tiruchendur Taluk, Thoothukkudi District- for the establishment or take steps to establish the industry under Section 25 of the Water (Prevention and control of Pollution)Act,1974, as amended in 1988(Central Act 53 of 1988) –Issued- Reg.

REF: 1. CTE Proc No.T4/F.6340/TNPCB/RL/TTN/W&A/2013 dated: 10.03.2014
2. CTE- Extn Proc No. T7/TNPCB/F.0495TTN/RL//TTN/W&A/2016 dated: 29.09.2016.
3. CTE- Revised Proc No. T4/TNPCB/F.0495TTN/RL//TTN/A/2021 dated: 25.03.2021
4. Unit's online application for CTE-Extn 50084899 dated. 17.2.2023
5. IR.No : F.0495TTN/RL/JCEE-M/TTN/2023 dated 01.08.2023
6. Minutes of 216th TSC meeting held on 3.8.2023 vide item No. 216-19

Consent to establish or take steps to establish was 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') to the Occupier of the unit of M/s.UDANGUDI SUPER CRITICAL THERMAL POWER PROJECT authorizing to establish or take steps to establish the industry in the site of S.F. No.594 -609,611-620,624-639,640(1),641(1),642-655,657-665,666(1),667-677,678(1),679(1),680-689,695-704,709-711,712(1),712(3),713-716,721-726,731-738,740,741,748(1),774(1),610,621(1),621(2A),621(2B),622,623(1),623(2),690-694,705-708,717-719(1,2,3),720,727(1,2),728(1,2),729-730,739,23(1,2,3),24(1A,1B,1C,2A,2B,2C),31(1A,1B1),32(2B,3,4)768(2),769(2),770,771(2A2,4B),772(1A2,2B),773(1,2),774(2),775(1-9),776(1,2),777(1-4),466(1A,1B,2A,2B,3A,4,5A,5B,6A,6B,7-10 ,12),467(1A,2A,2B,2C,2D1A,2D1B,3),468A(1-3),469(1-3),470(1,2A1A,2A1B,2A2,2B,3B,6A,6B,9A,9B),471(1B,3-6,7A,7B,8,9),472A(1,2A,2B), village, Tiruchendur Taluk, Thoothukkudi District vide reference First cited with validity for Five years **.**

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The subject was placed before the committee meeting vide reference third cited and the committee decided to extend the validity of the Consent to establish for further period.

In view of the above, the validity of the Consent to establish is extended for further period upto **October 13, 2024** , or till the industry obtains consent to operate under Section 25 of the Water (Prevention and Control of Pollution) Act, 1974, as amended in 1987 whichever is earlier subject to special and general conditions specified in the Consent for Establishment issued vide reference first cited.

Special Additional Condition:

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 comply with conditions stipulated in the CTE issued vide Bd. Proc. No. T4/F.6340/TNPCB/RL/TTN/W/2013 Dt: 10.03.2014, CTE extension issued vide Bd proc No. NO.T7/TNPCB/F.0495TTN/RL/TTN/W/2016 Dt: 29.09.2016 and CTE Revised issued Proc. No. NO.T4/TNPCB/F.0495TTN/RL//TTN/W/2021 Dt: 25.03.2021

For Member Secretary,
Tamil Nadu Pollution Control Board,
Chennai

To

CHIEF ENGINEER/PROJECTS,

M/s.UDANGUDI SUPER CRITICAL THERMAL POWER PROJECT,

TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION,

144, ANNA SALAI,

CHENNAI

Pin: 600002

Copy to:

1.The Executive Officer, UDANKUDI-Town Panchayat, Tiruchendur Taluk, Thoothukkudi District .

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

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

4. File

Annexure - XII

Chimney Clearance from AAI

Attachment no. 10

भारतीय विमानपत्तन प्राधिकरण
AIRPORTS AUTHORITY OF INDIA

No.AAI/20012/1537/2008 -ARI (NOC)

Dated : 25-Aug-08

EE/EMC

SE/C/P & E

05 SEP 2008

M/s Tamil Nadu Electricity Board,
NPKRR Maaligai, 5th Floor
Western Wing, 144, Anna Salai,
Chennai-600 002.

SE/civil/P&E

Sub:- Issue of NOC.

1. Please refer to your letter No. SE/C/P&E/EE/EMC/AEE/C/F.UDANGUDI STPP/D.645/08 Dated 23-07-08 on the subject mentioned above.

2. This office has no objection to the construction of the proposed **CHIMNEY by M/S TAMIL NADU ELECTRICITY BOARD**, here in after referred to as the applicant(s) at location **setting Up Of Udangudi Super Thermal Power Project(2x800 MW)- At Tuticorin Distt, Tamil Nadu [COORD:08°26'00"N 078°03'00"E] to height 278 Mtrs.** (Two Seven Eight metres) ABOVE GROUND LEVEL.so that the top of the proposed structure **when erected shall not exceed 3.2 meters.** (site Elevation)+ 278 meters (Height of the structure) i.e. **281.20 meters. ABOVE MEAN SEA LEVEL.**

3. This no objection certificate is being issued on the express understanding that the site-elevation reduced level (height above mean sea level) viz **3.2/M**, relative location of the proposed Bldg./Structure & its distances and Bearings from the ARP/Runway ends, as tendered by the applicant (s) are correct. If, However, at any stage it is established that the said data as tendered by the said applicant is actually different from the one tendered & which could adversely affect aircraft operations, the structure or part(s) thereof in respect of which this 'NOC' is being issued will have to be demolished at his own cost as may be directed by the Airports Authority of India. The applicant(s) is /are therefore advised in his/their own interest to verify the elevation and other data furnished for the site. before embarking on the proposed construction.

4. The issue of the 'NOC' is further subject to the provisions of Section 9-A of the Indian Aircraft Act, 1934 and those of any notifications issued thereunder from time to time and under which the applicant may be called upon by the Airports Authority of India to demolish in whole or in part the structure now being authorised vide this 'NOC'.

5. No radio/TV Antenna, lighting arresters, staircase, Mumtee, Overhead water tank and attachments of fixtures of any kind shall project above the height indicated in para 2.

6. The use of oil fired of electric fired furnace is obligatory, within 8 Kms. Of the Aerodrome.

7. The certificate is valid for a period of **SEVEN** years from the date of its issue. If the building/ structure/Chimney is not constructed & completed within the above mentioned period of **SEVEN** years he will be required to obtain a fresh 'No Objection Certificate' from the Chairman Airports Authority of India and/or the **G.M.(Aero), SOUTEHRN REGION.** The date of completion of Building/Structure/Chimney should be intimated to the AAI and/or **General Manager (Aero.), SOUTEHRN REGION** . No light or a combination of lights which by reason of its intensity, configuration of colour may cause confusion with the aeronautical ground lights of the Airport shall be installed at the site at any time during or after the construction of the building.

Day & Night markings with secondary power supply may be provided as per ICAO standards.

"NOC FOR HEIGHT CLEARANCE ONLY"
This Certificate is issued with the approval of Competent Authority.

25/08/08
(Tarun Chandolia)
Sr. Manager (ATC)
For General Manager (ATM-NOC), AAI

Copy to:

1. **The Regional Executive Director(Southern Region), AAI, Chennai Airport, Chennai-27.**
2. **Guard file.**
3. **GM(NOC) Bundle.**

Annexure - XIII

Tamil Nadu Maritime Board

TAMILNADU MARITIME BOARD
GOVERNMENT OF TAMILNADU

No. 171, South Kesavaperumalpuram,
Off Greenways Road,
Raja Annamalaipuram,
Chennai-600 028

Telephone: 044 2464 1232/
044 2493 4461
Fax 044 2495 1632
Email tnmb@tn.gov.in

Thiru.S.Natarajan, I.A.S.,
Vice Chairman and Chief Executive Officer

Letter No.3506/S1/2009, dated 06.02.2024

To

The Chief Engineer / Civil,
Udangudi Super Critical Thermal Project Stage –I
Tamil Nadu Generation and Distribution Corporation Limited,
Kallamozhi, Thiruchendur Taluk,
Udangudi– 628 206 - Tuticorin District.

Sir,

Sub: Tamil Nadu Maritime Board – TANGEDCO – USTPP- Stage I – Establishment of Captive Coal Jetty unloading facilities and Pipe conveyor for 2X660MW Udangudi STPP – Unloading of the Grab unloader at TANGEDCO Udangudi Captive Coal Jetty – reg.

Ref: 1. This Office letter No. 3506/S1/2009, dated 06.04.2023.
2. Your letter No. CE/C/SE/M/EE-III/M/USTPP-I/F.Coal Jetty/D.25/2024, dated 24.01.2024.
3. M/s. J.M.Baxi & Co. letter dated 24.01.2024.
4. Your letter No. CE/SE/Mech/EE/Mech/F.SUL.Coal Jetty/D.42/2024, dated 05.02.2024.

.....

In continuation to this office letter 1st cited and as requested in your letters 2nd and 4th cited, you are permitted to berth / unberth the project cargo vessel "M.V JIN XU XIANG", Flag Panama, at Udangudi Port Trestle jetty and unloading of the project cargo subject to the following conditions:

1. This permission is a onetime permission for the intended activity and shall not be construed as permission for operation of Udangudi Port.
2. The berthing / unberthing shall be carried out under the supervision of TNMB and by experienced pilots licensed by TNMB.

3. Berthing and unberthing operation shall be carried out in day time only and in settled weather conditions.

4. No shore leave is permitted to the ship's crew.

5. No sign on / sign off, bunkering, supply of freshwater and provisions are permitted.

6. Overtime dues as applicable for this operation shall be payable by you for the TNMB staff as per scale of rates.

7. You shall keep the Coast Guard, Navy informed of the arrival and departures of the vessel and the activities at Udangudi port.

8. Customs, Immigration and Port Health officials shall be arranged by you at Udangudi for inward and outward clearances.

9. All necessary Safety, Security and Environment precautions shall be taken by TANGEDCO

Yours faithfully,
Sd/- S.Natarajan,
Vice Chairman and
Chief Executive Officer

Copy to:- The Port Conservator, Kanyakumari – for information and follow up action.

/Forwarded/

State Port Officer

Annexure - XIV

Electrical Inspectorate certificate

SAVE ENERGY SAVE NATION

GOVERNMENT OF TAMIL NADU
ELECTRICAL INSPECTORATE

Web Site: www.tnei.tn.gov.in
E-mail: ceig@tn.gov.in

Phone: 22500 164, 22500 227,
22500 430, 22500 796
Fax: 22500 836

From:
The Chief Electrical Inspector to Government,
Post Box No. 1152,
Thiru Vi.Ka Industrial Estate,
Guindy, Chennai – 32

To
The Superintending Engineer,
Electrical / Erection,
Udangudi STPP – I, TANGEDCO,
Kallamozhi, Thoothukudi – 628 206

Letter No. TIN 5217/CEIG/D3/SC/2024, Dated 09.08.2024

Sir,

Sub: Electricity – **New EHV** – Electrical installations of voltage exceeding 33 kV and upto 650V at the premises of BTG 1 & 2, 2 x 660 MW Udangudi Super Critical Thermal Power Project, Stage – I, Udangudi, Kallamozhi, Thoothukudi District – 628 206 – Inspection under **Regulation 45 of Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023**, on 15.07.2024 – Approval – Accorded.

Ref:
1. This office letter No. TIN 5217/CEIG/D3/Drg/2024, dt. 05.07.2024
2. Your letter No. & dt.Nil, received on 09.07.2024
3. This office letter No. TIN 5217/CEIG/D3/Reg-45 Inspection/2024, dt. 10.07.2024
4. The Senior Electrical Inspector/Coimbatore letter No. TIN 5217/SEI/CBE/R45 A5/2024, dt. 22.07.2024
5. Your letter No. SE/E1/ER/USTPP-I/EE/E/AEE/E/F.2/D.No.49/24, dt. 30.07.2024, received on 01.08.2024

*****

Approval is hereby accorded under **Regulation 45 (4) of Central Electricity Authority (Measures relating to safety and Electric Supply) Regulations, 2023** to commission the Electrical installations inspected on 15.07.2024 at the above premises for 1 x 110 MVA, 2 x 6.3MVA, 2 x 5 MVA Power Transformers, 4 x 2.5 MVA Transformers, 2 x 2 MVA, 2 x 630 KVA Transformers and other equipment as enclosed in annexure subject to complying with the terms and conditions of the supplier.

The date of energisation of the installation should be intimated to this office. The equipment's permitted should be commissioned within six months from the date of issue of this letter failing which fresh permission should be obtained.

Under **Regulation 48 (7) of Central Electricity Authority (Measures relating to Safety and Electric Supply) Regulations, 2023**, the owner of the installation shall maintain and operate the installations in a condition free from danger and as recommended by the manufacturer or by the relevant Standards.

(Sd/-xxx)
Chief Electrical Inspector to Government

//True Copy/Forwarded//

Assistant Electrical Inspector/Technical

Encl: Annexure containing List of Electrical Equipments (13 Pages)

Copy to: M/s. KEPL EPC Infra, No.15, 2nd Floor, Om Shakthi Nagar, 2nd Street, Mettukuppam, Vanagaram, Chennai – 600 095. (With Annexure)

Copy to: The Senior Electrical Inspector/Coimbatore (With Annexure)

Copy to: The Electrical Inspector/Tirunelveli (With Annexure)

Annexure - XV

Coal Jetty (EC + CRZ Clearance)

ENVIRONMENTAL CLEARANCE

PARIVESH

(Pro-Active and Responsive Facilitation by Interactive, and Virtuous Environment Single-Window Hub)

Government of India
Ministry of Environment, Forest and Climate Change
(Impact Assessment Division)

To,

The CHIEF ENGINEER PROJECTS
TANGEDCO
5th Floor Western Wing
NPKRR Maaligai,
144 Anna Salai
Chennai 600002,,Chennai,Tamil Nadu-600002

Subject: Grant of Environmental Clearance (EC) to the proposed Project Activity under the provision of EIA Notification 2006-regarding

Sir/Madam,

This is in reference to your application for Environmental Clearance (EC) in respect of project submitted to the Ministry vide proposal number IA/TN/THE/178939/2020 dated 04 Jun 2022. The particulars of the environmental clearance granted to the project are as below.

1.	**EC Identification No.**	**EC22A004TN156490**
2.	**File No.**	10-66/2020-IA.III
3.	**Project Type**	New
4.	**Category**	A
5.	**Project/Activity including Schedule No.**	1(d) Thermal Power Plants
6.	**Name of Project**	Captive Coal Jetty and Pipe conveyor system for 2 X 660 MW Udangudi Super Critical Thermal Power Project
7.	**Name of Company/Organization**	TANGEDCO
8.	**Location of Project**	Tamil Nadu
9.	**TOR Date**	15 Dec 2020

The project details along with terms and conditions are appended herewith from page no 2 onwards.

(e-signed)
Amardeep Raju
Scientist E
IA - (INFRA-1 sector)

Date: 03/08/2022

Note: A valid environmental clearance shall be one that has EC identification number & E-Sign generated from PARIVESH.Please quote identification number in all future correspondence.

This is a computer generated cover page.

2. The proposed project is for construction of jetty with the dimensions of 555 m long and 25m wide berth with the Panamax capacity of 80,000 dead weight tonnage (DWT) for 2 ships. The breakwater is located at about (-) 18 m contour, it does not require any capital dredging or maintenance dredging. Initial 180m length of break water is aligned East West direction, and then takes a turn in NE direction aligned parallel to the berth for a length of 555m and finally turned towards North direction for a length of 180m. Structures of Coal jetty and pipe conveyor are designed not to affect fishing activity.

3. Initially, Environmental and CRZ Clearances for coal jetty and pipe conveyor system for the coal logistics to the Udangudi Super critical power project was obtained by the Ministry, vide letter no. F.No.11-48/2009-IA.III, dated 6th June 2011, subsequently, the Ministry vide letter even no dated 15th may, 2018 extended the EC till 05.06.2021. Since, TANGEDCO not completed the project within the valid EC time, TANGEDCO vide letter dated 20th August, 2020 requested MOEF seeking exemption/clarification on validity of EC dated 6th June 2020. Ministry vide letter No. 11-48/2009-IA.III(Pt.1) dated 29th Sept. 2020 informed the project proponent that "extension of validity would be governed as per the provision of the EIA notification, 2006 in terms of further extension of validity of the said clearance" and requested to PP apply for the fresh ToR to obtain the fresh EC and CRZ clearance for the balance part of the project.

4. The Terms of Reference (ToR) proposal was considered by the Expert Appraisal Committee(EAC) for infrastructure, CRZ and other miscellaneous projects in its 247th EAC meeting on 23rd -24th November 2020 and the committee recommended for grant of ToR, Ministry granted the ToR vide File No. 10-66/2020-IA-III dated 15th December, 2020..

5. The proposed project falls under Category (A) of item 7(e) as per EIA notification 2006. The proposal is appraised at Central Level as category A., In the Ministry of Environment, Forest and Climate Change, New Delhi. Total Investment/Cost of the project is Rs.1,90,286 Lakhs.

6. The proposed Captive Coal jetty is an interlinked project of ongoing Udangudi Super Critical Thermal Power Project Stage-I established in Udangudi village, Tiruchendur Taluk, Tuticorin District of Tamil Nadu. The nearest town is Tiruchendur at a distance of 12 km north-east of the project site. The nearest airport is Vagaikulam at a distance of 60 km north. The nearest sea port is Tuticorin at a distance of 45 km north. The land use is a barren and sandy land. There is no protected area within 10 km radius of the project.

7. The coal requirement for the Udangudi Super critical power project is 3.83 MTPA. TANGEDCO has entered signed an agreement with M/s. MMTC for supply of imported coal. Presently, TANGEDCO is establishing a 2 x 660 MW Units. TANGEDCO has obtained clearance for using 100% imported coal for the project. However, the project will be designed for the worst case scenario of 50% imported and 50% indigenous coal. Hence the Jetty and Pipe Conveyors have been designed for the ultimate coal handling capacity of 15.33 MTPA through Panamax ships of 80,000 to 120,000 Tons capacity.

8. There is no storage of coal in the proposed captive jetty area. Only coal handling and transfer is envisaged. During coal handling and transfer activities, there may be fugitive dust emission. To control dust emissions Pipe Conveyors will be used, apart from that, water sprinklers with high pressure swivelling type nozzles will be used at discharge / feeding points of Pipe conveyors at each transfer tower for efficient dust control. In addition to the above, suitable spray system shall also be provided at Shore Unloaders and coal stock yard.

9. Terrain and topographical features: The coastline of the study area is a sandy coast with presence of sand dunes. Typically, the coastline has been wider towards Manapad (southern side) and narrow towards Thiruchendur (northern side). Land next to the coast is also typically characterized with wide sandy terrain. No mangroves are present in the project site.

10. The island breakwater is proposed to be constructed at natural available depth of 17 m CD, which is approximately 7.91 Km offshore. Since it will be constructed at natural available depths, dredging is not required even for maintenance. Since there is no dredging involved, indirect impact on the shoreline is not envisaged due to the existence of the proposed island breakwater, there are no major changes in the hydrodynamics and the same was confirmed from the model study that was discussed in the previous section.

11. Water requirements: About 13,500 cum/hr of sea water shall be required, with closed cycle cooling system with natural-draft cooling tower (NDCT). Water for construction purpose will be sourced from local water resource & Desalinated water will be used during operation stage. No extraction of ground water. Water requirement for the operation phase will be met through captive desalination plant of 16 MLD capacity.

12. Waste Management: It is estimated that during the operation phase waste generated will be 18 kg/day; this will be collected at site and disposed of through Municipal Corporation. Used oil, spent oil, Wastes/Residue containing oil, Oil soaked rags, Cotton waste, discarded containers, barrels & Used Battery will be collected and disposed to approved vendors and same will be continued to proposed project. Further, Effluent Treatment Plant and Sewage Treatment Plant will be provided. The treated effluent/sewage will be utilised for green belt development. The brine from desalination plant will be mixed along with cooling tower blow down and will be discharged into the sea. Hazardous wastes generated at the port shall be disposed-off through authorized vendors duly adhering under guidelines of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and its amendment.

13. STP Details: STP sludge generated will be used as manure for green belt development and maintenance. No effluent generation is anticipated from the project. Therefore, no ETP is proposed. Two sequential batch reactors (SBR) based sewage treatment plant of 1.35 KLD capacities are planned for the project. One STP at jetty (underground deck) and the other near shore within the port landward boundary is proposed. Treated wastewater from the Jetty STP will be reused for flushing while the landward STP treated water will be reused for gardening.

14. Forest land Diversion: No forest land involved in the proposal and there is no National Park, Wild Life Sanctuary, Tiger/Elephant Reserves, Biosphere Reserves within 10 Km radius of the study area.

15. Tree cutting: No Tree cutting is involved.

16. Green Belt development: Greenbelt/area is developed in an extent of 16.5 ha within the port range covering periphery of yards, roads, buildings and along conveyor belt. In total, Greenbelt has been developed more than 57.9% of the total area and the green belt covering minimum of 33% of the acquired area will be planted inside the plant premises. A separate 33% green belt is adopted for thermal power plant boundary.

17. Dust Suppression Measures: Coal dust likely to generate at coal transfer points will be managed using enclosed pipe conveyor system and by employing dry fog dust suppression system at transfer points. Dust suppression measures like Ambient air quality monitoring, Water sprinkling, Greenbelt development etc. for Dust suppression telescopic cascade chutes shall be kept properly adjusted. This will dramatically reduce dust levels during bulk loading, minimizing the distance of free fall.

18. CRZ details: The project falls in CRZ-IA,CRZ-IB,CRZ-III, CRZ-IIIB and CRZ-IVA areas under the provisions of the CRZ Notification, 2011, Initially the State Coastal Zone Management Authority (SCZMA) has recommended the infrastructural facilities in CRZ area (Coal Jetty, Pipe Conveyor, Cooling water intake and outfall systems) to the Ministry vide letter no. 17249/EC-3/2009 dated 12.10.2009. Tamil Nadu maritime Board has given in-principal approval for establishing Coal jetty, Pipe Conveyor and Cooling Water intake & out fall systems on 06.07.2009. The Government of Tamil Nadu has notified the Minor Port at Udangudi for the captive use of UPCL to handle coal vides G.O.Ms.No.282 (Highways & Minor Ports (HF2) Department dt.16.09.2010. TNCZMA recommended the extension of CRZ clearance on 30.05.2022 with a condition to form separate Environment Management Cell.

19. Certified Compliance Report: Certified Compliance report obtained from the IRO, MoEF&CC vide letter F.No.EP/12.1/2011-12/TN/798 dated 30.08.2021.

20. Public hearing: The Expert Appraisal Committee gave exemption to the public hearing since about 40% of the work has been completed during the ToR stage, as of now more than 75% of the work has been completed at the site. Earlier public hearing for the supercritical thermal power plant and the minor port was conducted on 07.02.2009 under the presence of the District Collector following the EIA guidelines. Concerns raised during the public hearing are mainly related to hampering fishing in the port vicinity. EIA study depicted that impact on fishes due to outfall discharge will not be significant as mixing offered by the point of disposal is good and port operational impacts will be minimized by employing dry sweeping at berth, following MARPOL guidelines and operation of STPs. Other fishing locations like Alanthalai, Manappad, and Thiruchedur will not be disturbed at any stage.

Sl. No	Component	% of work completed
1	Construction of berths/Coal jetty	95%
2	Construction of breakwater	86%
3	Construction of approach trestle	94%
4	Installation of belt and pipe conveyor systems	35%
5	Installation of intake pipeline	89%
6	Installation of outfall pipeline	18%
7	Construction of port landward facilities	70%

21. Employment potential: Total man power requirement during the construction phase is approximately 650 workers. During operation phase, direct employment of 20 and indirect employment of 15 workers are envisaged.

22. Benefits of the project: The power project will help in augmenting the power requirement of the State of Tamil Nadu and will aid in the overall social and economic development of the region etc.

23. Details of court cases: No court cases are pending against the proposed project.

24. The EAC based on the information submitted and clarifications provided by the project proponent and detailed discussions held on all the issues in its 300 meeting during 15th June, 2022, recommended the project for grant of environmental and CRZ clearance with stipulated specific conditions along with other Standard EC Conditions.

25. The Ministry of Environment, Forest and Climate Change has considered the proposal based on the recommendations of the Expert Appraisal Committee (Infrastructure, CRZ and other Miscellaneous projects) and hereby decided to grant Environmental and CRZ Clearance for the "Construction of coal jetty and pipe conveyor system with the dimensions of 555 m long and 25m wide berth with the Panamax capacity of 80,000 dead weight tonnage (DWT) for 2 ships for the coal logistics required for Udangudi Super Critical Thermal Power Project Stage-I located at Udangudi village, Tiruchendur Taluk, Tuticorin District of Tamil Nadu by M/s Tamil Nadu Generation and Distribution Corporation (TANGEDCO)- for the balance work" under the EIA Notification, 2006 as amended and CRZ Notification 2011, subject to strict compliance of the following specific conditions, in addition to all standard conditions applicable for such projects.

SPECIFIC CONDITIONS

i. No additional component for the project has been proposed by the PP. The EC is required since the PP could not able to complete the project within the validity of the EC

ii. All the Conditions stipulated in the Environmental and CRZ clearance letter F.No.11-48/2009-IA.III, dated 06.06.2011 and 15th May, 2018 shall remain unchanged and shall be implemented.

iii. Construction activity shall be carried out strictly according to the provisions of the CRZ Notification, 2011. No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.

iv. All the recommendations and conditions specified by the Tamil Nadu State Coastal Zone Management Authority (TNCZMA) vide letter dated 30.05.2022 shall be complied with.

v. Consent to Establish/Operate for the project shall be obtained from the State Pollution Control Board as required under the Air (Prevention and Control of Pollution) Act, 1981 and the Water (Prevention and Control of Pollution) Act, 1974.

vi. The project proponent shall comply with the air pollution mitigation measures as submitted.

vii. The project proponent shall take mangrove plantation in the project area, wherever Possible. Adequate budget shall be provided in the Environment Management plan for such mangroves development.

viii. The Project proponent shall ensure that no creeks or rivers are blocked due to any activities at the project site and free flow of water is maintained.

ix. No underwater blasting is permitted.

x. Necessary approvals to be taken during implementation and commissioning from statutory bodies concerned.

xi. Shoreline should not be disturbed due to dumping. Periodical study on shore line changes shall be conducted and mitigation carried out, if necessary. The details shall be submitted along with the six monthly monitoring report.

xii. A continuous monitoring programme covering all the seasons on various aspects of the coastal and marine environs needs to be undertaken by a competent organization available in the State or by entrusting to the National Institutes/renowned Universities with rich experiences in marine science aspects. Monitoring should include sea weeds, sea grasses, mudflats, sand dunes, fisheries, mangroves and other marine biodiversity components as part of the management plan.

xiii. Continuous online monitoring of air and water covering the total area shall be carried out and the compliance report of the same shall be submitted along with the 6 monthly compliance reports to the regional office of MoEF&CC.

xiv. Sediment concentration should be monitored fortnightly at source and disposal location of dredging while dredging.

xv. Spillage of fuel / engine oil and lubricants from the construction site are a source of organic pollution which impacts marine life, particularly benthos. This shall be prevented by suitable precautions and also by providing necessary mechanisms to trap the spillage.

xvi. Necessary arrangements for the treatment of the effluents and solid wastes/ facilitation of reception facilities under MARPOL must be made and it must be ensured that they conform to the standards laid down by the competent authorities including the Central or

State Pollution Control Board and under the Environment (Protection) Act, 1986. The provisions of Solid Waste Management Rules, 2016. E- Waste Management Rules, 2016, and Plastic Waste Management Rules, 2016 shall be complied with.

xvii. Dredging shall not be carried out as PP submitted that there is no Dredging involved in the Current Proposal.

xviii. Periodical study on shore line changes shall be conducted and mitigation carried out, if necessary. The details shall be submitted along with the six monthly monitoring report.

xix. The schedule of implementation for the recommendations of the rapid risk assessment report, disaster management plan and safety guidelines shall be prepared and submitted to the Ministry within 3 months. All the recommendations mentioned in the rapid risk assessment report, disaster management plan and safety guidelines shall be implemented in time bound manner. The compliance to the recommendations as per schedule shall be submitted along with 6 monthly compliance reports to the regional office of MoEF&CC. Necessary arrangement for general safety and occupational health of people should be done in letter and spirit.

xx. As per the Ministry's Office Memorandum F. No. 22-65/2017-IA.III dated 30th September, 2020, the project proponent shall abide by all the commitments made by them to address the concerns raised during the public consultation. The project proponent shall initiate the activities proposed by them, based on the commitment made in the public hearing, and incorporate in the Environmental Management Plan and submit to the Ministry. All other activities including pollution control, environmental protection and conservation, R&R, wildlife and forest conservation/protection measures including the NPV, Compensatory Afforestation etc, either proposed by the project proponent based on the social impact assessment and R&R action plan carried out during the preparation of EIA report or prescribed by EAC, shall also be implemented and become part of EMP.

STANDARD CONDITIONS:

I. Statutory compliance:

(i) Construction activity shall be carried out strictly according to the provisions of CRZ Notification, 2011 and the State Coastal Zone Management Plan as drawn up by the State Government. No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.

(ii) A certificate of adequacy of available power from the agency supplying power to the project along with the load allowed for the project should be obtained.

(iii) All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Coast Guard, Civil Aviation Department shall be obtained, as applicable by project proponents from the respective competent authorities.

II. Air quality monitoring and preservation:

(i) The project proponent shall install system to carryout Ambient Air Quality monitoring for common/criterion parameters relevant to the main pollutants released (e.g. PM_{10} and $PM_{2.5}$ in reference to PM emission, and SO_2 and NOx in reference to SO_2 and NOx emissions) within and outside the project area at least at four locations, covering upwind and downwind directions.

(ii) Appropriate Air Pollution Control (APC) system shall be provided for all the dust generating points including fugitive dust from all vulnerable sources, so as to comply prescribed emission standards.

(iii) Shrouding shall be carried out in the work site enclosing the dock/proposed facility area. This will act as dust curtain as well achieving zero dust discharge from the site. These curtain or shroud will be immensely effective in restricting disturbance from wind in affecting the dry dock operations, preventing waste dispersion, improving working conditions through provision of shade for the workers.

(iv) Dust collectors shall be deployed in all areas where blasting (surface cleaning) and painting operations are to be carried out, supplemented by stacks for effective dispersion.

(v) The Vessels shall comply the emission norms prescribed from time to time.

(vi) Diesel power generating sets proposed as source of backup power should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Use of low sulphur diesel. The location of the DG sets may be decided with in consultation with State Pollution Control Board.

(vii) A detailed traffic management and traffic decongestion plan shall be drawn up to ensure that the current level of service of the roads within a 05 kms radius of the project is maintained and improved upon after the implementation of the project. This plan should be based on cumulative impact of all development and increased habitation being carried out or proposed to be carried out by the project or other agencies in this 05 Kms radius of the site in different scenarios of space and time and the traffic management plan shall be duly validated and certified by the State Urban Development department and the P.W.D./ competent authority for road augmentation and shall also have their consent to the implementation of components of the plan which involve the participation of these departments.

III. Water quality monitoring and preservation:

(i) The Project proponent shall ensure that no creeks or rivers are blocked due to any activities at the project site and free flow of water is maintained.

(ii) Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality. Silt curtains shall be used to contain the spreading of suspended sediment during dredging within the dredging area.

(iii) No ships docking at the proposed project site will discharge its on-board waste water untreated in to the estuary/ channel. All such wastewater load will be diverted to the proposed Effluent Treatment Plant of the project site.

(iv) Measures should be taken to contain, control and recover the accidental spills of fuel and cargo handle.

(v) The project proponents will draw up and implement a plan for the management of temperature differences between intake waters and discharge waters.

(vi) Spillage of fuel / engine oil and lubricants from the construction site are a source of organic pollution which impacts marine life. This shall be prevented by suitable precautions and also by providing necessary mechanisms to trap the spillage.

(vii) Total fresh water use shall not exceed the proposed requirement as provided in the project details. Prior permission from competent authority shall be obtained for use of fresh water.

(viii) Sewage Treatment Plant shall be provided to treat the wastewater generated from the project. Treated water shall be reused for horticulture, flushing, backwash, HVAC purposes and dust suppression.

(ix) A certificate from the competent authority for discharging treated effluent/ untreated effluents into the Public sewer/ disposal/drainage systems along with the final disposal point should be obtained.

(x) No diversion of the natural course of the river shall be made without prior permission from the Ministry of Water resources.

(xi) All the erosion control measures shall be taken at water front facilities. Earth protection work shall be carried out to avoid erosion of soil from the shoreline/boundary line from the land area into the marine water body.

IV. Noise monitoring and prevention:

(i) Noise level survey shall be carried as per the prescribed guidelines and report in this regard shall be submitted to Regional Officer of the Ministry as a part of six-monthly compliance report.

(ii) Noise from vehicles, power machinery and equipment on-site should not exceed the prescribed limit. Equipment should be regularly serviced. Attention should also be given to muffler maintenance and enclosure of noisy equipments.

(iii) Acoustic enclosures for DG sets, noise barriers for ground-run bays, ear plugs for operating personnel shall be implemented as mitigation measures for noise impact due to ground sources.

(iv) The ambient noise levels should conform to the standards prescribed under E(P)A Rules, 1986 viz. 75 dB(A) during day time and 70 dB(A) during night time.

V. Energy Conservation measures:

(i) Provide solar power generation on roof tops of buildings, for solar light system for all common areas, street lights, parking around project area and maintain the same regularly;

(ii) Provide LED lights in offices and project areas.

VI. Waste management:

(i) Dredged material shall be disposed safely in the designated areas.

(ii) Shoreline should not be disturbed due to dumping. Periodical study on shore line changes shall be conducted and mitigation carried out, if necessary. The details shall be submitted along with the six monthly monitoring reports.

(iii) Necessary arrangements for the treatment of the effluents and solid wastes must be made and it must be ensured that they conform to the standards laid down by the competent authorities including the Central or State Pollution Control Board and under the Environment (Protection) Act, 1986.

(iv) The solid wastes shall be managed and disposed as per the norms of the Solid Waste Management Rules, 2016.

(v) Any wastes from construction and demolition activities related thereto shall be managed so as to strictly conform to the Construction and Demolition Waste Management Rules, 2016.

(vi) A certificate from the competent authority handling municipal solid wastes should be obtained, indicating the existing civic capacities of handling and their adequacy to cater to the M.S.W. generated from project.

(vii) Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/ rules of the regulatory authority to avoid mercury contamination.

(viii) Oil spill contingency plan shall be prepared and part of DMP to tackle emergencies. The equipment and recovery of oil from a spill would be assessed. Guidelines given in MARPOL and Shipping Acts for oil spill management would be followed. Mechanism for integration of terminals oil contingency plan with the overall area contingency plan under the co-ordination of Coast should be covered.

VII. Green Belt:

(i) Green belt shall be developed in area as provided in project details with a native tree species in accordance with CPCB guidelines.

(ii) Top soil shall be separately stored and used in the development of green belt.

VIII. Marine Ecology:

(i) Dredging shall not be carried out during the fish breeding and spawning seasons.

(ii) Dredging, etc shall be carried out in the confined manner to reduce the impacts on marine environment.

(iii) The dredging schedule shall be so planned that the turbidity developed is dispersed soon enough to prevent any stress on the fish population.

(iv) While carrying out dredging, an independent monitoring shall be carried out through a Government Agency/Institute to assess the impact and necessary measures shall be taken on priority basis if any adverse impact is observed.

(v) A detailed marine biodiversity management plan shall be prepared through the NIO or any other institute of repute on marine, brackish water and fresh water ecology and biodiversity and submitted to and implemented to the satisfaction of the State Biodiversity Board and the CRZ authority. The report shall be based on a study of the impact of the project activities on the intertidal biotopes, corals and coral communities, molluscs, sea grasses, sea weeds, sub-tidal habitats, fishes, other marine and aquatic micro, macro and mega flora and fauna including benthos, plankton, turtles, birds etc. as also the productivity. The data collection and impact assessment shall be as per standards survey methods and include underwater photography.

(vi) Marine ecology shall be monitored regularly also in terms of sea weeds, sea grasses, mudflats, sand dunes, fisheries, echinoderms, shrimps, turtles, corals, coastal vegetation, mangroves and other marine biodiversity components including all micro, macro and mega floral and faunal components of marine biodiversity.

(vii) The project proponent shall ensure that water traffic does not impact the aquatic wildlife sanctuaries that fall along the stretch of the river.

IX. Public hearing and human health issues:

(i) The work space shall be maintained as per international standards for occupational health and safety with provision of fresh air respirators, blowers, and fans to prevent any accumulation and inhalation of undesirable levels of pollutants including VOCs.

(ii) Workers shall be strictly enforced to wear personal protective equipments like dust mask, ear muffs or ear plugs, whenever and wherever necessary/ required. Special visco-elastic gloves will be used by labour exposed to hazards from vibration.

(iii) In case of repair of any old vessels, excessive care shall be taken while handling Asbestos & Freon gas. Besides, fully enclosed covering should be provided for the temporary storage of asbestos materials at site before disposal to CTSDF.

(iv) Safety training shall be given to all workers specific to their work area and every worker and employee will be engaged in fire hazard awareness training and mock drills which will be conducted regularly. All standard safety and occupational hazard measures shall be

implemented and monitored by the concerned officials to prevent the occurrence of untoward incidents/ accidents.

(v) Emergency preparedness plan based on the Hazard identification and Risk Assessment (HIRA) and Disaster Management Plan shall be implemented.

(vi) Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.

(vii) Occupational health surveillance of the workers shall be done on a regular basis.

X. Environment Responsibility:

(i) The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental / forest /wildlife norms/ conditions. The company shall have defined system of reporting infringements / deviation / violation of the environmental / forest / wildlife norms / conditions and / or shareholders / stake holders. The copy of the board resolution in this regard shall be submitted to the MoEF&CC as a part of six-monthly report.

(ii) A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly report to the head of the organization.

(iii) Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report.

(iv) Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out.

XI. Miscellaneous:

(i) The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently.

(ii) The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.

(iii) The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.

(iv) The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the ministry of Environment, Forest and Climate Change at environment clearance portal.

(v) The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company.

(vi) The criteria pollutant levels namely; $PM_{2.5}$, PM_{10}, SO_2, NOx (ambient levels) or critical sectoral parameters, indicated for the project shall be monitored and displayed at a convenient location near the main gate of the company in the public domain.

(vii) The project proponent shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities, commencing the land development work and start of production operation by the project.

(viii) The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government.

(ix) The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report, commitment made during Public Hearing and also that during their presentation to the Expert Appraisal Committee.

(x) No further expansion or modifications in the project shall be carried out without prior approval of the Ministry of Environment, Forests and Climate Change (MoEF&CC).

(xi) Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986.

(xii) The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory under the provisions of the Environmental (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner.

(xiii) The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.

(xiv) The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.

(xv) The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.

(xvi) Any appeal against this EC shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

30. This issues with the approval of the Competent Authority.

(Amardeep Raju)
Scientist-E

Copy to:

1. The Principal Secretary, Department of Department of Environment, Climate Change and Forests, Government of Tamil Nadu.
2. The Member Secretary, Tamilnadu Pollution Control Board, 76, Anna Salai, Guindy Industrial Estate, Race View Colony, Guindy, Chennai, Tamil Nadu 600 032.
3. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi -32.
4. Addl. Principal Chief Conservator of Forests (C), Ministry of Env., Forest and Climate Change, Regional Office (SEZ), Ist and IInd Floor, Handloom Export Promotion Council,34, Cathedral Garden Road, Nungambakkam, Chennai - 34.
5. Monitoring Cell, MoEF&CC, Indira Paryavaran Bhavan, New Delhi.
6. Guard File/Record File
7. Notice Board.

(Amardeep Raju)
Scientist-E

Annexure - XVI

Specific Water Consumption G.O

		(NOx)	
		पारा (Hg)	0.03 mg/Nm³

* टीपीपी (इकाईयां) इस अधिसूचना के प्रकाशन की तारीख से दो वर्ष के भीतर परिसीमाओं को पूरा करेंगी।

** इसके अंतर्गत सभी टीपीपी (इकाईयां) हैं, जिन्हें पर्यावरणीय निकासी प्रदान की गई है और संनिर्माण के अधीन है।

[फा. सं. क्यू-15017/40/2007-सीपीडब्ल्यू]

डा. राशिद हसन, सलाहकार

टिप्पण :- मूल नियम भारत के राजपत्र, असाधारण, भाग II, खंड 3, उपखंड (ii) में सं. का.आ. 844(अ) 19 नवंबर, 1986 द्वारा प्रकाशित किए गए थे और उनका पश्चातवर्ती का.आ. 433(अ) तारीख 18 अप्रैल, 1987 ; सा.का.नि 176(अ) तारीख 2 अप्रैल, 1996; सा.का.नि. 97 (अ), तारीख 18 फरवरी, 2009 ; सा.का.नि 149(अ) तारीख 4 मार्च, 2009 ; सा.का.नि. 543(अ) तारीख 22 जुलाई, 2009 ; सा.का.नि. 739(अ) तारीख 9 सितम्बर, 2010 ; सा.का.नि. 809(अ) तारीख 4 अक्टूबर, 2010, सा.का.नि. 215(अ) तारीख 15 मार्च, 2011 ; सा.का.नि. 221(अ) तारीख 18 मार्च, 2011 ; सा.का.नि. 354(अ) तारीख 2 मई, 2011 ; सा.का.नि. 424(अ) तारीख 1 जून, 2011 ; सा.का.नि. 446(अ) तारीख 13 जून, 2011 ; सा.का.नि. 152(अ) तारीख 16 मार्च, 2012 ; सा.का.नि. 266(अ) तारीख 30 मार्च, 2012 ; सा.का.नि. 277(अ) तारीख 31 मार्च, 2012; सा.का.नि. 820(अ) तारीख 9 नवम्बर, 2012 ; सा.का.नि. 176(अ) तारीख 18 मार्च, 2013 ; सा.का.नि. 535(अ) तारीख 7 अगस्त, 2013 ; सा.का.नि. 771(अ) तारीख 11 दिसम्बर, 2013 ; सा.का.नि. 2(अ) तारीख 2 जनवरी, 2014 ; सा.का.नि. 229(अ) तारीख 28 मार्च, 2014 ; सा.का.नि. 232(अ) तारीख 31 मार्च, 2014 ; सा.का.नि. 325(अ) तारीख 7 मई, 2014, सा.का.नि. 612(अ) तारीख 25 अगस्त, 2014 और अन्तिम संशोधन सा.का.नि. 789(अ) तारीख 11 नवम्बर, 2014 किया गया था।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 7th December, 2015

S.O. 3305(E).— In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:–

1. (1) These rules may be called the Environment (Protection) Amendment Rules, 2015.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986, in Schedule – I, -

(a) after serial number 5 and entries relating thereto, the following serial number and entries shall be inserted, namely:–

Sr. No.	Industry	Parameter	Standards
1	2	3	4
"5A.	Thermal Power Plant (Water consumption limit)	Water consumption	1. All plants with Once Through Cooling (OTC) shall install Cooling Tower (CT) and achieve specific water consumption upto maximum of 3.5m³/MWh within a period

			of two years from the date of publication of this notification. II. All existing CT-based plants reduce specific water consumption upto maximum of 3.5m^3/MWh within a period of two years from the date of publication of this notification. III. New plants to be installed after 1st January, 2017 shall have to meet specific water consumption upto maximum of 2.5 m^3/MWh and achieve zero waste water discharged";

(b) for serial number 25, and the entries related thereto, the following serial number and entries shall be substituted, namely:-

Sr. No.	Industry	Parameter	Standards
1	2	3	4
"25.	Thermal Power Plant	**TPPs (units) installed before 31st December, 2003***	
		Particulate Matter	100 mg/Nm^3
		Sulphur Dioxide (SO_2)	600 mg/Nm^3 (Units Smaller than 500MW capacity units) 200 mg/Nm^3 (for units having capacity of 500MW and above)
		Oxides of Nitrogen (NOx)	600 mg/Nm^3
		Mercury (Hg)	0.03 mg/Nm^3(for units having capacity of 500MW and above)
		TPPs (units) installed after 1st January,2003, upto 31st December, 2016*	
		Particulate Matter	50 mg/Nm^3
		Sulphur Dioxide (SO_2)	600 mg/Nm^3 (Units Smaller than 500MW capacity units) 200 mg/Nm^3 (for units having capacity of 500MW and above)
		Oxides of Nitrogen (NOx)	300 mg/Nm^3
		Mercury (Hg)	0.03 mg/Nm^3
		TPPs (units) to be installed from 1st January, 2017**	
		Particulate Matter	30 mg/Nm^3
		Sulphur Dioxide (SO_2)	100 mg/Nm^3
		Oxides of Nitrogen (NOx)	100 mg/Nm^3
		Mercury (Hg)	0.03 mg/Nm^3

*TPPs (units) shall meet the limits within two years from date of publication of this notification.

**Includes all the TPPs (units) which have been accorded environmental clearance and are under construction".

[F. No. Q-15017/40/2007-CPW]

Dr. RASHID HASAN, Advisor

Note: - The principal rules were published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i) *vide* number S.O. 844(E), dated the 19th November, 1986 and subsequently amended *vide* the following notifications:—
S.O. 433(E), dated 18th April 1987; G.S.R. 176(E) dated 2nd April, 1996; G.S.R. 97(E), dated the 18th February, 2009; G.S.R. 149(E), dated the 4th March , 2009; G.S.R. 543(E), dated 22nd July, 2009; G.S.R. 739(E), dated the 9th September, 2010; G.S.R. 809(E), dated, the 4th October, 2010, G.S.R. 215(E), dated the 15th March, 2011; G.S.R. 221(E), dated the 18th March, 2011; G.S.R. 354(E), dated the 2nd May, 2011; G.S.R. 424(E), dated the 1st June, 2011; G.S.R. 446(E), dated the 13th June, 2011; G.S.R. 152(E), dated the 16th March, 2012; G.S.R. 266(E), dated the 30th March, 2012; and G.S.R. 277(E), dated the 31st March, 2012; and G.S.R. 820(E), dated the 9th November, 2012; G.S.R. 176(E), dated the 18th March, 2013; G.S.R. 535(E), dated the 7th August, 2013; G.S.R. 771(E), dated the 11th December, 2013; G.S.R. 2(E), dated the 2nd January, 2014; G.S.R. 229(E), dated the 28th March, 2014; G.S.R. 232(E), dated the 31st March, 2014; G.S.R. 325(E), dated the 07th May, 2014, G.S.R. 612,(E), dated the 25th August, 2014 and lastly amended vide notification G.S.R. 789(E), dated 11th November, 2014.

Printed by the Manager, Government of India Press, Ring Road, Mayapuri, New Delhi-110064
and Published by the Controller of Publications, Delhi-110054.

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

CORRIGENDUM

New Delhi, the 7th March, 2016

S.O. 682(E).—In the notification of the Government of India in the Ministry of Environment, Forest and Climate Change vide number S.O. 3305(E), dated the 7th December, 2015, published in the Gazette of India, Part II, Section 3, Sub-section (ii), in page 4, in the Table, against serial number 25, for "1st January, 2005" substitute "1st January, 2004".

[F.No. Q-15017/40/2007-CPW]

Dr. RASHID HASAN, Advisor

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and Published by the Controller of Publications, Delhi-110054.

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 28th June, 2018

G.S.R. 593 (E).—Whereas, a draft notification, for Thermal Power Plants was published in the Gazette of India, Extraordinary, vide notification of the Government of India in the erstwhile Ministry of Environment, Forest and Climate Change number G.S.R. 3337(E), dated the 16th October, 2017, inviting objections and suggestions from all persons likely to be affected thereby within a period of sixty days from the dated on which copies of the Gazette containing the said notification were made available to the public;

And Whereas, copies of the Gazette were made available to the public on the 16th October, 2017;

And Whereas, all objections and suggestions received from all persons and stakeholders in response to the draft notification have been duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986) read with sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:-

1. (1) These rules may be called the Environment (Protection) Amendment Rules, 2018.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986, in Schedule-I,-

(a) against serial number 5A, in column 4, for item III, the following item shall be substituted, namely:-

"III. Specific water consumption shall not exceed maximum of 3.0 m^3/MWh for new plants installed after the 1st January, 2017 and these plants shall also achieve zero waste water discharge.";

(b) after serial number 5A and the entries relating thereto, the following serial number and entries shall be inserted, namely:-

Sl. No.	Industry	Parameter	Standards
1	2	3	4
"5B.	Thermal Power Plant (water consumption limit) using sea water	Water consumption	Items I to III in column 4 in serial number 5A above shall not be applicable to the Thermal Power Plants using sea water";

(c) in serial number 25, the following Note shall be inserted, namely:—

"**Note:** All monitored values for SO_2, NOx and Particulate Matter shall be corrected to 6% Oxygen, on dry basis";

(d) after serial number 33 and the entries relating thereto, the following serial number and entries shall be inserted, namely:—

Sl. No.	Industry	Parameter	Standards
1	2	3	4

"33A.	Thermal Power Plants with wet Flue Gas Desulphurization (FGD)	Stack Height/Limit in Meters	Power generation capacity: 100 MW and above $H=6.902(QX0.277)^{0.555}$ or 100 m minimum Less than 100 MW $H=6.902(QX0.277)^{0.555}$ or 30 m whichever is more"; Q = Emission rate of SO_2 in kg/hr* H = Physical stack height in meter *total of the all Unit's connected to stack **Note:** These standards shall apply to coal / lignite based Thermal Power Plants.".

[F. No. Q-15017/40/2007-CPW]
DR. A. SENTHIL VEL, Scientist 'G'

Note: The principal rules were published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i) *vide* number S.O. 844 (E), dated the 19th November, 1986 and last amended *vide* notification number G.S.R. 263(E), dated the 22nd March, 2018.

RAKESH SUKUL

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