Terms of Reference

J-13012/01/2012 - IA. II (T)
Government of India
Ministry of Environment & Forests

Paryavaran Bhavan, C.G.O. Complex
Lodi Road, New Delhi -110003.
Dated: May 28, 2012.

To

M/s TANGEDCO
3rd Floor Eastern Wing,
NPKRR Maaligai
144, Anna Salai,
Chennai – 2.

Sub: 2x800 MW Super Critical Coal Based Thermal Power Plant at villages Uppur, Valamavoor and Thiruppalaikudi, in Thiruvadanai Taluk, in Ramanathapuram Distt., in Tamil Nadu -reg. TOR

Sir,

The undersigned is directed to refer to your letter dated 11.11.2011 on the above mentioned subject.

2. It is to inform that the proposal was considered by the Expert Appraisal Committee during its 46th Meeting held during April 09-10, 2012, for determination of the Terms of Reference (TOR) for undertaking detailed EIA study in accordance with the provisions of the EIA notification dated September 14, 2006.

3. Based on the information provided by you with regard to the above mentioned project proposal, the Committee has prescribed the following Terms of Reference (TORs) for preparation of the Environmental Impact Assessment (EIA) Report and Environment Management Plan (EMP), in respect of your above mentioned project.

i) Vision document specifying prospective long term plan of the site, if any, shall be formulated and submitted.

ii) Status of compliance to the conditions stipulated for environmental and CRZ clearances of the previous phase(s), as applicable, shall be submitted.

iii) CRZ clearance shall be obtained and submitted along with EIA/EMP Report;

iv) Executive summary of the project indicating relevant details along with recent photographs of the approved site shall be provided. Response to the issues raised during Public Hearing and to 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.

v) Diversion of community land to be strictly in accordance with the rules and approval of Panchayat/Gram Sabha shall be obtained for acquisition of Panchayat/Gam Sabha/Community land (as applicable).

vi) Once through system shall not be undertaken for cooling and accordingly details of closed cycle cooling system shall be furnished;

vii) Harnessing solar power within the premises of the plant particularly at available roof tops and other available areas shall be formulated and status of implementation shall be submitted to the Minist

viii) The coordinates of the approved site includin submitted along with topo sheet (1:50,000 scal plant boundary and NRS satellite map of the are plant site and ash pond with respect to HFL of specified, if the site is located in proximity to the

ix) Layout plan indicating break-up of plant area

x) 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 and revised layout (as modified by the EAC) shall be provided.

xi) Present land use as per the revenue records (free of all encumbrances of the proposed site, shall be furnished. Information on land to be acquired, if any, for coal transportation system as well as for laying of pipeline including ROW shall be specifically stated.

xii) The issues relating to land acquisition and R&R scheme with a time bound Action Plan should be formulated and clearly spelt out in the EIA report.

xiii) Satellite imagery or authenticated topo sheet indicating drainage, cropping pattern, water bodies (wetland, river system, stream, nallahs, ponds etc.), location of nearest villages, creeks, mangroves, rivers, reservoirs etc. in the study area shall be provided.

xiv) 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 Office of the Chief Wildlife Warden of the area concerned.

xv) Topography of the study area supported by toposheet on 1:50,000 scale of Survey of India, alongwith 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 fill material required, its source, transportation etc. shall be submitted.

xvi) 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 to be acquired is developed alternatively and details plan shall be submitted.

xvii) A mineralogical map of the proposed site (including soil type) and information (if available) that the site is not located on economically feasible mineable mineral deposit shall be submitted.

xviii) Details of 100% fly ash utilization plan as per 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.

xix) Scheme for regeneration and preservation of village ponds in the study area shall be formulated.

xx) Water requirement, calculated as per norms stipulated by CEA from time to time, shall be submitted along with water balance diagram. Details of water balance calculated shall take into account reuse and re-circulation of effluents which shall be explicitly specified.

xxi) Water body/nallah (if any) passing across the site should not be disturbed as far as possible. In case any nallah / drain has to be diverted, it shall be ensured that the diversion does not disturb the natural drainage pattern of the area. Details of diversion required shall be furnished which shall be duly approved by the concerned department.

xxii) 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.

xxiii) Hydro-geological study of the area shall be carried out through an institute/ organisation 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.

xxiv) 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/creek/ sea etc shall be carried out and submitted alongwith 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.

xxv) 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. Commit requisite quantity of water from the Competent Au with letter / document stating firm allocation of wat

xx) Detailed plan for carrying out rainwater harvesting the plant shall be furnished.

xx i) Feasibility of zero discharge concept shall be criti submitted.

xx ii) Optimization of COC along with other water conser shall be specified.

xx) Plan for recirculation of ash pond water and submitted.

xx Detailed plan for conducting monitoring of water maintenance of records shall be formulated. identification of monitoring points (between the plan of flow of surface / ground water) shall be submi parameter to be monitored also include heavy metals

xxx Socio-economic study of the study area comprising shall be carried out by a reputed institute / agenc assessment of the impact on livelihood of local comm

xxx Action Plan for identification of local employable relevant to the project for eventual employment in the project itself shall be formulated and numbers specified during construction & operation phases of the Project.

xxxiii) 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.

xxxiv) A detailed CSR plan along with activities wise break up of financial commitment shall be prepared. CSR component shall be identified considering need based assessment study. Sustainable income generating measures which can help in upliftment of poor section of society, which is consistent with the traditional skills of the people shall be identified. Separate budget for community development activities and income generating programmes shall be specified.

xxxv) While formulating CSR 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 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). CSR details done in the past should be clearly spelt out in case of expansion projects.

xxxvi) 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.

xxxvii) Assessment of occupational health as endemic diseases of environmental origin shall be carried out and Action Plan to mitigate the same shall be prepared.

xxxviii) 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 years shall be conducted with an excellent follow up plan of action wherever required.

xxxix) One complete season site specific meteorological and AAQ data (except monsoon season) as per MoEF Notification dated 16.11.2009 shall be collected and the dates of monitoring recorded. The parameters to be covered for AAQ shall include SPM, RSPM (PM10, PM2.5), SO_2, NO_x, Hg and O_3 (ground level). The location of the monitoring stations should be so decided so as to take into consideration the pre-dominant downwind direction, population zone, villages in the vicinity and sensitive receptors including reserved forests. 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.

xl) A list of industries existing and proposed in the study area shall be furnished.

xli) Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be well assessed. 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 roses should also be shown on the location map as well.

xlii) Radio activity and heavy metal contents of coal to be sourced shall be examined and submitted along with laboratory reports.

xliii) Fuel analysis shall be provided. Details of auxillary fuel, if any, including its quantity, quality, storage etc should also be furnished.

xliv) Quantity of fuel required, its source and characteristics and documentary evidence to substantiate confirmed fuel linkage shall be furnished.

xlv) 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.

xlvi) For proposals based on imported coal, inland transportation and port handling and rolling stocks /rail movement bottle necks shall be critically examined and details furnished.

xlvii) 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.

xlviii) 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.

xlix) A Disaster Management Plan (DMP) along with risk assessment study including fire and explosion issues due to storage and use of fuel should be carried out. 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.

l) The DMP so formulated shall include measures against likely Tsunami/Cyclones/Storm Surges/Earthquakes etc, as applicable. It shall be ensured that DMP consists of both on-site and off-site plan complete with details of containing likely disaster and shall specifically mention personnel identified for the task. Smaller version of the plan shall be prepared both in English and local languages.

li) Detailed plan for raising green belt of native species of appropriate width (50 to 100 m) and consisting of at least 3 tiers around plant boundary (except in areas not possible) with tree density of 2000 to 2500 trees per ha with a good survival rate of about 80% shall be submitted. Photographic evidence must be created and submitted periodically including NRSA reports.

lii) Over and above the green belt, as carbon sink, additional plantation shall be carried out in identified 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.

liii) Corporate Environment Policy

i. 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.

ii. 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.

iii. 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.

iv. Does the company has system of reporting of non compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism should be detailed in the EIA report.

All the above details should be adequately brought out in the EIA report and in the presentation to the Committee.

liv) Details of litigation pending or otherwise with respect to project in any court, tribunal etc. shall invariably be furnished.

Further, the following shall be strictly followed (as applicable):

a) Low lying areas fulfilling the definition wetland as per Ramsar Convention shall be identified and clearly demarcated w.r.t the proposed site.

b) 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 agency shall be submitted.

c) 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 bunds should be strengthened and desilted.

d) Additional soil for leveling of the sites should be generated as far as possible within the sites, in a way that natural drainage system of the area is protected and improved

e) Marshy areas which hold large quantities of flood water shall be identified and shall not be disturbed.

f) No waste should be discharged into Creek, Canal systems, Backwaters, Marshy areas and seas without appropriate treatment. The outfall should be first treated in a guard pond (wherever feasible) and then 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.

g) 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.

h) 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.

i) Impact on fisheries at various socio economic level shall be assessed.

j) An endowment of **Fishermen Welfare Fund** should be created out of CSR grants not only to enhance their quality of life 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 fishe
tropical cyclones and storms etc.
Tsunami Emergency Management Plan shall be epared and plan submitted prior to the commencement of construction work.
There should not be any contamination of soil, g nd and surface waters (canals & village pond) with sea water in and around project sites. In other words necessary preventive measures for spillage from pelines, such as liming of guard pond used for the treatment of outfall before di arging into the sea and surface RCC channels along the pipelines of outfall and intake should be adopted. This is

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resented in the report especially hich
ed and the source should invaria
ments provided are in a languag Engl
ld be provided.
aire for environmental appraisal jects
by the Ministry shall also be filled
ts involved in the preparatic rt af
th Quality Council of India (QCI) n Boe
d Training (NABET) would need in th
IA/ EMP reports prepared by th by oth
aboratories including their statu s rega
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s website http://www.moef.nic.in

In addition to the above, information on the following may also be incorporated in the EIA report.

1. Is the project intended to have CDM-intent?

   (i) If not, then why?
   (ii) If yes, then

   a. Has PIN (Project Idea Note) (or PCN (Project Concept Note)) submitted to the ?NCA? (National CDM Authority) in the MoEF?
   b. If not, then by when is that expected?
   c. Has PDD (Project Design Document) been prepared?
   d. What is the Carbon intensity? from your electricity generation projected (i.e. CO_2 Tons/MWH or Kg/KWH)
   e. Amount of CO_2 in Tons/year expected to be reduced from the baseline data available on the CEA?s web site (www.cea.nic.in)

2. Notwithstanding 1(i) above, data on (d) & (e) above shall be worked

ntal clearance shall be applie y after firm

e Draft EIA (as per the generic structure prescribed in Appendix-III of the EIA Notification, 2006) covering the above mentioned issues, the same shall be submitted to the SPCB for conducting the public hearing as per procedure of EIA notification 2006. The issues emerged during public hearing shall be further incorporated in the Draft EIA/EMP report. The final EIA/EMP report along with public hearing repo

Compliance to Terms of Reference

46th EAC (Thermal) meeting held on 9th April 2012 for determination of Terms of Reference for 2x800 MW Super Critical Coal Based Thermal Power Plant at villages Uppur, Valamavoor and Thiruppalaikudi, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu by M/s TANGEDCO, Tamil Nadu and issued Terms of Reference (TOR).TOR No.: J-13012/01/2012 - IA. II (T) Dated: May 28, 2012

Compliance of TOR

S.No.	Terms of Reference	Compliance
i)	Vision document specifying prospective long term plan of the site, if any, shall be formulated andsubmitted.	In view of acute shortage of power in the state of Tamil Nadu and in order to bridge the demand availability gap of power, Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO) is exploring the possibility of establishing thermal power projects. The Government of Tamil Nadu in the budget speech for the year 2011-12 had announced that a 2x800 MW Uppur Thermal Power Project will be established in Ramanathapuram district. Rapid industrialization and increase in commercial and domestic use of electricity are the main reasons for increase in power consumption. In addition, the government policies like rural electrification, electricity to all by 2012, development of irrigation, sector, are also contributing in increase the future power demand. To meet above requirements, the additions in the power generation capacity will have to match with the future power demands. The 17th Electric power survey report by CEA provides a quantitative forecast of the future demands and planned/required capacity additions. Based on the CEA report, installation of power projects are already in progress. As Tamil Nadu state is the most preferred state for industrialization, 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 will be on the rise. The location being close to sea, cooling water is perennially available in the site for the power plant. Imported coal is being considered as the main fuel for the proposed power plant and supplied by MMTC Ltd. Further, the grid is large enough to accommodate this proposed 2x800 MW coal fired power plant.
ii)	Status of compliance to the conditions stipulated for environmental and CRZ clearances of the previous phase(s), as applicable, shall be submitted.	The proposed 2x800 MW thermal power plant is a green field project. Hence the environmental and CRZ clearances of the previous phase are not applicable to the proposed project.
iii)	CRZ clearance shall be obtained and	TANGEDCO appointed Institute of Remote

S.No.	Terms of Reference	Compliance
	submitted along with EIA/EMP Report.	Sensing, Anna University, Chennai for preparation of CRZ studies & maps as per CRZ Notification-2011. Copies of maps are enclosed in **Annexure–IV.** The application for CRZ clearance will be submitted to Coastal Zone Management Authority for obtaining recommendations of TNSCZMA.
iv)	Executive summary of the project indicating relevant details along with recent photographs of the approved site shall be provided. Response to the issues raised during Public Hearing and to 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.	Executive summary of the project indicating relevant details along with recent photographs of the approved site are provided in draft EIA/EMP report. Public Hearing proceedings and the written representations along with a time bound action plan and budgetary allocations addressing against each action will be incorporated in final EIA/EMP report after public hearing.
v)	Diversion of community land to be strictly in accordance with the rules and approval of Panchayat/Gram Sabha shall be obtained for acquisition of Panchayat/Gam Sabha / Community land (as applicable).	Community land is not proposed to be acquired for the power project.
vi)	Once through system shall not be undertaken for cooling and accordingly details of closed cycle cooling system shall be furnished.	Closed cycle cooling system is proposed for 2x800 MW thermal power plant and the details are furnished in **Chapter–2** in EIA/EMP report.
vii)	Harnessing solar power within the premises of the plant particularly at available roof tops and other available areas shall be formulated and status of implementation shall be submitted to the Ministry.	The project management is planning to harness solar power at roof tops, security, and at administration building. The status of implementation will be submitted to the ministry after obtaining statutory clearances.
viii)	The coordinates of the approved site including location of ash pond shall be submitted along with topo sheet (1:50,000 scale) and confirmed GPS readings of plant boundary and NRS satellite map of the area, shall be submitted. Elevation of plant site and ash pond with respect to HFL of water body/nallah/river shall be specified, if the site is located in proximity to them.	The geographical coordinates of all four corners of approved plant site along with ash pond are shown on topo sheet of 1:50,000 scale map. The confirmed GPS readings of plant boundary are; **1. 9°33'12.62"N 78°53'50.36"E** **2. 9°36'02.58"N 78°55'17.84"E** **3. 9°35'12.88"N 78°53'50.36"E** Ash Pond coordinates area; **9°35'58.04"N 78°55'12.56"E** NRSA satellite imagery IRS R2 L4 FX is provided in **Figure–3.5.** Elevation of plant site and ash pond with respect to HTL of sea water are specified and shown in plant layout plan **Figure–2.1** in

S.No.	Terms of Reference	Compliance
ix)	Layout plan indicating break-up of plant area, ash pond, area for green belt, infrastructure, roads etc. shall be rovided.	The plant layout plan indicating break-up of plant area, ash pond, area for green belt, infrastructure, roads are shown in **Figure–2.1** in **Chapter–2** of EIA/EMP report.
x)	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 and revised layout (as modified by the EAC) shall be provided.	Land requirement for the project has been optimized as per CEA guidelines. Item wise break up of land requirement is provided. S. No. / Land Use / Area in Acres 1. Plant Area 50 2. Roads & Drains 30 3. Railway siding 112 4. Coal Handling system (Coal stack yard) 80 5. Pipe corridors 25 6. Water System (cooling tower) 63 7. Switch yard 60 8. Facilities (Administrative Building, canteen, service building) 35 9. Ash Disposal Area 138 10. Green Belt 275 11. Infrastructure Facilities (sea water intake pump house, intake & outfall pipe corridors) 44 Total 912 The revised layout plan is shown in **Figure–2.1** in **Chapter–2** of EIA/EMP report.
xi)	Present land use as per the revenue records (free of all encumbrances of the proposed site, shall be furnished. Information on land to be acquired) if any, for coal transportation system as well as for laying of pipeline including ROW shall be specifically stated.	Land acquisition details are provided in **Annexure–V.**
xii)	The issues relating to land acquisition and R&R scheme with a time bound Action Plan should be formulated and clearly spelt out in the EIA report.	Land acquisition details are provided in **Annexure–V.**
xiii)	Satellite imagery or authenticated topo sheet indicating drainage, cropping pattern, water bodies (wetland, river system, stream, nallahs, ponds etc.), location of nearest villages, creeks, mangroves, rivers, reservoirs etc. in	Satellite imagery IRS R2 L4 FX indicating drainage & cropping pattern, water bodies, location of nearest villages, reservoirs in the 10 km study area are shown in **Figure–3.5** in **Chapter–3** of EIA/EMP report.

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	the study area shall be provided.	
xiv)	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 Office of the Chief Wildlife Warden of the area concerned.	There are no National Parks, Sanctuaries, Elephant/Tiger Reserves, migratory routes/wildlife corridors within 10 km of the project site.
xv)	Topography of the study area supported by topo sheet 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 fill material required; its source, transportation etc. shall be submitted.	Topography of the study area supported by topo sheet on 1:50,000 scale map is shown in **Figure–1.2** in **Chapter–1**& 1:25,000 scale map is shown in **Figure–2.1** in **Chapter–2** of EIA/EMP report. The safe grade elevation of the project site will be maintained at 5.23 m above MSL.
xvi)	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 to be acquired is developed alternatively and details plan shall be submitted.	The land use pattern of study area based on satellite imagery IRS R2 L4 FX is shown in **Figure–3.6** in **Chapter–3** of EIA/EMP report. Action plan for land management will be formulated and the details are provided in **Chapter–8** of EIA/EMP report. No grazing land is acquired for the proposed project.
xvii)	A mineralogical map of the proposed site (including soil type) and information (if available) that the site is not located on economically feasible mineable mineral deposit shall be submitted.	A mineralogical map of the proposed site is shown in **Figure–2.3** in **Chapter–2** of EIA/EMP report.
xviii)	Details of 100% fly ash utilization plan as per 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.	Details of 100% fly ash utilization plan as per **latest fly ash utilization Notification of GOI November 3, 2009**, along with mode of disposal of bottom ash is provided in **Chapter–8** of EIA/EMP report.
xix)	Scheme for regeneration and preservation of village ponds in the study area shall be formulated.	Schemes for regeneration and preservation of village ponds in the study area are provided in **Chapter–8** of EIA/EMP report. Hydrogeological report by Ann University is enclosed in **Annexure–VI**.
xx)	Water requirement, calculated as per norms stipulated by CEA from time to	Water requirement as per CEA norms is provided in **Table–2.1**in **Chapter–2** of

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	time, shall be submitted along with water balance diagram. Details of water balance calculated shall take into account reuse and re-circulation of effluents which shall be explicitly specified.	EIA/EMP report. The water balance diagram including reuse and re-circulation of effluents is shown in **Figure–8.1** in **Chapter–8** of EIA/EMP report.
xxi)	Water body/nallah (if any) passing across the site should not be disturbed as far as possible. In case any nallah / drain has to be diverted, it shall be ensured that the diversion does not disturb the natural drainage pattern of the area. Details of diversion required shall be furnished which shall be duly approved by the concerned department.	The water bodies passing across the proposed site will not be disturbed its natural drainage pattern. The details are furnished in **Chapter–4** of EIA/EMP report. The channel of Naganendhal big tank is passing through the proposed plant area. Based on Hydrogeological study report done by Anna University, it is proposed to desilt and deepen the nearby tanks so that the water received from the water shed is stored in the tanks. Further it is proposed to connect both Naganendhal big tank and valamvur tank so that the excess water can be diverted and connected to the Peyar river in the southern side of the plant boundary.
xxii)	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.	The proposed project site is 500 m away from HTL of Palk Bay.
xxiii)	Hydro-geological study of the area shall be carried out through an institute/ organisation 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.	Hydrogeological study report is enclosed in **Annexure–VI.**
xxiv)	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/creek/ 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.	Marine study done by Department of Ocean Engineering, IIT Madras, Chennai Tamil Nadu is enclosed in **Annexure–VII.**
xxv)	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	Sea water is proposed for entire water requirement of 2x800 MW power plant and sourced from Palk Bay through pipeline. The intake and outfall points are shown in plant layout in **Figure–2.1** in **Chapter–2** of EIA/EMP report. The intake and outfall studies were done by Department of Ocean Engineering,

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	of the proposed project. Commitment regarding availability of requisite quantity of water from the Competent Authority shall be provided along with letter / document stating firm allocation of water.	IIT Madras, Chennai Tamil Nadu and the report is enclosed in **Annexure–VII.**
xxvi)	Detailed plan for carrying out rainwater harvesting and its proposed utilisation in the plant shall be furnished.	Roof tops as well as surface rain water harvesting will be implemented in the proposed plant site. The stored rainwater will be used for green belt development and dust suppression within the plant premises.
xxvii)	Feasibility of zero discharge concept shall be critically examined and its details submitted.	Brine from the desalination plant and cooling tower blow down will be discharged into the sea after proper dilution. However Zero discharge concept will be implemented for the proposed project except The details are provided in **Chapter–8** of EIA/EMP report.
xxviii)	Optimization of COC along with other water conservation measures in the project shall be specified.	COC of 1.3 will be optimized so as to conserve water in the plant. Other water conservation measures are Rain water harvesting, Reuse of treated wastewater, recirculation of ash pond water will be implemented.
xxix)	Plan for recirculation of ash pond water and its implementation shall be submitted.	Recirculation of ash pond water and its implementation is provided in **Chapter–8** of EIA/EMP report.
xxx)	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.	Detailed plan for conducting monitoring of water quality is provided in **Chapter–5** of EIA/EMP report. Maintenance of records will be implemented after commissioning of the project. Identification of surface & ground water points based on drainage pattern from the plant site and water quality data are provided in **Chapter–3** of EIA/EMP report.
xxxi)	Socio-economic study of the study area comprising of 10 km from the plant site shall be carried out by a reputed institute / agency which shall consist of detail assessment of the impact on livelihood of local communities.	Detailed Socio-economic & Community Needs Assessment study was conducted by Madras School of Social Work, Chennai, which consists of detail assessment of impact on livelihood of local communities in 10 km study area is provided in **Annexure–VIII**.
xxxii)	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.	Action Plan for identification of local employable youth for training in skills, relevant to the project, for eventual employment in the project is provided in **Chapter–8** of EIA/EMP report. The manpower requirement of 103 during construction and 324 for operation & maintenance is proposed for the project.
xxxiii)	If the area has tribal population it shall	Detailed Socio-economic & Community Needs

S.No.	Terms of Reference	Compliance
	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.	Assessment study was conducted by Madras School of Social Work, Chennai, which consists of detail assessment of impact on livelihood of local communities in 10 km study area is provided in **Annexure–VIII**.
xxxiv)	A detailed CSR plan along with activities wise break up of financial commitment shall be prepared. CSR component shall be identified considering need based assessment study. Sustainable income generating measures which can help in upliftment of poor section of society, which is consistent with the traditional skills of the people shall be identified. Separate budget for community development activities and income generating programmes shall be specified.	Detailed Socio-economic & Community Needs Assessment study was conducted by Madras School of Social Work, Chennai, which consists of detail assessment of impact on livelihood of local communities in 10 km study area is provided in **Annexure–VIII**.
xxxv)	While formulating CSR 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 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). CSR details done in the past should be clearly spelt out in case of expansion projects.	Detailed Socio-economic & Community Needs Assessment study was conducted by Madras School of Social Work, Chennai, which consists of detail assessment of impact on livelihood of local communities in 10 km study area is provided in **Annexure–VIII**.
xxxvi)	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.	Detailed Socio-economic study was conducted by Madras School of Social Work, Chennai, which consists of detail assessment of impact on livelihood of local communities in 10 km study area is provided in **Annexure–VIII**.
xxxvii)	Assessment of occupational health as endemic diseases of, environmental origin shall be carried out and Action Plan to mitigate the same shall be prepared.	Assessment of occupational health as endemic diseases of environmental origin will be carried out after commissioning of the plant. Action plan to mitigate the same is provided in **Chapter–8**of EIA/EMP report.
xxxviii)	Occupational health and safety	The detailed occupational health & safety

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	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 equipment etc. shall be provided. Review of impact of various health measures undertaken at intervals of two years shall be conducted with an excellent follow up plan of action wherever required.	measures are discussed in **Chapter–8** of EIA/EMP report.
xxxix)	One complete season site specific meteorological and AAQ data (except monsoon season) as per MoEF Notification dated 16.11.2009 shall be collected and the dates of monitoring recorded. The parameters to be covered for AAQ shall include SPM, RSPM (PM_{10}, $PM_{2.5}$), SO_2, NO_x, Hg and O_3 (ground level). The location of the monitoring stations should be so decided so as to take into consideration the pre-dominant downwind direction, population zone, villages in the vicinity and sensitive receptors including reserved forests. 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.	Site specific meteorological & Air quality data of July, August & September 2012 was collected. The monitoring has been done as per MoEF Notification dated 16.11.2009. The dates of monitoring were recorded and provided in **Annexure–II**. The parameters SPM, PM_{10}&$PM_{2.5}$, SO_2, NO_x, Hg, and O_3 (ground level) are covered in AAQ. The location of the monitoring stations was decided based on the pre-dominant downwind direction, population zone, villages in the vicinity and sensitive receptors. The monitoring station Tiruppalaikudi considered as upwind direction (North) and Uppur as pre-dominant downwind direction (South) based on wind pattern during the study period.
xl)	A list of industries existing and proposed in the study area shall be furnished.	There are no existing/proposed industries in 10 km radius study area.
xli)	Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be well assessed. 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	There are no existing/proposed industries in 10 km radius study area. AERMOD View model is used for GLCs predictions. The isopleths of predicted GLCs are shown in **Figure–4.1 to 4.6** in **Chapter–4** of EIA/EMP report. Input data for modeling is provided in **Annexure–4** of EIA/EMP report. The air quality contours are plotted on the topographical map of study area and shown in

S.No.	Terms of Reference	Compliance
	nearby, sensitive receptors, if any. The wind roses should also be shown on the location map as well.	**Figures–3.1a to 3.1e** in **Chapter–3** of EIA/EMP report.
xlii)	Radio activity and heavy metal contents of coal to be sourced shall be examined and submitted along with laboratory reports.	Proximate and ultimate analysis of coal is provided in **Chapter–2** of EIA/EMP report.
xliii)	Fuel analysis shall be provided. Details of auxiliary fuel, if any, including its quantity, quality, storage etc should also be furnished.	Fuel analysis of coal Proximate and ultimate analysis along with auxiliary fuel LDO & HFO provided in **Chapter–2** of EIA/EMP report.
xliv)	Quantity of fuel required, its source and characteristics and documentary evidence to substantiate confirmed fuel linkage shall be furnished.	Quantity of coal required, its source and characteristics are provided in **Chapter–2** of EIA/EMP report.
xlv)	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.	Feasibility study for transportation of coal done by RITES is enclosed in **Annexure–IX.**
xlvi)	For proposals based on imported coal, inland transportation and port handling and rolling stocks /rail movement bottle necks shall be critically examined and details furnished.	Feasibility study for transportation of coal done by RITES is enclosed in **Annexure–IX.**
xlvii)	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.	Infrastructure facilities such as sanitation, fuel, restrooms, medical facilities, safety will be provided to labour force during construction phase as well as to the casual workers including truck drivers during operation phase and the details are provided in **Chapter–4** of EIA/EMP report.
xlviii)	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.	The anticipated environmental impacts & mitigation measures due to the proposed project are provided in **Chapter–4** and item wise cost of its implementation in a time bound manner are provided **Table–5.2** in **Chapter–5** of EIA/EMP report.
xlix)	A Disaster Management Plan (DMP) along with risk assessment study including fire and explosion issues due to storage and use of fuel should be carried out. It should take into account the maximum inventory of storage at site at any point of time. The risk	Disaster Management Plan (DMP) along with risk assessment study including fire and explosion issues due to storage and use of fuel were carried out. The maximum inventory of storage at site at any point of time was considered for the study. The risk contours were plotted on plant layout map shown in

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	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.	**Figure–6.1** in **Chapter–6** of EIA/EMP report. The proposed safeguard measures against fire hazards are provided in **Chapter–6** of EIA/EMP report.
I)	The DMP so formulated shall include measures against likely Tsunami/Cyclones/Storm Surges/ Earthquakes etc, as applicable. It shall be ensured that DMP consists of both on-site and off-site plan, complete with details of containing likely disaster and shall specifically mention personnel identified for the task. Smaller version of the plan shall be prepared both in English and local languages.	The measures against natural calamities such as Tsunami/Cyclones/Storm Surges are included in DMP. The proposed project is in **Seismic Zone–II** as per IS: 1893-2002 BIS GOI. The DMP is containing on-site and off-site emergency plans, likely disaster occurrence and specifically mentioned personnel identified for the task. The details area provided in in Chapter – 6 of EIA/EMP report. Smaller version of DMP will be prepared in English & Tamil languages and made available after execution of the project.
Ii)	Detailed plan for raising green belt of native species of appropriate width (50 to 100 m) and consisting of at least 3 tiers around plant boundary (except in areas not possible) with tree density of 2000 to 2500 trees per ha with a good survival rate of about 80% shall be submitted. Photographic evidence must be created and submitted periodically including NRSA reports.	Detailed green belt with native species will be developed around plant boundary. The width of green belt around 50–100 m will be maintained with 3 tiers in the plant site. The tree density of 2000 per ha with 80% survival rate of plant species will be maintained. Photographs along with satellite imageries of the plant site will be submitted before and after green belt development.
Iii)	Over and above the green belt, as carbon sink, additional plantation shall be carried out in identified 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.	Green Belt will be developed in an area of 275 acres in the proposed project site. In addition to that plantation will be carried out around the plant boundary. There is no forest land in 10 km radius of study area.
Iiii)	Corporate Environment Policy i. 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. ii. Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest	• TANGEDCO has established one Environment Management Cell at its Headquarters, comprising one Executive Engineer, three Assistant Executive Engineers, one Assistant Engineer and one Chemist and its functions are as follows: • To obtain all Statutory Environmental, Coastal Regulation Zone and Aviation

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xlviii)	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.	The anticipated environmental impacts & mitigation measures due to the proposed project are provided in **Chapter–4** and item wise cost of its implementation in a time bound manner are provided **Table–5.2** in **Chapter–5** of EIA/EMP report.
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	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.	**Figure–6.1** in **Chapter–6** of EIA/EMP report. The proposed safeguard measures against fire hazards are provided in **Chapter–6** of EIA/EMP report.
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Iii)	Over and above the green belt, as carbon sink, additional plantation shall be carried out in identified 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.	Green Belt will be developed in an area of 275 acres in the proposed project site. In addition to that plantation will be carried out around the plant boundary. There is no forest land in 10 km radius of study area.
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	norms / conditions? If so, it may be detailed in the EIA. iii. 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. iv. Does the company has system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism should be detailed in the EIA report. All the above details should be adequately brought out in the EIA report and in the presentation to the Committee.	clearances for the State Sector Power Projects from the controlling authorities viz., Ministry of Environment and Forests/Government of India, Tamil Nadu Pollution Control Board/ State Environment & Forests Department and Airports Authority of India, including preparation of Environment Impact Assessment and Environment Management Plan. • Conducting Ambient Air Quality Survey, Stack Emission Test, Effluent Analysis, Noise level measurements and study of General Environmental Conditions in all the TANGEDCOs Thermal Power Stations (coal and gas based) annually. The team of engineers and chemist go on camp for 10 days each to every Thermal Power Station for conducting the above survey and environmental study. • Then detailed report on the study with suggestions for mitigate measures are prepared and submitted to higher authorities for approval and then forwarded to the Power Station concerned for follow up actions on the points raised. • Management of environmental problems and co-ordination with other Government/Controlling Authorities on environmental related issues in respect of all the TANGEDCO's Thermal Power Stations. • Co-ordination & follow up action on Environmental Protection Act 1986 and Notifications & Rules issued there under. • Identification of sites for new thermal projects under Environmental Guidelines / Norms
liv)	Details of litigation pending or otherwise with respect to project in any court, tribunal etc. shall invariably be furnished. Further, the following shall be strictly followed (as applicable): a) Low lying areas fulfilling the definition wetland as per Ramsar Convention shall be identified and	No litigation is pending with respect to the project. The project site is not defined as wetland as per Ramsar Convention.

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	clearly demarcated w.r.t the proposed site.	
	b) 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 agency shall be submitted.	The site is demarcated under CRZ and it is sited away from CRZ. The authenticated CRZ map prepared by Institute of Remote Sensing, Anna University, Chennai is enclosed in **Annexure–IV.**
	c) 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 bunds should be strengthened and desilted.	The site is flat terrain and requires minor leveling. A detailed Hydrogeological study has been done by Anna University, Chennai for regeneration and preservation of village tanks and for diversion of minor canals/natural drains in the study area. The hydrogeological report is enclosed in **Annexure–VI.**
	d) Additional soil for levelling of the sites should be generated as far as possible within the sites, in a way that natural drainage system of the area is protected and improved	Additional soil for leveling of the project site will be procured from the desilting of tanks of surrounding project area.
	e) Marshy areas which hold large quantities of flood water shall be identified and shall not be disturbed.	No marshy lands are there in near the project area.
	f) No waste should be discharged into Creek, Canal systems, Backwaters, Marshy areas and seas without appropriate treatment. The outfall should be first treated in a guard pond (wherever feasible) and then 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.	The wastewater will be treated as per CPCB norms and will be discharged to the sea. The detailed study done by Department of Ocean Engineering, IIT Madras, Chennai Tamil Nadu is enclosed in **Annexure – VII.**
	g) 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.	Mangrove conservation and regeneration plan will be formulated.
	h) A common Green Endowment Fund should be created by the project	A common Green Endowment Fund will be created so as to improve the green

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	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.	cove in and around proposed plant site.
	i) Impact on fisheries at various socio economic level shall be assessed.	Detailed Socio-economic study was conducted by Madras School of Social Work, Chennai, which consists of detail assessment of impact on livelihood of local communities in 10 km study area is provided in **Annexure–VIII**.
	j) An endowment of Fishermen Welfare Fund should be created out of CSR grants not only to enhance their quality of life 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.	
	k) Tsunami Emergency Management Plan shall be prepared and plan submitted prior to the commencement of construction work.	The measures against natural calamities such as Tsunami/Cyclones/Storm Surges are included in DMP.
	l) 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 is fertile agricultural land used for paddy cultivation.	Ash pond will be lined with non-permeable membrane HDPE lining will be provided. Epoxy lining will be provided for guard pond to prevent seepage. All the preventive measures will be taken care for pipelines and RCC channels.
4	**Besides the above, the following general points will be followed:**	
	a. All documents to be properly referenced with index, page numbers and continuous page numbering.	All the documents in EIA/EMP report are properly reference with index, page numbers and continuous page numbering.
	b. Where data is presented in the report especially in table, the period in which the data was collected and the source should invariably be indicated.	The dates and the period are clearly indicated in the data provided in EIA/EMP report.
	c. Where the documents provided are in a language other than English, an English translation should be provided.	English translation of all material will be provided in Regional languages.
	d.The Questionnaire for environmental appraisal of thermal power projects as devised earlier by the Ministry shall also be filled and submitted.	The filled in questionnaire for environmental appraisal of thermal power projects will be submitted along with final EIA/EMP report.

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	e. The consultants involved in the preparation of EIA/EMP report after accreditation with Quality Council of India (QCI) / National Accreditation Board of Education and Training (NABET) would need to include a certificate in this regard in the EIA/ EMP reports prepared by them and data provided by other organization / Laboratories including their status of approvals etc. In this regard circular no. F.No. J-11013/77/2004-IA-II (I) dated 2nd December, 2009 is posted on the Ministry's website http://www.moef.nic.in may be referred.	QCI/NABET Accreditation Certificate is enclosed in **Chapter–10** EIA/EMP report.
4	**In addition to the above, information on the following may also be incorporated in the EIA report.**	
	1. Is the project intended to have CDM-intent?	The project is intended to have CDM intent.
	(i) If not, then why?	
	(ii) If yes, then	
	a. Has PIN (Project Idea Note) {or PCN (Project Concept Note)} submitted to the ?NCA? (National CDM Authority) in the MoEF?	PIN is under preparation.
	b. If not, then by when is that expected?	After Environmental Clearance
	c. Has PDD (Project Design Document) been prepared?	Under preparation
	d. What is the Carbon intensity? from your electricity generation projected (i.e. CO2 Tons/MWH or Kg/KWH)	0.941 t CO_2/MWhr (based on CDM Executive Board approved methodology ACM0013 Ver01)
	e. Amount of CO2 in Tons/year expected to be reduced from the baseline data available on the CEA?s web-site (www.cea.nic.in)	The amount of CO2 expected to be reduced is 1.15 millions Tonnes/year. This shall be updated during the development of PIN and PDD for the project
	2. Notwithstanding 1(i) above, data on (d) & (e) above shall be worked out and reported.	-

Executive Summary

Executive Summary

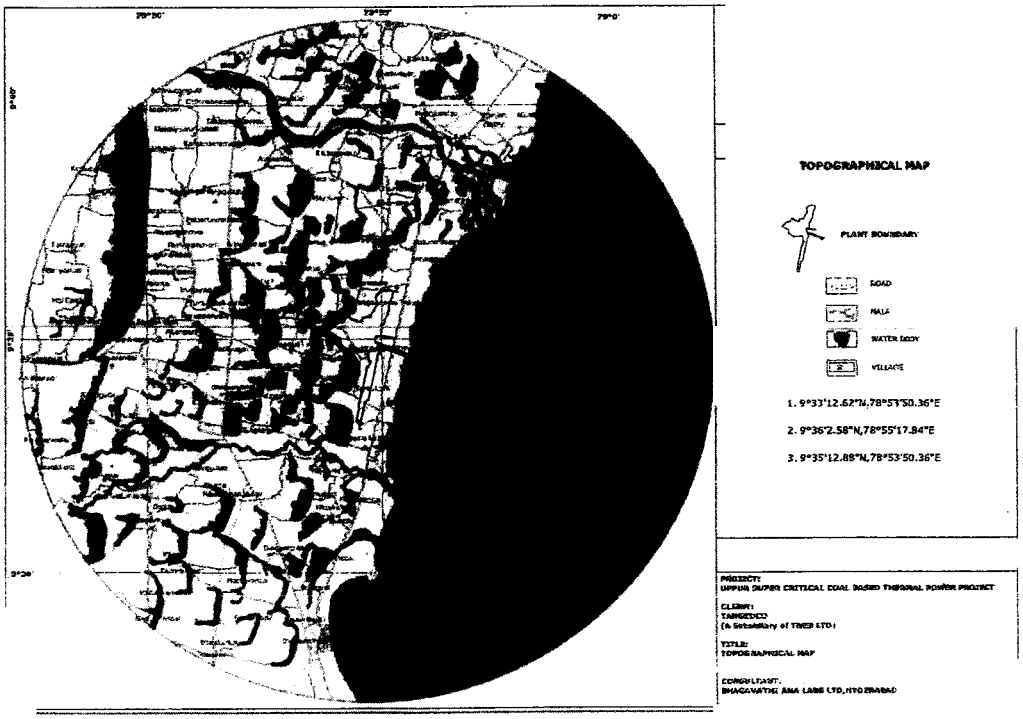
1.0 Project Description

Introduction

TANGEDCO has proposed to install imported coal based power plant of capacity 2 x 800 MW with Super Critical technology at Uppur, Valamavoor and Thiruppalaikudi villages, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu.

Project Location

The coordinates of plant site are 9°32'42.14"N 78°53'47.95"E to 9°36'13.29"N 78°55'11.62"E with an elevation of 4.5 m above mean sea level. The East Coast Road connecting Ramanathapuram–Pattukottai the East Coast Road is at a distance of 600 m on the eastern side of the project and National Highway–NH-210 is at 4.0 km. The nearest Railway station is Ramanathapuram which at a distance of 28 km from the site. The nearest Airport is Madurai, which is about 130 km from the site. The Tuticorin port is at a distance of 140 km. The water bodies in the study area are Peyar River at 2.0 km and Uppar River at 6.5 km from the project site. In addition tanks such as Uppur Tank, Aladiyendal Tank, Naganendal Small Tank, Naganendal Big Tank, Valamavoor Tank, Mavilangaiyenthal Tank, Thiruppalaikudi Tank, etc., are located in the study area. The Palk Bay is at a distance of 1.0 km. There are no National parks / Sanctuaries / Wildlife reserves within a radius of 10 km from the Project site



Land Details of Proposed Plant

The total land requirement for the project is about 912 acres. Out of this, Patta lands are about 674 acres and Poramboke lands are about 238 acres. Out of this, about 30% of the land ie., 275 acres, are earmarked for green belt development. No forest land is involved.

Technical Details of the Proposed Power Plant:

Capacity	2 x 800MW
Technology	Supercritical
Coal	Imported coal 4.64 Million tonnes per annum at 85%PLF
Gross Calorific value	5500 Kcal/kg
Max. Sulphur content	0.8%
Ash content	10%
Transportation of coal	From Tuticorin Port to project site by rail
Water requirement	Sea water will be drawn from Palk bay. 15376 m^3/hr
Cooling System	NDCT with Closed Cycle cooling system adopted
Project Cost	Rs.9600 crores

Power Evacuation:

Power generated in the Power Plant would be available at 400 kV level in the station switchyard bus and would be fed to Tamil Nadu Transmission Corporation Limited (TANTRANSCO) 400KVA Karaikudi substation which is about 40KMs North West and 400KVA Chekkanurani substation which is about 90KMs west of the proposed site.

Terms of Reference for the Project:

The site was demarcated under Coastal Regulation Zone (CRZ) through Institute of Remote Sensing, Anna University and the site is outside the CRZ area. The project proposal was considered by the Ministry of Environment & Forests (MOEF), Government of India on 9.4.2012 and prescribed Terms of Reference (TOR) for the Project. Based on the TOR, the following works have been carried out by TANGEDCO through the following agencies / consultants.

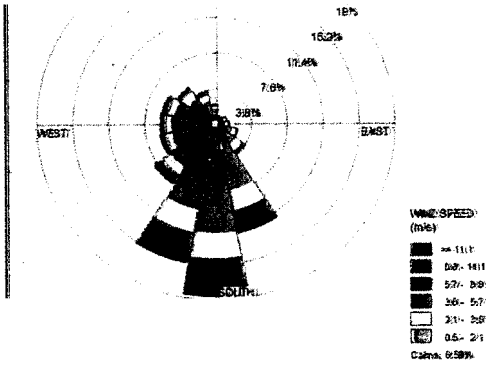
- Terrestrial Environmental Impact Assessment Study – M/s. Bhagavathi Ana Labs, Hyderabad

- Marine Environmental Impact Assessment Study – M/s.WAPCOS Ltd., a Government of India Organisation
- Mathematical Modelling for Intake and Outfall of cooling water for the Project – M/s.IIT Madras
- Detailed Project Report – M/s. Development Consultants Private Limited, Chennai
- Geo Hydrological Study – Anna University, Chennai
- Feasibility of Transportation of Coal for the Project – M/s.RITES, a Government of India Organisation
- Socio Economic and Community Needs Assessment Study – M/s. Madras School of Social Work

2.0 Description of the Environment

Environmental Study was carried out during July – September 2012. The predominant wind direction during the study period is from South.

Wind Rose



Air Environment

Ten locations were monitored for studying baseline ambient air quality. The location of monitoring stations and the values are given in the following table:

Ambient Air Quality in the Study Area

Air Quality Station	Code	Particulars	SPM $\mu g/m^3$	PM_{10} $\mu g/m^3$	$PM_{2.5}$ $\mu g/m^3$	SO_2 $\mu g/m^3$	NO_x $\mu g/m^3$	CO mg/m^3	Hg ng/m^3	O_3 $\mu g/m^3$
Plant Site-1	A1	Minimum	96	36.8	14.6	10.0	12.1	0.8	NT	19.9
		Maximum	116	46.3	18.0	13.0	15.5	1.4	NT	23.2
Plant site-2 (Valamavoor)	A2	Minimum	93	35.2	14.5	9.8	14.2	0.8	NT	19.6
		Maximum	118	45.6	19.1	12.1	15.8	1.4	NT	24.2
Thirupplaikudi	A3	Minimum	110	42.8	16.6	11.4	14.8	1.1	NT	20.6
		Maximum	136	62.3	24.2	14.4	18.2	1.7	NT	24.6
Devipattinum	A4	Minimum	115	52.3	16.6	11.3	16.0	1.2	NT	20.3
		Maximum	140	66.6	25.1	15.4	18.9	1.5	NT	25.2
Uppur	A5	Minimum	106	45.6	15.0	10.3	12.9	0.8	NT	19.2
		Maximum	136	56.2	19.2	13.0	15.9	1.6	NT	24.2
Uranangudi	A6	Minimum	110	45.2	15.4	10.5	13.2	0.9	NT	19.9
		Maximum	135	60.3	19.2	12.9	16.9	1.5	NT	25.3
Rajasingamangalam	A7	Minimum	119	46.2	16.9	10.4	10.2	1.0	NT	20.6
		Maximum	148	64.2	24.3	13.6	18.7	1.6	NT	26.2
Kalavamkudi	A8	Minimum	108	44.6	15.5	10.9	14.5	0.9	NT	19.6
		Maximum	138	58.9	17.6	13.6	16.8	1.5	NT	25.3
NAAQ CPCB Standards as on 18-11-2009			-	**100**	60	80	80	4	-	180

*NT: Not Traceable

***The obtained values are well within the NAAQ Standards.*

Noise Environment

Baseline ambient noise levels were monitored in ten locations and the values are given in following table:

Noise Levels in dB (A)

The study area the day equivalents during the study period were in the range of 47.4 to 58.4 dB (A). The night equivalents were in the range of 42.3 dB (A) to 54.1 dB (A). The Day equivalents and the Night equivalents were within the Ambient Noise standards.

Water Environment

A total of 18 water samples were collected; out this 14 samples are from ground water sources and 4 samples from surface water.

The water samples were analyzed as per Standard Methods IS 10500 and for analysis of water and wastewater, American Public Health Association (APHA) Publication.

- The pH varying for ground water samples from 7.21 to 8.31 and in surface water the pH was observed 7.24-7.61.
- The Chloride levels in the ground water samples collected in the study area were ranging from 21 mg/l to a maximum of 1664 mg/l, whereas in surface waters levels are between 64 to 32061 mg/l.

- In the ground water samples collected from the study area, the hardness is varying from 24 mg/l to 755 mg/l. In surface waters the hardness levels are between 245 to 11500 mg/l.
- In the ground water samples of study area the fluoride value were in the range of 0.40 mg/l to 1.3 mg/l. whereas in the surface waters the fluoride levels are between 1.0 to 2.0 mg/l.

All the ground water samples collected from the study area were found well within the permissible limits. Most of the heavy metals in all samples are below detectable limits.

Soil Quality

- The texture of the soil is clay & sandy loam
- The pH of the soil in the study area is in the range of 6.74 – 8.26.
- The electrical conductivity for the soil samples is in the range of 48 – 6040 micro siemens
- The organic carbon in the study area is varying from 0.1 – 0.6 %
- It was observed that Nitrates, Sodium and potash are in the range of 20 – 220 kg/ha, 2 – 25 kg/ha, 95 – 916 kg/ha respectively

Biological and Marine Environment

The ecology of study area is influenced by marine habitat. The existing species are well adapted to high salt tolerance. Due to intense interactions between land, sea and air productivity of natural system along the coastal area is very high.

Various results on the chemical and biological parameters indicate that the water is well oxygenated, nutrient rich and biologically productive at primary and secondary levels. The marine flora and fauna also indicate the existence of diverse population. The Uppur coastal area has mangrove vegetation along the shore with Avicennia marina, and Rhizophora apiculata. However, the project is more than 1 km from the sea shore and hence will not affect the mangrove vegetation. The cooling water intake and outfall pipelines will be routed so as to cause minimal impact on the mangrove vegetation. Further, Project proponent will also take action to improve the mangrove cover of the coast as a part of CSR activities.

It is proposed to draw sea water at a distance of about 4.8 km from the shore and discharge at a distance of about 6.5km from the shore near ambient temperature due to closed cycle cooling system. The Modelling Study for dispersion of temperature

and salinity has been conducted by IIT Madras for worst conditions and it is seen that due to the discharge of cooling water into the

about 0.5-0.75 °C within a radius of 2.5km. B

conditions. Likewise salinity rise will also be diluted within a radius of 2.0km and then the plume will have ambient conditions. The

Plant would not change the quality of existing

The mitigation measures for air, water and solid waste management will be followed as a result of that, there would not be any sig

km study area.

Socio-economic Environment

The study area consists of 41 villages. Total population of the study area is 90,831. The total ST population is 237 and SC population is 21369 in the study area. The

te is 62

Environment

ground level concentrations are estimated due to the emissions from the

emissions.

Predicted Ground Level Concentrations (GLCs) for using 100% imported Coal

	GLCs for 2x800 MW with Imported Coal		
Study period	**July, August & September 2012**		
Baseline Scenario (max)	**PM_{10}**	**SO_2**	**NO_x**
	66.6	15.4	18.9
Predicted Ground Level Concentrations (GLCs-max)	0.80	35.32	14.60
NAAQ Standards for rural and residential areas (2009)	100	80	80

Predicted Ground Level Concentrations (GLCs) for using blended Coal

	GLCs for 2x800 MW with blended Coal		
Study period	July, August & September 2012		
Baseline Scenario (max)	PM_{10}	SO_2	NO_x
	66.6	15.4	18.9
Predicted Ground Level Concentrations (GLCs-max)	0.80	31.81	15.90
Over All Scenario (worst case)	67.40	47.21	34.8
NAAQ Standards for rural and residential areas (2009)	100	80	80

Mitigation Measures

- Suitably designed ESPs with an efficiency of 99.9% will be placed upstream of the stacks which will separate out the incoming dust in flue gas and limit the dust concentration at its designed outlet concentration to less than 50 mg/Nm^3
- Stack is proposed to the height of 275 m for an effective dispersion of the pollutants.
- Dust suppression system by water sprinkler at dump hopper of coal.
- Control of fugitive emissions from the ash dyke through maintaining a permanent blanket of water cover over the deposited ash.
- Green belt development and afforestation in the plant and surroundings of ash disposal area.

Noise Environment

The major noise generating activities in the plant site are fans, blowers, compressors, pumps & motors etc.

Mitigation Measures

To achieve the noise limitations around the equipment, the following mitigation measures will be implemented:

- Provision of Acoustic enclosures

- Small units like condensate and vacuum pumps, will be designed so as to limit noise emission,
- Provision of silencers
- Noise generating items such as fans, blowers, compressors, pumps, motors etc. are so specified as to limit their speeds and reduce noise levels

Water Environment & Wastewater Management

The plant area will be designed with a network of drains to channel runoff during the rainy season. Surface drainage would be either open RCC rectangular drains or brick lined drains with trapezoidal shape. All drains will be covered in the proposed plant and building areas. The surface water run-off from the coal stack yard will be led to a sump for settling and the overflow will be utilized for green belt development.

Sea Water Outfall

S. No.	Description	Wastewater Generation (m^3/hr)	Disposal
1.	Ultrafiltration	122	Discharge to the outfall point in the Palk Bay
2.	Desalination plant	660	
3.	RO plant	26	
4.	CT Blow down cum Reject water	9700	
Total		**10508**	

Wastewater Generation and Reuse

S. No.	Type of water	m^3/day
1	Boiler Blow down	1200
2	DM Regeneration	259
3	CPU Regeneration	
4	Waste from floor cleaning of plant area	240
5	Oil wastewater from power house	600
6	Oil handling area run off	
7	CTBD	1200
8	Sewage Treatment Plant	75
	Total	**3574**

The major impact on ground/surface water quality is insignificant as all the wastewater generated from the proposed power plant will be treated in effluent treatment plant and reused for ash management, dust suppression and green belt development. Only the cooling tower blow down and desalination plant brines will be suitably diluted and then let out into sea after ensuring that the temperature and salinity of the outfall water are within the limits.

Solid waste Management

The main solid waste from the power plant will be ash (Fly ash and Bottom ash). The average coal consumption rate from the power plant is given in the table.

Description	Details of Ash Generation 2x800 MW TPP	
	100% Imported Coal	Blended Coal (70% imported coal & 30% indigenous coal)
Coal consumption	4.64 MTPA	5.57 MPTA
Total Ash	0.464 MTPA (10%)	1.8938 MTPA (34%
Fly Ash (@80%)	0.3712 MTPA	1.515 MTPA
Bottom Ash (@20%)	0.0928 MTPA	0.3788 MTPA

It is proposed to utilize 100% of the fly ash for which ash utilization plan is ready. During emergency the ash will be disposed off safely in ash pond area. The proposed ash pond area is 138 acres. The average ash dump height is 9.0 m. Bottom ash and unutilized fly ash will be disposed off in the ash pond. To control fugitive dust emission from the ash pond area water layer will be maintained above the ash pond.

The Sludge generated in ETP will be about 28.8 tonnes/day and sludge from STP will be 7.5 tonnes per day. The dried STP sludge will be utilized as manure for green belt development and the ETP sludge will be utilized for land filling in low lying areas.

4.0 Environmental Monitoring Program

Environmental Laboratory Equipment

The industry has an in-house environmental laboratory for the routine monitoring of air, water, noise, and soil quality. For all non-routine analysis, the plant may utilize the services of external laboratories and facilities.

Monitoring System:

Online stack monitoring system will be installed in the plant premises. Ambient monitoring stations will be suitably located, preferably in the vicinity of Boiler, Steam Generator, Steam turbine, Coal stockyard, and Ash disposal area.

- The equipment / instruments of the monitoring station will be housed in suitable enclosure / room
- Power supply to the station will be made from the central UPS system for all plant instrumentation / emergency shutdown systems for process plants

- The monitoring stations will include sampling & analysis provisions for NO_x, SO_2, Particulate Matter (PM_{10}& $PM_{2.5}$)

Environmental Budget

The management has proposed to take adequate measures to mitigate all possible adverse impacts at the plant premises. The project has earmarked an amount of Rs. 960 Crores towards Environmental Protection and Rs.38 Crores for Corporate Social Responsibility (CSR) activities.

S.No.	Particulars	Capital Cost (Rs. in Crores)	Recurring Cost (Rs. in Crores)
1	Air i) ESPs ii) Dust Suppression system for coal handling	 250.00 10.00	 12.50 0.50
2	RCC bi-flue chimney	100.00	--
3	Cooling towers	180.00	9.00
4	Bottom ash and fly ash collection, storage and disposal system	150.00	7.50
5	ETP & STP	110.00	5.50
6	Occupational Health & Safety	100.00	5.00
7	Greenbelt development	50.00	2.50
8	Pollution monitoring instrument/ equipment & Laboratory	10.00	0.50
	Total	**960.00**	**48.00**

5.0 Additional Studies

Risk assessment for power plant has been carried out with the objective to identify the potential hazards from the proposed storage facilities and appropriate disaster management Plan has been designed.

6.0 Environmental Management Plan

Air Quality Management

- Suitably designed ESP with efficiency of 99.9% will be placed downstream of the stacks which will separate out the incoming dust in flue gas and limit the dust concentration at its designed outlet concentration of less than 50 mg/Nm^3.
- For the effective dispersion of the pollutants stack height is proposed about 275 m.

- The dust generated from coal handling plant will be minimised because of handling of fine coal will be in closed circuit. For further suppression of dust adequate water spray system will be provided;
- A well-designed burner system, will limit the temperature to a reasonably low value of NO_x.
- All vehicles and their exhausts would be well maintained and regularly tested for emission concentration;
- Adequate thickness of insulating material with proper fastening will be provided to control the thermal pollution;
- Provision of regular preventive maintenance of pollution control equipment; and
- Stack emissions will be regularly monitored by In-house / external agencies on periodic basis.
- FGD provision is made for future purpose.

Fugitive Emission Management

The following measures will be adopted:

- Dust suppression system by water sprinkler at dump hopper of coal
- Regular dust suppression with water sprinkler at transfer points;
- Control of fugitive emissions from the ash dyke through maintaining a permanent blanket of water cover over the deposited ash.
- Green belt development and afforestation in the plant and surroundings of ash disposal area.
- Dust suppression/extraction system at Coal handling plant to control fugitive emissions.

Water Quality Management

- Continuous attempt to optimize/reduce the use of water in plant.
- Regular record of level and flow of surface water sources;
- Raw water quality will be checked on regular basis for essential parameters under BIS: 10500 before and after treatment;
- All the treated effluents would be monitored regularly for the flow rate and quality to identify any deviations in performance of effluent treatment plants.

Storm Water Management

Based on the rainfall intensity of the proposed area, storm water drainage system will be designed and connected to the storm water networks. Storm water drainage system consists of well-designed network of open surface drains and rainwater

harvesting pits along the drains so that all the storm water is efficiently drained off without any water logging.

Rain Water harvesting System

The rain (storm) water from the building roofs, non-process area and grade level surfaces will be directed through the open drains to the storm drainage system. All drains will be lined and will be arranged to provide the shortest possible drainage path for efficient drainage. The recharge water shall be diverted to the village tanks/ponds at the vicinity of the project site by lying of pipelines.

Green Belt & Afforestation

The afforestation will be taken up around coal handling area, ash disposal area and along roadside and pathways. Local species have been selected for plantation. Trees will be planted in consultation with the local Forest Department. An area of about 275 acres of land in the plant and ash dyke area will be developed under greenbelt.

Fire Protection System

- The plant proposes adequate number of wall/column mounted type portable fire extinguishers in various strategic areas of the plant including the control room, administration building, stores, pump house etc. These portable fire extinguishers are basically of carbon dioxide and dry powder type.
- Fire Hydrants at suitable locations for TG building, boiler area, Fuel handling & Storage area.
- Medium velocity water spray system for the cable gallery.
- Necessary electric driven, diesel driven, Jockey pumps with piping valves & instrumentation for safe operation.

Occupational Health & Safety

The precautionary measures, which will be followed to reduce the risk due to dust on the workers, engaged in and around the material handling areas:

- Adequate arrangements will be made for preventing the generation of dust by providing the chutes at transfer points to reduce the falling height of material, preventing spillage of material by maintaining the handling equipment, isolating the high dust generating areas by enclosing them in

appropriate housing and appropriately de-dusting through high efficiency bag filters;

- Due care will be taken to maintain continuous water supply in the water spraying system and all efforts would be made to suppress the dust generated by coal handling system by water spraying at appropriate points;
- Almost all material handling systems are automatic. The workers engaged in material handling system will be provided with personal protective equipment like dust masks, respirators, helmets, face shields, ear plugs, etc;
- All workers engaged in material handling system will be regularly examined for lung diseases such as PFT (Pulmonary Function Test) tests;
- Thermal insulation will be provided wherever necessary to minimize heat radiation from the equipment, piping, etc. to ensure protection of workers.

Socio-economic Environment

For the benefit of the community in the vicinity of the project, the management will take up several measures to develop various amenities in an effort to improve standard of living, and earmarked an amount of Rs. 38.00 Crores under CSR program comprising the following:

- Drinking water supply to the nearby villages around the project area
- Desilting tanks / ponds around the project area
- Augmentation of facilities in nearby Schools, Anganwadis and Public Health Centres
- Provision of Community Halls, fish auction halls, net mending sheds, fish drying platforms, etc.,
- Fishermen welfare fund
- Women self help group fund
- Roads, streetlights and toilet facilities augmentation

7.0 Project Benefits

The Power Demand and Supply gap in the 13th Plan Period will be reduced thus paving way for Industrial and Commercial development for the State.

- Direct and Indirect employment opportunities to local people in contractual works like housing construction, transportations, sanitation, for supply of goods and services to the project and other community services
- Additional housing demand for rental accommodation will increase
- Market and business establishment facilities will be increased
- Improvement in communication, transport, education, community development and medical facilities

Conclusion

The potential environmental, social and economic impacts have been assessed. The proposed power plant has certain level of marginal impacts on the local environment. With effective implementation of proposed environment management plan, these effects will get marginalized. Implementation of the project has beneficial impact in terms of providing direct and indirect employment opportunities. This will be a positive socio-economic development in the region. Quality of life of the people will improve.

With commitment and dedication, Uppur Thermal Power Station, undertakes various community welfare measures for the upliftment of the villages of the study area.

EIA/EMP Report

Introduction

Chapter – 1
Introduction

1.0 Introduction

Tamil Nadu Generation and Distribution Corporation (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 supply to large number of industries has been well recognized. Tamil Nadu state is the most preferred State for IT and industrialization. Henceforth, 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.

To meet the increasing demand for power supply in the sectors of agriculture, domestic, industrial and commercial purposes in Tamil Nadu, TANGEDCO has proposed to install coal based power plant of capacity 2 x 800 MW with Super Critical technology at Uppur, Valamavoor and Thiruppalaikudi villages, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu.

The imported coal will be supplied by MMTC Ltd., either from Indonesia or other country for the proposed project of 2 x 800 MW Power Plant, which requires 4.64 million tonnes per annum based on 85% Plant Load Factor (PLF).

Consumptive water would be drawn from the sea at a distance of 1.0 km from the proposed plant and pumped to the site through pipelines. The sea water will be treated in desalination plant at the proposed plant site.

1.1 Purpose of the Report

The purpose of this report is to present the environmental related issues of the proposed 2x800 MW imported coal based power plant of TANGEDCO, Tamil Nadu. The proposed project will be established in 912 acres (369.23 ha) near Uppur, Valamavoor and Thiruppalaikudi villages, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu.

1.2 Identification of Project

In total four sites were identified for the proposed power plant. The following parameters were considered to select a suitable site.

- Type of usage of the proposed land
- Topography and geological aspects of land
- Feasibility of developing dedicated rail line from nearest railway station
- Site accessibility from the State highway
- Access roads and other facilities available for the transportation of materials and equipment
- Feasibility for power evacuation
- Environmental aspects like site away from metropolitan city, historical or cultural sites, places of archaeological interest, religious spots, tourist spots, defence installations, national park, bird sanctuary etc.

Table – 1.1
Comparison of Alternative Sites

S No	Description	Site-1	Site-2	Site-3	Site-4
1	Village	Narippaiyur	Sakkarakottai and Pattanamkathaan	Thondiakadu	**Uppur, Valamavoor and Thiruppalaikudi**
2	Source of Water	Palk Bay	Palk Bay	Palk Bay	**Palk Bay**
3	Availability of Water	Sea water	Sea water	Sea water	**Sea water**
4	Land use of site	Patta/Poromboke	Patta/Poromboke	Un-surveyed land	**Patta/Poramboke lands**
5	Land use of surrounding area	Salt pans	Municipal premises	Water logged, salt swamp and lagoons	**Vacant land**
6	Availability of land	1200	832	2000	**1110**
7	Forest Land	Forest land	Nil	Muthupet R.F.	**Nil**
8	National Parks/ Wildlife Sanctuary	Gulf of Mannar, Melselvanur-Kilselvanur Bird Sanctuary	Nil	Nil	**Nil**
9	Resettlement & Rehabilitation	Salt pans	Municipal premises	Nil	**Vacant land**
10	Coal Availability	Imported	Imported	Imported	**Imported**

The salient features of the study area of in 10km radius distance are described below in **Table 1.2**

Table – 1.2
Salient Features of the Project Site

Project Name	2x800 MW Super critical imported coal based thermal power project
Location of Project	
Village	Uppur, Valamavoor and Thiruppalaikudi
Tehsil	Thiruvadanai
District & State	Ramanathapuram, Tamil Nadu
Coordinates of the plant site	1. 9°33'12.62"N 78°53'50.36"E 2. 9°36'02.58"N 78°55'17.84"E 3. 9°35'12.88"N 78°53'50.36"E
Coordinates of Ash Pond Area	9°35'58.04"N 78°55'12.56"E
General Climatic Conditions	
Mean Maximum Temperature (°C)	37.8
Mean Minimum Temperature (°C)	20
Relative Humidity (%)	70
Annual Rainfall (mm)	827
Wind Pattern (during study period)	South
Elevation	4.5 m MSL
Accessibility	
Road Connectivity	Ramanathapuram–Pattukottai (East Coast Road – 600 m) National Highway–NH-210 (6.0 km)
Rail Connectivity	Ramanathapuram (28 km)
Airport	Madurai (140 km)
Seaport	Tuticorin Port (130 km)
Environmental Sensitivity	
Water bodies	Peyar River (2.0 km) Uppar River (6.5 km) Palk Bay (1.0 km)
Forest Area	None within the 10 km radius of the proposed plant site
Sanctuaries / National Parks	None within the 10 km radius of the proposed plant site
Archaeological/Historically Important Site	None within the 10 km radius of the proposed plant site
Seismic zone	Seismic Zone–II as per IS: 1893-2002

The location map of project site is shown in **Figure-1.1** and topographical map of 10 km radius study area is shown in **Figure-1.2**.

1.3 Project Proponent

Tamil Nadu Generation and Distribution Corporation (TANGEDCO) is the promoter of 2X800 MW super critical imported coal based thermal power plant. The estimated project cost is Rs.9600 Crores.

1.4 Brief Description of Project site

The East Coast road is at a distance of 600 metres towards East of the site. The nearest railway station Thiruppalaikudi is at a distance of 3.0 km. The airport Madurai, which is 140 km from the site. The Tuticorin sea port is at a distance of 130 km from the project site.

1.5 Project Importance to the Country & Region

Considering the present energy shortage and peak demand in Tamil Nadu for power supply in the sectors of agriculture, domestic, industrial and commercial purposes in Tamil Nadu, Ramanathapuram is an economically backward district. Establishment of a thermal power plant of 2x800 MW will bring in revenue flow for the district and will create employment for the local people. Hence, TANGEDCO has decided to set up 2x800 MW super critical coal based thermal power plant so as to reduce the quantum of power shortage.

1.6 Present Status of Demand and Availability

Capacity addition during 11th Plan as per planning commission target is 78700 MW. With this addition, total installed capacity at the end of 11th Plan i.e. 31.03.2012 will be 2,11,029 MW as against peak demand of 1,52,746 MW. Hence, for meeting the annual peak demand during the 12th Plan and 13th Plan, capacity addition is expected to be around 78000 MW during each of 5th year plan.

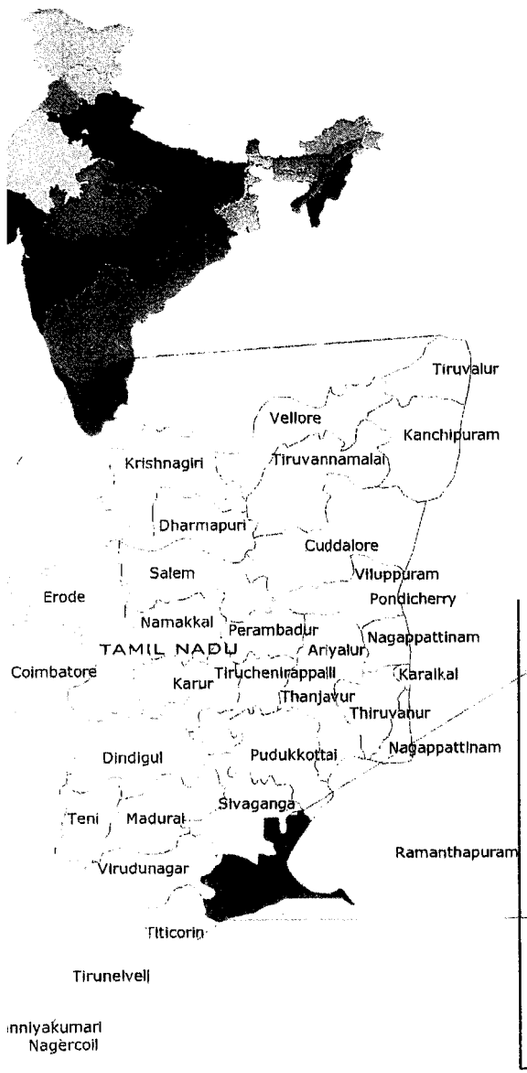
Table–1.3
Project Demand and Supply

Period	Energy Requirement (GWh)	Annual Peak Demand (MW)
2007 – 2012 (11th Plan)	968659	152746
2012-2017 (12th Plan)	1392066	218209
2017-2022 (13th Plan)	1914508	298253

Table–1.4
Power Supply Demand during 2012 – 13 to 2021-22

PROJECT LOCATION MAP

INDIA



PROJECT SITE

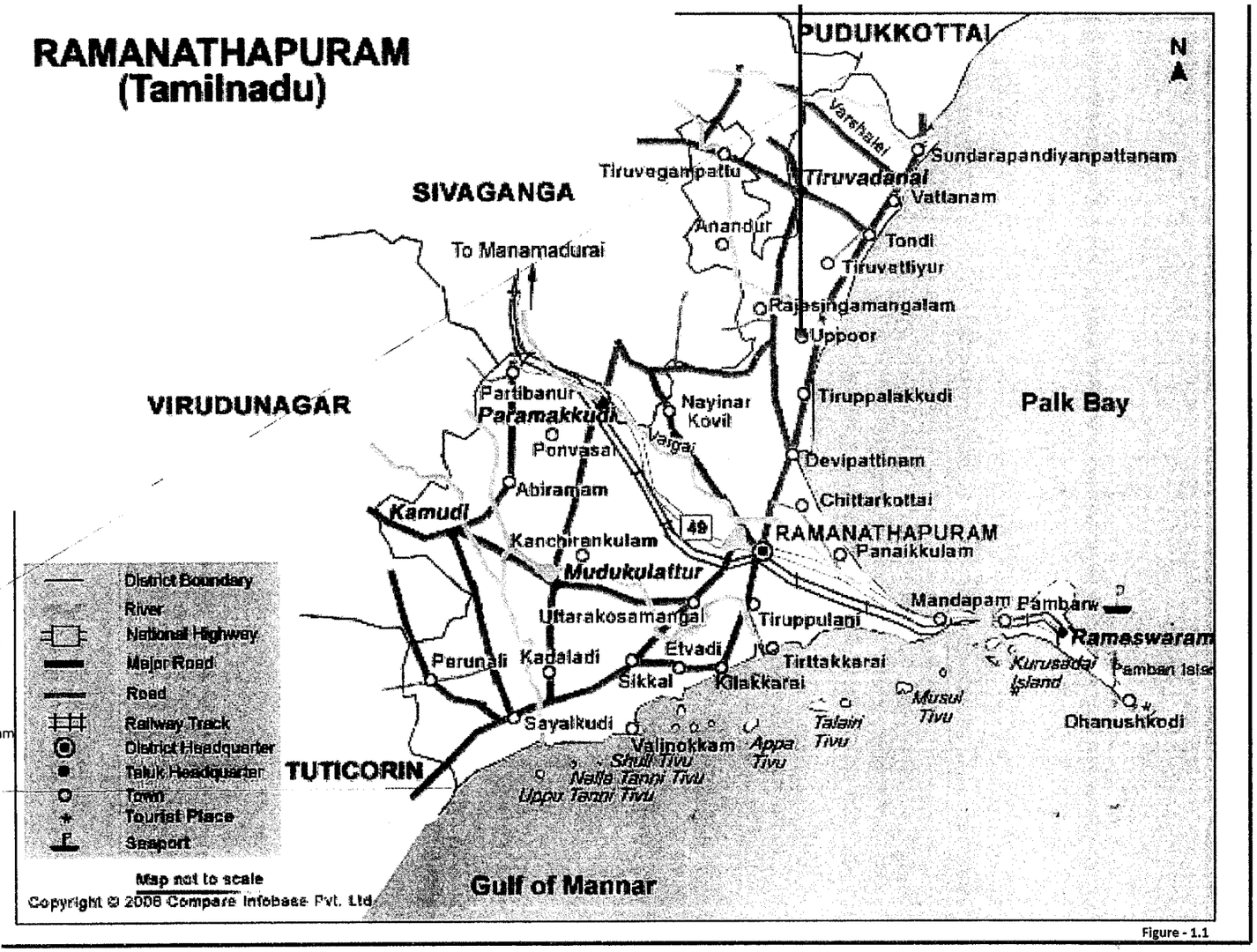
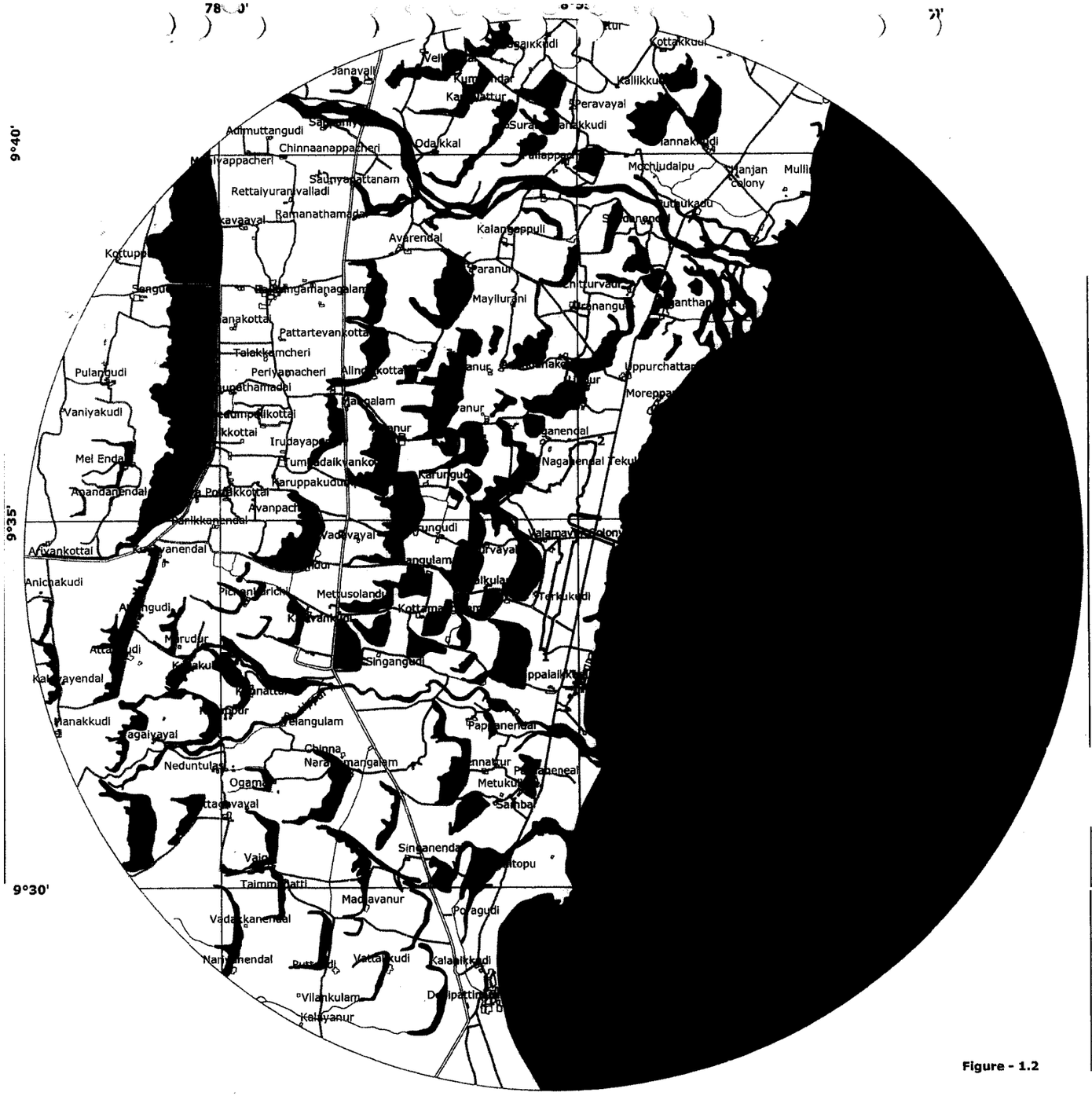


Figure - 1.1



PLANT BOUNDARY

ROAD

NALA

WATER BODY

VILLAGE

1. 9°33'12.62"N,78°53'50.36"E

2. 9°36'2.58"N,78°55'17.84"E

3. 9°35'12.88"N,78°53'50.36"E

0 1 2 3 4 5KM

PROJECT:
UPPUR SUPER CRITICAL COAL BASED THERMAL POWER PR

CLIENT:
TANGEDCO
(A Subsidiary of TNEB LTD)

TITLE:
TOPOGRAPHICAL MAP

CONSULTANT:
BHAGAVATHI ANA LABS LTD,HYDERABAD

Figure - 1.2

Year	Installed capacity (MW)	Capacity addition (MW)	Total installed capacity (MW)	Total availability (MW)	Projected Demand (MW)	Deficit surplus (MW)
2011 – 12	10237	132	10369	8081	12271	
2012 – 13	10369	474.5	10619	8484	13716	
2013 – 14	10619	3560	13873	11672	15352	-3680
2014 – 15	13873	938.5	14811	12470	17205	-4735
2015 – 16	14811	0	14706	12365	19323	-6958
2016 – 17	14706	3278	17878	15028	20816	-5788
2017 – 18	17878	3091	20969	17156	22375	-5219
2018 – 19	20969	3780	24749	20369	24057	-3688
2019 – 20	24749	1440	26189	21593	25876	-4283
2020 – 2021	26189	640	26829	22137	27838	-5701
2021 - 2022	26829	0	26829	22137	29975	

1.7 Scope of the Study

TANGEDCO (TNEB) has entrusted the EIA studies for 2x800 MW Thermal Power plant to M/s Bhagavathi Ana Labs Ltd, Hyderabad to carry out Environmental Impact Assessment (EIA) study and preparation of an effective Environmental Management Plan (EMP) in order to obtain Environmental clearance.

Scope of this study is to identify environmental impacts and to provide mitigation measures as per Central Pollution Control Board (CPCB) guidelines. The report is prepared based on TORs issued by MoEF reference no. F. No. J- 13012/01/ 2012-IA II (T) dated 28-05-2012.

The TORs issued by MOEF Expert Appraisal Committee are as given below:

i. Vision document specifying prospective long term plan of the site, if any, shall be formulated and submitted.

ii. Status of compliance to the conditions stipulated for environmental and CRZ clearances of the previous phase(s), as applicable, shall be submitted.

iii. CRZ clearance shall be obtained and submitted along with EIA/EMP Report.

iv. Executive summary of the project indicating relevant details along with recent photographs of the approved site shall be provided. Response to the issues raised during Public Hearing and to 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.

v. Diversion of community land to be strictly in accordance with the rules and approval of Panchayat/ Gram Sabha shall be obtained for acquisition of Panchayat/ Gam Sabha / Community land (as applicable).

vi. Once through system shall not be undertaken for cooling and accordingly details of closed cycle cooling system shall be furnished.

vii. Harnessing solar power within the premises of the plant particularly at available roof tops and other available areas shall be formulated and status of implementation shall be submitted to the Ministry.

viii. The coordinates of the approved site including location of ash pond shall be submitted along with topo sheet (1:50,000 scale) and confirmed GPS readings of

plant boundary and NRS satellite map of the area, shall be submitted. Elevation of plant site and ash pond with respect to HFL of water body/nallah/river shall be specified, if the site is located in proximity to them.

ix. Layout plan indicating break-up of plant area, ash pond, area for green belt, infrastructure, roads etc. shall be provided.

x. 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 and revised layout (as modified by the EAC) shall be provided.

xi. Present land use as per the revenue records (free of all encumbrances of the proposed site, shall be furnished. Information on land to be acquired) if any, for coal transportation system as well as for laying of pipeline including ROW shall be specifically stated.

xii. The issues relating to land acquisition and R&R scheme with a time bound Action Plan should be formulated and clearly spelt out in the EIA report.

xiii. Satellite imagery or authenticated topo sheet indicating drainage, cropping pattern, water bodies (wetland, river system, stream, nallahs, ponds etc.), location of nearest villages, creeks, mangroves, rivers, reservoirs etc. in the study area shall be provided.

xiv. 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 Office of the Chief Wildlife Warden of the area concerned.

xv. Topography of the study area supported by topo sheet 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 fill material required; its source, transportation etc. shall be submitted.

xvi. 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 to be acquired is developed alternatively and details plan shall be submitted.

xvii. A mineralogical map of the proposed site (including soil type) and information (if available) that the site is not located on economically feasible mineable mineral deposit shall be submitted.

xviii. Details of 100% fly ash utilization plan as per 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.

xix. Scheme for regeneration and preservation of village ponds in the study area shall be formulated.

xx. Water requirement, calculated as per norms stipulated by CEA from time to time, shall be submitted along with water balance diagram. Details of water balance calculated shall take into account reuse and re-circulation of effluents which shall be explicitly specified.

xxi. Water body/nallah (if any) passing across the site should not be disturbed as far as possible. In case any nallah / drain has to be diverted, it shall be ensured that the diversion does not disturb the natural drainage pattern of the area. Details of diversion required shall be furnished which shall be duly approved by the concerned department.

xxii. 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.

xxiii. Hydro-geological study of the area shall be carried out through an institute/ organisation 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.

xxiv. 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/creek/ 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.

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. Commitment regarding availability of requisite quantity of water from the Competent Authority shall be provided along with letter / document stating firm allocation of water.

Detailed plan for carrying out rainwater harvesting and its proposed utilisation in the plant shall be furnished.

Feasibility of zero discharge concept shall be critically examined and its details submitted.

Optimization of COC along with other water conservation measures in the project shall be specified.

Plan for recirculation of ash pond water and its implementation shall be submitted.

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.

xxxi. Socio-economic study of the study area comprising of 10 km from the plant site shall be carried out by a reputed institute / agency which shall consist of detail assessment of the impact on livelihood of local communities.

xxxii. 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.

xxxiii. 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.

xxxiv. A detailed CSR plan along with activities wise break up of financial commitment shall be prepared. CSR component shall be identified considering need based assessment study. Sustainable income generating measures which can help in upliftment of poor section of society, which is consistent with the traditional skills of the people shall be identified. Separate budget for community development activities and income generating programmes shall be specified.

xxxv. While formulating CSR 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 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).

CSR details done in the past should be clearly spelt out in case of expansion projects.

xxxvi. 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.

xxxvii. Assessment of occupational health as endemic diseases of environmental origin shall be carried out and Action Plan to mitigate the same shall be prepared.

xxxviii. 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 years shall be conducted with an excellent follow up plan of action wherever required.

xxxix. One complete season site specific meteorological and AAQ data (except monsoon season) as per MoEF Notification dated 16.11.2009 shall be collected and the dates of monitoring recorded. The parameters to be covered for AAQ shall include SPM, RSPM (PM10, PM2.5), SO2, NOx, Hg and O3 (ground level). The location of the monitoring stations should be so decided so as to take into consideration the pre-dominant downwind direction, population zone, villages in the vicinity and sensitive receptors including reserved forests. 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.

xl. A list of industries existing and proposed in the study area shall be furnished.

xli. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be well assessed. 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 roses should also be shown on the location map as well.

xlii. Radio activity and heavy metal contents of coal to be sourced shall be examined and submitted along with laboratory reports.

xliii. Fuel analysis shall be provided. Details of auxiliary fuel, if any, including its quantity, quality, storage etc should also be furnished.

xliv. Quantity of fuel required, its source and characteristics and documentary evidence to substantiate confirmed fuel linkage shall be furnished.

xlv. 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.

xlvi. For proposals based on imported coal, inland transportation and port handling and rolling stocks /rail movement bottle necks shall be critically examined and details furnished.

xlvii. 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.

xlviii. 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.

xlix. A Disaster Management Plan (DMP) along with risk assessment study including fire and explosion issues due to storage and use of fuel should be carried out. 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.

l. The DMP so formulated shall include measures against likely Tsunami/Cyclones/Storm Surges/ Earthquakes etc, as applicable. It shall be ensured that DMP consists of both on-site and off-site plan, complete with details of containing likely disaster and shall specifically mention personnel identified for the task. Smaller version of the plan shall be prepared both in English and local languages.

li. Detailed plan for raising green belt of native species of appropriate width (50 to 100 m) and consisting of at least 3 tiers around plant boundary (except in areas not possible) with tree density of 2000 to 2500 trees per ha with a good survival rate of about 80% shall be submitted. Photographic evidence must be created and submitted periodically including NRSA reports.

lii. Over and above the green belt, as carbon sink, additional plantation shall be carried out in identified 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.

liii. Corporate Environment Policy

i. 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.

ii. 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.

iii. 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.

iv. Does the company has system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism should be detailed in the EIA report.

All the above details should be adequately brought out in the EIA report and in the presentation to the Committee.

liv Details of litigation pending or otherwise with respect to project in any court, tribunal etc. shall invariably be furnished.

Further, the following shall be strictly followed (as applicable):

a) Low lying areas fulfilling the definition wetland as per Ramsar Convention shall be identified and clearly demarcated w.r.t the proposed site.
b) 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 agency shall be submitted.
c) 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 bunds should be strengthened and desilted.
d) Additional soil for levelling of the sites should be generated as far as possible within the sites, in a way that natural drainage system of the area is protected and improved
e) Marshy areas which hold large quantities of flood water shall be identified and shall not be disturbed.
f) No waste should be discharged into Creek, Canal systems, Backwaters, Marshy areas and seas without appropriate treatment. The outfall should be first treated in a guard pond (wherever feasible) and then 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.
g) 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.
h) 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.
i) Impact on fisheries at various socio economic level shall be assessed.
j) An endowment of Fishermen Welfare Fund should be created out of CSR grants not only to enhance their quality of life 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.
k) Tsunami Emergency Management Plan shall be prepared and plan submitted prior to the commencement of construction work.
l) 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 is fertile agricultural land used for paddy cultivation.

Project Description

Chapter – 2
Project Description

2.0 Type of Project

TANGEDCO (TNEB) is proposed capacity of 2 x 800 MW at Uppur, Valamavoor and Thiruppalaikudi, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu. The fuel of 100% imported coal will be used for the proposed project. However, the plant will be designed for 70% imported coal and 30% indigenous coal (70:30 blended coal). The imported coal will be supplied by MMTC Ltd.

2.1 Need for the Project

Considering the present energy shortage and peak demand in Tamil Nadu and presently facing severe power shortage and is likely to continue experiencing the same. Ramanathapuram is an economically backward district of Tamil Nadu. The project proponent has proposed coal based thermal power plant, so as to reduce the quantum of power shortage and in other hand the proposed unit will bring in revenue flow for the district and will create employment for the local people.

2.2 Technical Details

The Technical information and principle features of 2x800 MW imported coal based thermal power plant are presented in **Table 2.1**.

Table – 2.1: Technical Inf[illegible]f the P[illegible]d P[illegible] Plant

Parameter	Description	
Production Capacity	2x800 MW	
Source of coal	100% Imported coal	Blended coal (70:30)
Coal requirement	14939 TPD	17934 TPD
Calorific value	5500 Kcal/kg	4990 Kcal/kg
Maximum ash content in coal (%)	Imported coal 10%;	Indigenous coal 34%
Maximum sulphur content in coal	0.8 %	0.6%
Start-up fuels	LDO : 3700 KL/year HFO: 11100 KL/year	

Parameter	Description
Water requirement	15376 m^3/hr
Source of water	Palk Bay
Water transportation	Water intake point at 9°33'3.49"N; 78°58'23"E at a distance of 5.8 km from the shore at a depth of 4.5 m in the sea. The outfall point of the 9°33'38.9"N; 78°59'11.9"E at a distance of 6.5 km from the shore at a depth of 5.0 m in the sea. The land fall point of intake and outfall is 9°34'21.5"N; 78°55'25"E on the sea shore. The intake and outfall points are shown in proposed plant layout **Figure–2.1.** The intake and outfall studies were done by Department of Ocean Engineering, IIT Madras, Chennai Tamil Nadu and the detailed report is enclosed in **Annexure–VII.**
Raw water treatment	Desalination Plant, RO plant and DM plant
Cooling water system	Natural draft cooling tower

2.3 Basic Requirements for the Proposed Project

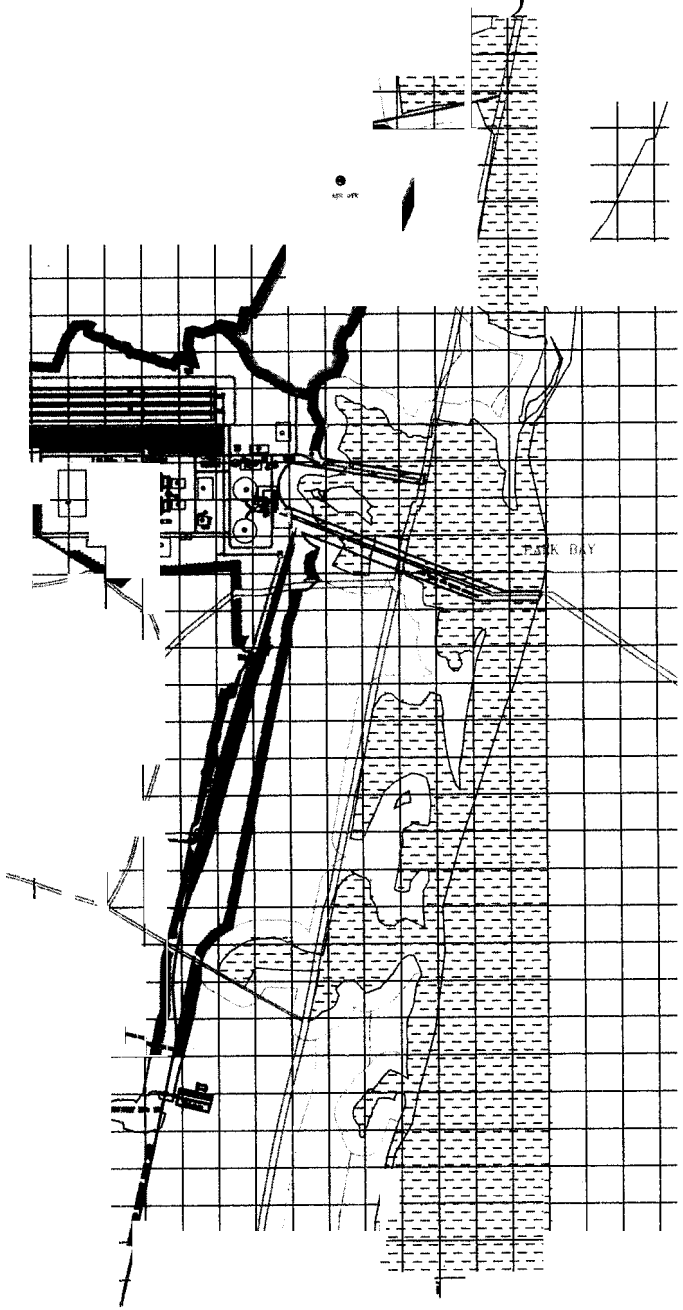
2.3.1 Land Requirement

The total land required for proposed project to accommodate the main plant components, coal yard, water system area and CW system area etc. is 912 acres.

The land requirements are given in the following **Table 2.2**.

Table 2.2: Land Use Break[illegible]f Project A

S. No.	Land Use	Area in Acres
1.	Plant Area	50
2.	Roads & Drains	30
3.	Railway siding	112
4.	Coal Handling system (Coal stack yard)	80
5.	Pipe corridors	25
6.	Water System (cooling tower)	63
7.	Switch yard	60
8.	Facilities (Administrative Building, canteen, service building)	35
9.	Ash Disposal Area	138
10.	Green Belt	275
11.	Infrastructure Facilities (sea water intake trestles, intake & outfall pipe corridors)	44
Total		**912**



SL. NO.	DESCRIPTION	AREA (SQ.M)
1.	TG GENERAT	80
2.	BOILER & MILL b	12k
3.	ESP	100
4.	CHIMNEY	633
5.	T.G. HALL	338
6.	COMPRESSOR ROOM	40(
7.	SERVICE BUILDING	20(
8.	TRANSFORMER YARD	250
9.	400KV GIS SWITCHYARD WITH CONTROL ROOM	22(
10.	DG ROOM	30(
11.	DESALINATION PLANT	60(
12.	DM PLANT	55(
13.	DM STORAGE TANKS	13(
14.	EFFLUENT TREATMENT PLANT	120
15.	COMPRESSOR FOR DRY ASH HANDLING	20(
16.	ASH SILOS	80(
17.	ASH SLURRY AND ASH WATER PUMP HOUSE	48(
18.	SECURITY HOUSE	10(
19.	FIRE OFFICE	3x6
20.	FIRE STATION	18(
21.	ADMINISTRATION BUILDING	80(
22.	CAR PARKING SHED	30(
23.	TWO WHEELER PARKING SHED	30(
24.	DISPENSARY	20(
25.	CANTEEN	30(
26.	STORE	75(
27.	WORKSHOP	75(
28.	PACKAGE BOILER	80(
29.	F.O.S.	50(
30.	FUEL OIL TANKS / PUMP HOUSE	120
31.	ESP CONTROL ROOM	60(
32.	CONTRACTORS OFFICE	100
33.	RAIN WATER HARVESTING	25(
34.	NEUTRALISATION PIT	150
35.	ACID ALKALI STORAGE TANK	20(
36.	CPU REGENERATION BUILDING	22(
37.	NATURAL DRAFT COOLING TOWER	8,(
38.	CW PUMP HOUSE	16(
39.	CW FOREBAY	40(
40.	BOILER MAINTAINANCE BUILDING	10(
41.	MILL MAINTAINANCE BUILDING	10(
42.	PRODUCT WATER/ FIRE WATER PUMP HOUSE	80
43.	ELECTRO CHLORINATION PLANT	30(
44.	HyPLANT	20(
45.	COAL STOCK PILE	60(
46.	CHP CONTROL ROOM	40(
47.	WEIGH BRIDGE	25(
48.	ASH DYKE AREA	1,(
49.	MCC ROOM NEAR MILL BAY	10(
50.	BAY CLAMSHEL	64
51.	ELECTRICAL & CONTROL ROOM FOR ASH HANDLING SYSTEM	17(
52.	CT BLOW DOWN CUM REJECT WATER STORAGE TANK & PUMP HOUSE	40(
53.	PRODUCT WATER/ FIRE WATER STORAGE TANK	60(
54.	ENVIRONMENTAL LAB	42(
55.	MILL REJECT/COMPRESSOR HOUSE & ELECTRICAL/ CONTROL ROOM	15(
56.	MILL REJECT WLD	(
57.	CONDENSATE STORAGE TANK	48(
58.	LOCO SHED	36(
59.	WAGON TIPPLER (4 NOS)	--
60.	INTAKE PUMP HOUSE	15(
61.	ASH RECOVERY PUMP HOUSE	10(

NOTES

LEGENDS

REFERENCE DRAWINGS

CONSULTANTS

REV	DESCRIPTION	DATE
	AS PER IGF/DCO E-MAIL DATED 08.04.13 REC. - FINAL PLANT BOUNDARY UPDATION	
	AS PER ANDELCO E-MAIL DATED 09.04.13 REC. - PLANT APPENDARY UPDATION	
	FINAL SUBMISSION	10.06.13
	FIRST SUBMISSION	16.04.13
	NATURE OF REVISION & EXPLANATION	DATE

DESIGNED	
DRAWN	
CHECKED	
APPROVED	

2.3.2 Water Requirement

The total plant water requirement will be 15,376 m^3/hr. The water is used in different process of the thermal power plant, the main uses are Make-up water for condenser cooling; Cooling of electrical and mechanical auxiliary equipment such as, generators, transformers, compressors, and other heat exchangers; Make-up water for power cycle (boiler make-up); water requirement for ash disposal; Water for miscellaneous services such as Fire-fighting, General services viz. air conditioning, ventilation, service water, dust suppression, potable water for plant and township, etc.

The water requirement includes the drinking water requirement includes the drinking water supply to the nearby villages.

Total present population in the nearby villages of Uppur, Valamavoor and Thiruppalaikudi is about 13000. Considering the life of the power project as 30 years and gradual influx of migrants to service the power plant, the population in the area may triple in size, ie., to about 39000.

As per the IS 1172 – 1993, for communities with population up to 20,000, without flushing system, for supply of water through stand post, the per capita per day water requirement is a minimum of 40 litres. Therefore the water requirement for 13,000 to 39000 persons, an average of 25,000 persons, will be about 1000,000 litres per day of drinking water is required for the three villages and to be supplied.

Table – 2.3 : Consumptive Water Requ rement

S.No.	Consumption	Desalination Water Usage (m^3/hr)			Sea water usage (m^3/hr)		
		DM water	Potable water	Service water	Desalination feed water	CT Makeup water	Electro Chlorination water
1	Heat cycle makeup	50					
2	Make up requirement for CCCW system	2					
3	Chemical feed system	4					
4	H_2 Generation plant	10					
5	Condensate polishing unit	10					
6	Regeneration of DM plant	2					
7	Reject from RO phase-II	26					
8	Potable water requirement plant & township				56		
	Potable water requirement for nearby villages						
10	Service water			100			
11	AHP (Cooling & Sealing)			100			
12	ASH Conditioning			10	280		
13	HVAC Plant makeup			50			
14	Fire Protection System			20			
15	11MLD Desalination plant reject water				660		
16	Ultra filtration reject				122		
17	DAF Clarifier sludge water				304		
18	CT makeup water					13660	
19	Electro chlorination plant feed water						190
	Total						**15376**

Cycle of concentration (COC) ratio considered for proposed plant is 1.3.

2.3.3 Fuel Requirement

Coal

The imported coal will be used as a main fuel in the boiler for the proposed project with a capacity of 2x800 MW super critical technology thermal power plant. The imported coal will be transported from Tuticorin Port Trust to the project site through the existing railway line from Tuticorin to Ramanathapuram and then by laying a private siding from Ramanathapuram to the project site. TANGEDCO has carried out the feasibility study for transporting the coal from Tuticorin Port to the site through rail route by M/s RITES. The coal requirement is 4.64 million metric tonnes per annum (MMTPA) with 85% PLF by using 100% imported coal and 5.57 MMTPA with 85% PLF blended coal with the ratio of 30% indigenous coal and 70% imported coal as optional. The coal characteristics that will be used in the power plant are given in **Table-2.4.**

Parameter	**Concentration**	
	Imported Coal	**Indigenous coal**
Proximate Analysis	(% by weight)	(% by weight)
Fixed carbon	42.20	28.98
Volatile matter	32.00	25.02
Moisture	21.00	12.00
Ash	10.00	34.00
Ultimate Analysis		
Gross Calorific Value (GCV)	5500 Kcal/kg	3800 Kcal/Kg
Carbon	58.20	39.05
Hydrogen	3.57	3.10
Sulphur	0.80	0.65
Nitrogen	1.20	0.89
Oxygen	10.63	10.31
Lead	0.004	0.004
Mercury	0.09	0.09

Fuel Oil

The coal fired boilers require fuel oil for light up and also to stabilize the flame and raise the steam up to 30-35% of boiler capacity. Light Diesel Oil (LDO) will be used for cold start and Heavy Fuel Oil (HFO) will be used as flame support of fuel at low loads and flame stabilization. The requirement of HFO for 2x800 MW power station is estimated as 11100

kilolitres per annum and LDO 3700 kilolitres per annum. Two storage tanks of each 500 m^3 volume is considered. LDO will be pumped by pressurizing pumps from the storage tank to the boiler for start-up. HFO will be stored in two numbers storage tanks each of capacity 2000 m^3.HFO will be pumped by pressurizing pumps from the storage tank to the boiler for low load operation and flame stabilization. Two HFO heaters (1W + 1S) will be used on the discharge side of HFO pressurizing pump with stream heating arrangement. HFO tanks will be provided with steam tracers, mat coil heaters, suction heaters. The HFO piping will have steam tracers for heating. The complete HFO system will have thermal insulation. The DG set requires HSD. One storage tank of 300 m^3 volume is considered. The expected characteristics of fuel are given in **Tables 2.5 & 2.6.**

Table – 2.5
Characteristics of LDO Diesel Fuels (IS: 1460-1974)

S. No.	Parameter	Value
1.	Acidity	Nil
2.	Ash%, by mass (max)	0.02
3.	Carbon residue %, by mass (max)	1.50
4.	Pour point, Max	12^{0}C for winter, 18^{0}C for summer
5.	Flash point	56^{0}C
6.	Kinematic Viscosity, cs at 38^{0}C	2.5-15.7
7.	Sediment %, by mass (max)	0.1
8.	Sulphur content by mass (max.)	1.8%
9.	Water content, % by volume, Max.	0.25
10.	Gross Calorific value kCal/kg	10,300
11	Specific gravity	0.85 at 15^{0}C

Table – 2.6
Characteristics of the HFO Grade MV2 (IS: 1593)

S. No.	Parameter	Unit	Value
1.	Flash point	^{0}C	66
2.	Viscosity @ 15^{0}C Max.	Cst	180
3.	Pour point	^{0}C	21
4.	Ash content by weight	% max.	01
5.	Free Water content by volume	% max.	1.0
6.	Sediments by weight	% max.	0.25
7.	Total sulphur by weight	% max.	4.0
8.	Calcium	ppm	30.5
9.	Sodium	ppm	10
10.	Lead content	ppm	0.2
11.	Vanadium	ppm	40.50
12.	(a) Carbon residence (Rams bottom)	% wt	7.74
14.	(b) Approximate gross calorific value	Kcal/kg	10,000
15	(c) SP gravity at 15^{0}C Max.		0.933

2.4 Utilities

Various utilities will be provided for smooth and efficient functioning of the proposed 2x800 MW power plant. These include the following:

2.4.1 Water

The proposed scheme of water utilities for Power Plant consists of the following:

- Raw water supply and pre-treatment system
- Condenser cooling water (CW) system
- CW Make up water system
- Auxiliary cooling water (ACW) system (DM Water)
- Water treatment (Demineralised water (DM) system)
- Service & potable water system
- Fire protection system
- Effluent treatment plant

The overall water balance schematically is shown in **Figure 2.2**

2.4.2 Raw Water Supply System

The water system consists of various sub-systems listed below:

- Raw Water System
- Condenser Cooling Water (CW) System
- Auxiliary Cooling Water (ACW)
- Desalination System
- De-Mineralization (DM) Water System
- Service & Potable Water System
- Effluent Treatment System
- Fire Water System

The water is used in different processes of the thermal power plant, the main uses are Make-up water for condenser cooling; Cooling of electrical and mechanical auxiliary equipment such as, generators, transformers, compressors, and other heat exchangers; Make-up water for power cycle (boiler make-up); water requirement for ash disposal; Water for miscellaneous services such as Firefighting, General services viz. air conditioning, ventilation, service water, dust suppression, potable water for plant and township, etc.

The seawater will be abstracted by means of a pipeline along a jetty. Trestles will be provided for jetty. The sea water will be drawn through an intake well of 15m diameter at a

distance of 5.8 km into the sea at a depth of 4.5m. The coolant water will be discharged at a depth of 5.0m, at a distance of 6.5km into the sea through diffusers as per the mathematical modelling study report of IIT Madras. The intake and outfall pipelines will be laid over Jetty. The height of the Jetty and the support piling will be located such that it enables free movement of fishing boats.

The intake/outfall pipelines will follow a common corridor from landfall point at shoreline to offshore location at 4m contour which is at a distance of approximately 5.5-6.0 km. The separation distance between intake and outfall will be 2.0 km as suggested by model studies done by IIT Madras. Locating the outfall at deeper water will enable better dilution of effluent. While the intake is provided at a location away from outfall and where circulation of water will be better due to higher currents in lower depth. The total length of intake line will be about 6 km and outfall line will be 7 km. The length of common stretch is about 5.25 km.

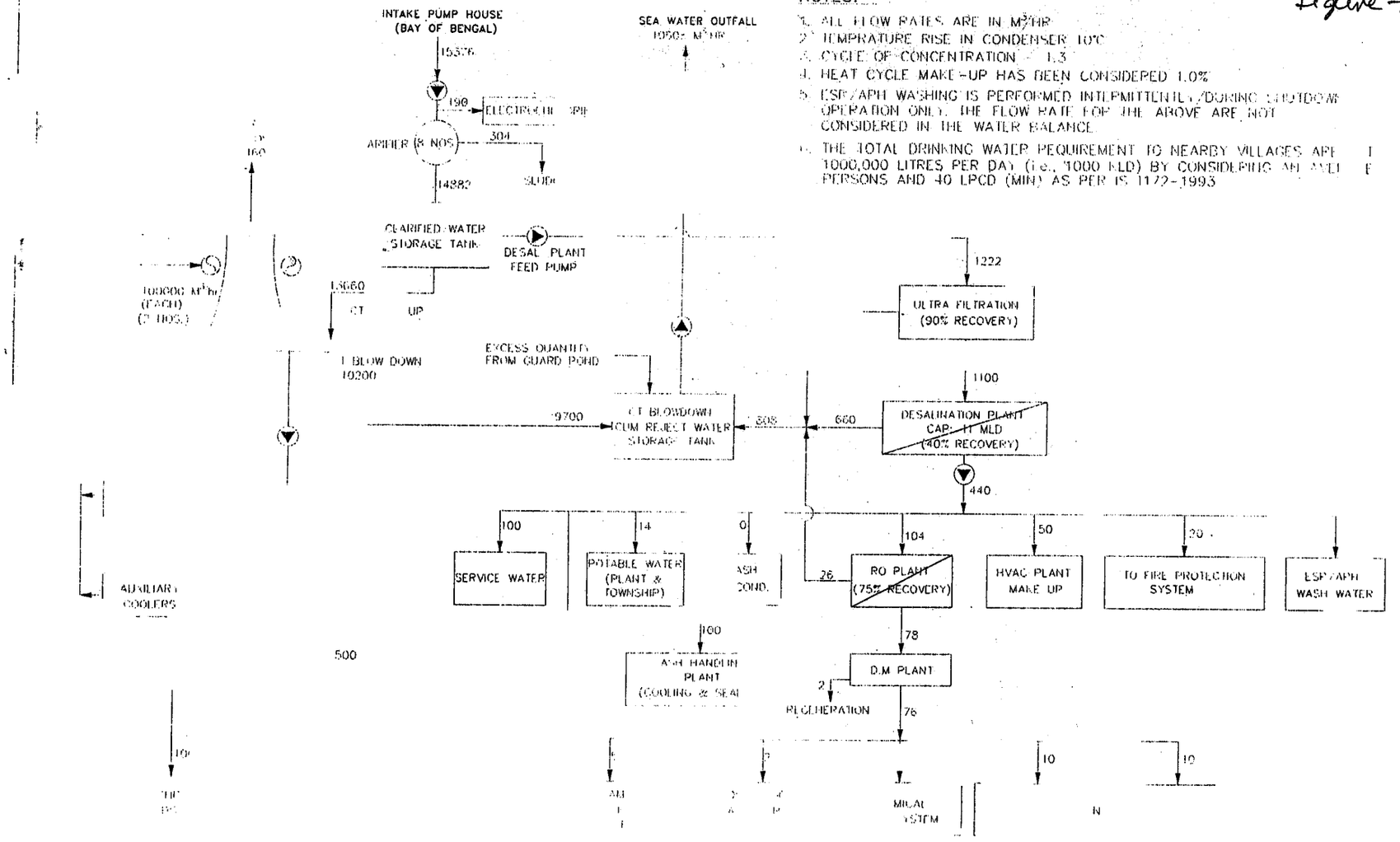
Glass Reinforced Plastic (GRP) pipe up to plant site and outfall pipe size would be one number 1600 mm dia. Duplicate cross country line considered would eliminate the possibility of disruption water supply system through long stretch of pipe line. Sea water at the plant end would be clarified in the DAF (Dissolved Air Flotation) Clarifier. The clarified water would be transferred to cooling tower basin through intermittent clarified water storage tank. From cooling tower basin condenser cooling water requirement would be met by use of condenser cooling water circulating pumps.

A part of sea water 1222 m^3/hr would be taken to desalination plant and treated from the intermittent clarified water storage tank by use of desalination plant feed pump. Treated water from the desalination plant would be pumped to desalinated water cum fire water storage tanks with twin compartment having capacity of 5000 m^3 each to cater the treated water requirement for the proposed station.

Desalinated RO water will cater to the requirement of service water, potable water, ash conditioning, RO-DM plant, HVAC (Heating, Ventilation and Air Conditioning) system, ash handling plant (cooling & sealing), ESP/APH washing and firefighting system make-up. The treated water of 190 m^3/hr would be electro-chlorinated and used as potable water for the plant and nearby villages, stilling chamber of pretreatment plant, NDCT forebay of cooling water system and seawater intake system. Closed cycle cooling system with Natural Draft Cooling Towers (NDCT) are proposed for this project.

DM water will be used for heat cycle make-up and as primary coolant in heat exchangers for the auxiliary cooling system of boiler, TG auxiliaries and other common auxiliaries. The heated DM water would be subsequently cooled in 3x50% capacity (2W+1S) plate type heat

Figure-2.2



NOTES:-

1. ALL FLOW RATES ARE IN M³/HR
2. TEMPRATURE RISE IN CONDENSER 10°C
3. CYCLE OF CONCENTRATION = 1.3
4. HEAT CYCLE MAKE-UP HAS BEEN CONSIDERED 1.0%
5. ESP/APH WASHING IS PERFORMED INTERMITTENTLY DURING SHUTDOWN OPERATION ONLY. THE FLOW RATE FOR THE ABOVE ARE NOT CONSIDERED IN THE WATER BALANCE.
6. THE TOTAL DRINKING WATER REQUIREMENT TO NEARBY VILLAGES ARE 1000,000 LITRES PER DAY (i.e., 1000 KLD) BY CONSIDERING AN AVERAGE PERSONS AND 40 LPCD (MIN) AS PER IS 1172-1993

WATER BALANCE DIAGRAM

2x800MW UPPUR THERMAL POWER PROJECT

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED

DEVELOPMENT CONSULTANTS PVT. CONSULTING ENGINEERS

exchangers for TG auxiliaries and 2x100% (1W+1S) capacity plate type heat exchangers for SG auxiliaries for each unit using sea water from cooling tower basin through a set of auxiliary cooling water pumps in the secondary circuit. Auxiliary cooling water is tapped from main cooling water line before condenser inside the TG building and 3x50% capacity (2W+1S) booster pumps for each unit are provided to meet the head required for the system.

Cooling water in circulation would be 2,00,000 m^3/hr including the requirement of auxiliary cooling circuit for 2x800 MW unit. The CW system will be adequately dozed with NaOCl (Sodium hypochlorite) to arrest biological growths. The Cycle of Concentration (COC) will be maintained 1.3. The total makeup water requirement for cooling circuit at full load is 13660 m^3/hr. The blow down from the cooling towers will be 10200 m^3/hr. 400 m^3/hr blow down will be used for ash handling system and 100 m^3/hr of blow down will be used for dust suppression in coal handling plant. About 9700 m^3/hr excess quantity CT blowdown, 122 m^3/hr UF rejects, 660 m^3/hr desalination rejects, 26 m^3/hr RO plant reject and excess quantity 100 m^3/hr of treated effluents from CMB would be pumped to sea water outfall system through CT blow down cum reject water transfer pumps taking suction from CT blow down cum reject water storage tank.

2.4.3 RO-DM Plant & Heat Cycle Make-up System

The DM plant will meet the requirements of steam generator (SG) feed water make up, ACW system make-up and plant / colony potable water. It will be designed an average of 1.0 % make-up for the heat cycle and accounting for four hours regeneration time, three demineralizing chains of 39 m^3/hr capacity each are proposed for this unit. In the proposed DM plant two streams will be in operation and one stream will be as standby. DM plant will also supply heat cycle make-up, the make-up requirement for primary water circuit of stator cooling system, chemical feed system, CPU make-up and DM water requirement for the hydrogen generation plant.

Desalinated water would be pumped to RO-DM plant for demineralization. In the RO-DM plant, desalinated water will be passed through RO plant (stage-II) and then to mixed bed exchangers. The demineralized water will be stored in DM water storage tanks. Acid and alkali handling, storage and feeding system will be installed for the DM plant resin regeneration. The DM water produced in the plant would then be taken to two DM water storage tanks, each of 1000 m^3 capacity to meet the total requirement in case of any exigency. DM water from the storage tanks would be transferred to unit condensate storage tanks by 2x100% capacity DM transfer pumps.

2.4.4 Coal Handling System

The Coal Handling System proposes receipt of coal by railway for 2x800 MW units. The proposed power project is planned to be used with 100% Imported coal. However, the option of blended coal usage is also considered (Indigenous- 30%, Imported- 70%).

The wagon tippler shall be provided with integral weigher. Conveying system shall be of 2000TPH rated capacity and 2400TPH design capacity. Three (3) nos. self-propelled, hydraulic driven, rail mounted, stackercum-reclaimers with adequate slewing and luffing arrangement would be used to stack or reclaim crushed coal from the stockpiles. Coal storage in the (4) stacks is considered for 45 days. The uncrushed coal (-50 mm) from the wagon tippler would be conveyed to the crusher house. In the crusher house coal would be sized down to (-) 25 mm in 4 x 50% Ring granulator after screening the fines in roller screens preceding the crushers and further conveyed through conveyor 3A/B & 4 A/B to stockpile (By conveyor 5 & 6) or same shall be conveyed to the bunker. The crushed coal would then be taken to the mill bunkers by the conveyors BCN 8A/B to 16 A/B. In the unlikely event of outage of both stacker-cum-reclaimer, there would be provision of emergency coal feed system to the bunker through emergency reclaim hopper. Bulldozers and pay loaders may be used to feed limited amount of coal to the reclaim hoppers ERH-1 from the stockpile.

Eleven (11) nos. belt weighers, one (1) no. coal sampling units, flap gates as required, eight (8) nos. in-line magnetic separators, two(2) nos. suspended magnet type separators and eight (8) nos. metal detectors etc. would be provided to ensure satisfactory operation. A centralized control room with PLC based control system located near the primary crusher house is proposed for operation of the Coal Handling System. Another control room near the wagon unloading house is proposed for control and record of unloading of coal wagons. Special precaution will be taken to control pollution by providing dust extraction and dust suppression arrangements in unloading as well as different transfer points and stockpile areas. Adequate ventilation system would be provided for the underground tunnels, transfer points and at bunker level. Fire hydrant ring main encompassing the coal stacks and the conveying system has been proposed to combat fire. CHP control room, conveyor and cable gallery, spreader room to be equipped with appropriate fire alarm and protection system to combat incidence of fire. Necessary water distribution network for drinking and service water would be provided for distributing water at all transfer points, crusher house, control rooms etc.

2.4.5 Ash Handling System

The ash generated in the furnace by burning coal needs to be removed periodically/ continuously to avoid undue build-up in the furnace bottom/flue duct hoppers and resultant

obstruction. For Ash Handling System of the proposed power station, the system proposed is described hereinafter. The wet disposal system will be adopted for Bottom ash. Fly Ash Handling system with dry extraction (through pneumatic vacuum conveying) from fly ash hoppers, air preheater hoppers and stack hoppers and dry conveying (through pneumatic pressure conveying) to storage silo. The system will be 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. During emergency condition provision will be made for ash slurry (for fly ash ash) to be transported in pipe from silo to slurry sump then to ash pond. Sea water will be used for the emergency disposal system The quantum of ash generation would depend on the plant load factor and the quality of coal being fed. In keeping with the design system capacity proposed for coal handling plant, worst coal parameters from the source mentioned earlier is used for equipment selection of the Ash Handling Plant. It is planned to use 100% Imported coal. However, the option of blended coal usage is also considered (Indigenous- 30%, Imported- 70%) for 2x800 MW unit. The ash handling system shall be designed considering 20% of ash for the coal. The conveying system shall be designed assuming the percentage of fly ash 80% and bottom ash as 20% of total ash generated, usual for such application. The conveying capacity for bottom ash conveying shall be selected as 8 Hrs of ash generation to be evacuated once in shift in 90 mins and for Fly ash handling system as 8 Hrs of ash generation to be evacuated in 4.5 hrs. The following data has been considered for design of ash handling system:

a. Hourly coal firing rate at MCR condition

For one unit (Imported coal) : 372T

b. Ash content in coal considered

for ash disposal area calculations : 20%

c. The maximum ash collection at various hoppers for design will be:

- Bottom ash hopper : 25% (maximum)
- Economizer ash hoppers : 5% (maximum)
- Fly ash in ESP hoppers : 90% (maximum)
- Fly ash in APH hoppers : 5% (maximum)
- Stack hopper : 0.5% (maximum)

Capacity and Time Cycle

a. MCR coal firing rate per unit : 372 TPH

b. Rate of ash generation for design of

Equipment (20 % of (a)) : 75 TPH

c. Rate of bottom ash and economiser : 22.5 TPH

Formation (30% of (b))	
d. Total bottom ash formed in 8 hours	: 180 T
e. Time required for removing bottom ash	
Formed once in a shift	: 90 min
f. Bottom ash system capacity required	: 120TPH
g. Rate of fly ash formation (95.5% of (b))	: 72TPH
h. Total fly ash formed in 8 hours per unit	: 576T
i. Time required for removal of fly ash	
generated in 8 hours	: 4.5hours
j. Fly ash system capacity required	: 128 TPH

Wet Bottom Ash System

Bottom Ash Handling system shall be provided with refractory lined, water impounded, maintained level, two V-Section type steel- fabricated bottom ash hopper having a hold up volume to store bottom ash preferably for a period of eight (8) hours. Under each V-Section, there shall be two (2) outlets. Each outlet shall be fitted with a feed gate, clinker grinder, feed sump, jet pump and set of piping and valves designed for removal of the ash in slurry form. Out of four outlets, only three (2) outlets (one from each V-Section) will be operating simultaneously. The slurry thus formed shall be transported to the common slurry sump through pipes (running on pipe racks). Bottom ash system operation will be controlled from bottom ash local panel. The coarse ash collected from the economizer hoppers is connected to the bottom ash hopper top (above the maintained water level) by means of an adequately sized sloping pipe for transporting slurry by gravity.

Bottom ash and economizer ash generated in eight (8) hours will be cleared in about 90 minutes period once in a shift. Bottom ash generation will be calculated at 100% worst coal. Ash generation during soot blowing also to be considered for conveying capacity selection.

Hydraulically operated bottom doors are located at the bottom of transition hopper. Ash storage time is provided by closing these gates, if required in order to perform any maintenance work on downstream equipment, with the boiler still under operation.

Fly Ash Handling System

The fly ash will be collected from ESP hoppers, air pre-heater hoppers, duct hoppers and stack hopper and will be designed to collect fly ash in dry form in RCC silo using vacuum cum pressure pneumatic system.

For collecting fly ash in dry form, the system will be designed such that, the fly ash and conveying air mixture will be conveyed to buffer hopper through bag filters. The fly ash will

be sequentially extracted from these hoppers by creating vacuum in the extraction piping circuit with the help of vacuum pumps. Adequately sized fly ash piping streams per unit will be provided. All the streams will be in operation simultaneously for fly ash removal. The fly ash from buffer hopper will be conveyed to RCC silo by using air compressors / blowers. There will be two ash feeder vessels below each Buffer Hopper, out of which one will be operating and the other will be standby. A vent filter will be mounted on the silo to vent out the air and to reduce the environmental pollution. The system controls will be such that, it will be possible to stop unloading fly ash from any hopper or to bypass any hopper, as desired by the operator. Fly ash removal of each unit at full load will take about 4.5 hours in a shift of eight (8) hours for ash collected in various hoppers while firing coal.

Disposal of Fly Ash from Silo

Dry fly ash from the air pre-heater, stack hopper and ESP hoppers will be collected in the fly ash storage silo. There will be four fly ash storage silos, common for two units. The storage silo will be designed to have a storage capacity twenty four (24) hours. The dry fly ash collected in the storage silo will be disposed in the dry conditioned form. Three number of unloading arrangement will be provided. The fly ash will be unloaded in dry form at the rate of 90 TPH through rotary feeder in each outlet.

i. One opening for closed truck disposal through telescopic chute

ii. One opening for open truck disposal through dust conditioner.

iii. *One opening for emergency slurry disposal through mixing tank.*

iv. *One blanked opening for future.*

Emergency Slurry Disposal System

Ash slurry from Fly ash from silo (during emergency condition) will be transferred to common ash slurry sump then from where it will be disposed to ash pond by means of slurry pumps. There will be three streams of pumps (Streams -1W+2S) and in which three pumps in series in each stream. The slurry pumps are expected to operate continuously for ash slurry disposal. Each time at the end of disposal of ash slurry in a shift, complete disposal line will be flushed with water in order to prevent settling of ash inside the slurry pipe lines.

Ash Disposal Area

Ash will be transported to ash pond in the land identified near the plant. Ash slurry will be dumped into the disposal area would be contained in the ash pond by constructing bunds around the periphery of the disposal area. The ash pond will be lined with impervious lining such as HDPE sheets, which will provide a perfect lining for the ash ponds. The HDPE geo-

membrane has a lower tendency to exchange ions with leachate constituents and maintains its integrity as a barrier over a long period of time. The garland drains around the ash pond site will be provided for the collection of run-off water during monsoon season. Ash slurry sump will be built inside the premise to collect the bottom ash slurry and fly ash slurry during emergency.

2.4.6 Fire Protection System

The design and installation of complete fire protection system shall in general comply with regulations of Tariff Advisory Committee (TAC) of India In the absence of TAC regulations; the National Fire Protection Association (NFPA) standard shall be adopted. All equipments, special purpose fittings, couplings or accessories shall be approved and certified for use in fire fighting system application by UL / FM. 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.

i) Hydrant System for entire area of power plant

ii) High Velocity Water Spray System (HVWS) for Generator transformer, Interconnecting transformer, Unit transformer, Unit auxiliary transformer, Station transformer & all other oil filled transformers of rating 10 MVA and above, Turbine lube oil canal pipe lines in main plant, Boiler burner front, Main lube oil tank, Clean and Dirty lube oil tanks, Boiler feed pumps & its accessories and Generator seal oil unit.

iii) Medium Velocity Water spray system for Cable gallery/Cable spreader room, Coal conveyors, Transfer points and Crusher houses, Fuel oil pump house, Fuel oil storage tanks and DG set room including diesel oil tank for DC.

iv) Foam system for Fuel oil storage tanks

v) Portable and mobile fire extinguishers for entire plant

vi) Fire tenders

vii) Inert Gas System for Central Control Room, Control Equipment Room, Computer Room and UPS & Inverter Room in the TG building

viii) Fire Detection and Alarm system for all Central Control rooms/Local Control Room, Control Equipment Room, battery rooms, all switchgear rooms / MCC rooms, Cable spreader rooms and Computer rooms located in Power block and BOP area, Detection system for various equipment and in other auxiliary buildings cable spreader, MCC room and Control room.

ix) All necessary instruction and warning plates.

x) All necessary facemasks, fire jackets, breathing and resuscitation apparatus and/or other protection devices for optimal protection of the personnel.

Hydrant System

The hydrant system shall consist of a large network of pipe, which shall feed pressurised water, to a number of hydrant valves and water monitors. The system shall consist of a network of piping installed underground and above ground around areas to be protected, hydrant valves (external/internal), hoses, hose cabinets, couplings, branch pipes & nozzles. External hydrants shall be located all around the periphery of buildings and internal hydrants shall be provided at each landing floor of staircases and other necessary places through above ground main. Outdoor type fixed water monitors will be provided for ESP areas and other areas in the coal conveyors at locations where water cannot reach from hydrant system. Hose pipes of suitable length fitted with standard accessories like hose coupling, branch pipes and nozzles shall be located in Hose houses (for outdoor hydrants) and in Hose boxes (for indoor hydrants). Each riser in the building shall be provided with an air release valve at the highest point and an isolation valve & a drain valve at the lower most point.

High Velocity Water Spray (HVWS) System

HVWS system shall automatically detect, control and extinguish any outbreak of fire and simultaneously give audible alarm. A pipe network fitted with quartzoid bulb detectors/ probe type heat detectors shall be provided around equipments / tanks to be protected. This pipe network shall be kept pressurised by water tapped from the upstream side of a deluge valve provided at the riser of HVWS main. The downstream of the deluge valve shall also be connected to a dry pipe network having strategically located open spray nozzles around the Equipments / tanks. In case of fire, the quartzoid bulbs will break thereby releasing the pressure in the detector network. This shall hydraulically open the deluge valve thus allowing water into dry pipe network which is sprayed on to the equipments / tanks through projector nozzles in the form of a solid conical emulsifying spray. Local audible alarm will be produced by water motor gong.

Medium Velocity Water Spray (MVWS) System

The medium velocity spray system shall 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 spray nozzles shall discharge a cone of water spray consisting of medium size droplets of water. The water supply to the MVWS system shall be controlled by a deluge valve which shall operate hydraulically on release of water pressure.

In order to avoid total flooding of the entire area of cable gallery / coal conveyor system, the area to be protected by MVWS system shall be divided into number of zones. Each zone

shall have separate water supply network controlled by a deluge valve. A fire detection system provided for the MVWS protected area shall sense fire and 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 shall be opened.

The cable galleries shall have number of rows of cable trays and each row will have number of tiers of cable trays. Each of the cable rows shall be provided with a network of water distribution pipes with nozzles. The distribution network shall consist of distribution header for each row of cable tray and on these headers drop pipes shall be provided so as to cover all the tiers. For cable gallery/cable spreader rooms, analogue addressable smoke detector in cross zoning principle supplemented with linear heat sensing cable of non-electrically operated fibre optic type shall be used for detection of fire. Upon detection of fire, MVW spray system shall be brought into operation by automatic opening of deluge valve, which shall allow the projectors located in those areas to feed water in the form of spray, which in turn, will cut off oxygen supply and extinguish the fire.

The MVWS system for coal conveyors shall be provided for both forward and return conveyors. Hoppers and feeders shall also be covered. Fire in the coal conveyor will be detected by quartzoid bulbs, linear heat sensing cables and infrared spark / ember detectors which shall provide signal for electrical actuation of deluge valve.

The MVWS system for fuel oil pump house shall be designed considering the pump house as a single zone. A network of pipes with spray nozzles shall be located near the roof of the pump house which shall be connected to a deluge valve. The fire in the fuel oil pump house shall be detected by a detection system comprising of quartzoid bulb detectors which shall actuate the deluge valve.

Probe type heat detectors shall be used for detection of fire in the fuel oil storage tanks and quartzoid bulb detectors shall be used in DG room in addition to heat detectors.

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 foam tank, foam eductor, foam maker, fixed piping, valves, nozzles, etc.

Inert Gas System

Inert gas system will automatically detect and suppress fire within a protected area. The system will be a total flooding fire suppression system with automatic detection and agent release capability. Complete system design will be in accordance with NFPA.

Potable and Trolley Mounted Fire Extinguishers

Portable and trolley mounted fire extinguishers of suitable capacity, rating and medium such as water, CO_2, foam, Dry Chemical Powder (DCP) with standard accessories in adequate numbers as per TAC covering all the buildings in the power plant premises will be provided.

2.4.7 Hydrogen Generation Plant

Hydrogen gas is used for generator cooling. Supply of pure hydrogen is essential for generator filling and maintaining of hydrogen gas pressure inside the generator casing. The suitable type of hydrogen generation plant shall be selected. Hydrogen is prepared by electrolysis of pure demineralised water. When D.C. current is passed through water it decomposes the water into two elements, one volume of oxygen and two volumes of Hydrogen. Oxygen gas produced is separated and vented to atmosphere. Hydrogen gas is compressed, purified in filters and passed through drier to meet the hydrogen purity requirement of 99.9%. The hydrogen after filtration and purification will then be passed on to a cylinder filling manifold. Hydrogen leak detectors will be provided in the hydrogen area to give alarms for safety purpose in case hydrogen level in atmosphere rises above the safe limits. The suitable capacity Hydrogen generation plant with three (3) streams (2W+1Common standby for 2x800MW) each of 100% capacity shall be provided. Three (3) nos. of hydrogen compressors to compress hydrogen gas up to 150 bar will be provided. The complete hydrogen generation plant system, equipment, layout etc will be designed to meet the requirement of the Explosives Rules/ Act.

2.5 Process Description

In thermal power generation, chemical energy of coal 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).

2.5.1 Power Generation Process

The power generating units will consist of boilers, turbo-generators with accessories, transformer and other complementary parts. Coal from the coal handling plant will be transported to the boiler bunkers through Conveyor belts. Thereon, the pulverized coal will be fed to the boiler furnace with the help of heated air driven by primary air (PA) fans.

Forced draught (FD) fans will provide additional controllable air to the burners to assist desirable combustion.

This combustion will produce ash, out of which the bottom ash will fall to the bottom of the boiler. The fly ash carried in the flue gases will travel through the electrostatic precipitators (ESP) where it will be precipitated on the high voltage electrodes. The relatively clear flue gas will pass through the stacks with the help of induced draught (ID) fans.

The bottom ash will be collected in wet form and disposed as ash slurry into the demarcated ash disposal area. The dry fly ash, stored in the silos will be transported through closed /covered trucks. Bottom ash slurry from Bottom Ash Hopper will be conveyed to ash slurry sump by the jet pumps below the Bottom Ash Hopper. Fly ash from the intermediate fly ash surge hopper/ buffer hopper will be conveyed in slurry form to the ash slurry sump through wetting unit, collector tanks and air washer unit by the jet pumps provided below the surge hoppers/ buffer hoppers. The Fly ash slurry and bottom ash slurry will be pumped from the ash slurry sump to the ash pond one after the other in each shift. Horizontal centrifugal pumps will be provided for this purpose. Two series of pumps and one pipeline associated with each series will be provided. Each series consists of two slurry disposal pumps. One series of pumps and one pipeline will be operating while the other series of pumps and pipeline will serve as stand by. HDPE impermeable lining will be applied for ash pond area.

The heat released by the burning coal is absorbed by the demineralised boiler feed water passing through the boiler wall tubing to produce high-pressure steam. The steam will then be discharged onto the turbine blades, which will make the turbine to rotate. The generators coupled to the turbines will also rotate and produce electricity. The electricity will pass to the transformer, which will increase the voltage to the desired level of the transmission grid system.

Thermodynamic Cycle

The thermo-dynamic cycle will consist of super critical Boiler, the Steam Turbine, the condenser, the condensate extraction and boiler feed systems, the condensate and feed water heaters along with all other necessary equipment for single reheat, regenerative feed heating system. A single reheat steam cycle with regenerative feed heating system is proposed. Project specific HBD (Heat Balance Diagram) shall be provided by turbine vendor. Heat balance diagram is based on 'Zero' make-up, 33°C condenser cooling water inlet emperature with condenser back pressure of 77mm of Hg. As shown in the scheme and heat balance diagram, the main steam from the boiler, after expansion through the HP turbine, would be sent back to the boiler for re-heating. The reheated steam, after expansion

through the double flow IP turbine & then through two double flow LP casing would be exhausted into the respective condensers. The exhaust steam from the LP turbine would be condensed by circulation of cooling water. Vacuum would be maintained in the condenser by 2x100% (1W+1S) capacity vacuum pumps. The LP feed heating system would consist of three(3) to four(4) stages of low pressure heaters, one(1) gland steam condenser, one(1) drain cooler for the low pressure heater, drain flash and one(1) deaerator. HP feed heating system will consist of two (2) 50% capacity parallel trains of high-pressure heaters. However, number of heaters varies from manufacturer to manufacturer. The condensate from the hot well would be extracted by 3 x 50% capacity condensate extraction pumps (2 working + 1 standby) and pumped to the deaerator through gland steam condenser, drain cooler and the LP heaters. The feed water after being de-aerated in the deaerator would be pumped to the boiler through the high-pressure heaters. Provision would be kept for dosing hydrazine solution in the condensate extraction pump discharge and in deaerator feed tank or boiler feed suction line for oxygen scavenging and pH control of the feed condensate steam cycle. For the unit 2x50% turbine driven & 1x30% motor driven BFP with booster pump mounted on common shaft is envisaged. Normally the steam-driven pumps would be in operation. The boiler feed pumps would be provided with lube oil system, automatic leak off and minimum flow re-circulation valves. Motor-driven BFW pump would be provided with modulating variable speed hydraulic coupling. Condensate drain from the HP heaters would be cascaded to the deaerator feed storage tank and the condensate drains from the LP heaters would be cascaded to the condenser through the drain cooler. The auxiliary steam for the station would be divided into two subsystems, One Boiler Auxiliary Steam (BAS) and other Turbine Auxiliary Steam (TAS). Both BAS & TAS would receive steam supply after pressure reducing & de super heating from the inlet of boiler final SH & CRH line.

The auxiliary steam supply system of the unit would supply steam to the deaerators, turbine gland sealing system during light load and start-up conditions. Auxiliary steam will also be supplied for soot blowing, atomisation system etc. The units will also be provided with HP and LP Turbine bypass system for quick start and large load rejections. The turbine generator units would be so designed that these will be capable of cyclic duty and frequent start-ups and shutdowns during the lifetime. The salient features and parameters of major equipment of the 800 MW sets are furnished hereinafter. The details of the units may vary to some extent as per vendors' standard product.

Steam Generator

The steam generator (SG) will be designed for firing 100% coal and will be with assisted circulation and drum type. The SG will be of two pass design, radiant, single reheat, balanced draft, semi-outdoor type, rated to deliver 360 t / hr of superheated steam at 179 atmosphere pressure and 540°C when supplied with feed water at a temperature of 252°C at the economiser inlet. The reheat steam temperature will also be 540°C.

The steam generator will be provided with coal mills on either side of the furnace, along with individual raw coal gravimetric feeders and coal bunkers. Sampling arrangement at mill outlet will be provided for purpose of establishing the average gross calorific value of coal as well as coal fineness. The coal mills will be provided with steam blanketing system for the purpose of fire protection. The SG will be designed to handle and burn HFO as secondary fuel up to 22.5 % MCR (maximum continuous rating) capacity and flame stabilization during low-load operation. For unit light up and warm up purposes HFO will be used with air atomization. The required fuel oil pressurizing units and fuel oil heating equipment will be provided. High-energy electric arc igniters will be provided to ignite the fuel oil guns.

The steam generator will consist of water cooled furnace, radiant and convection super-heaters, re-heaters, economizer, regenerative air heaters, steam coil pre-heaters, etc. Soot blowers will be provided at strategic locations and will be designed for sequential fully automatic operation from the unit control room.

The draft plant will comprise of primary air fans, forced draft fans, and induced draft fans. Electrostatic precipitator (ESP) and fly ash hoppers will be provided for the collection of fly ash. The ESP will be designed with one field standby for design coal firing and with no field standby for worst coal firing, to achieve an outlet dust concentration of 50 mg / Nm^3 (Max) as stipulated by the State / Central Pollution Control Board.

Steam Turbine

The steam turbine generators (STG) will be rated for 800MW maximum continuous output at the generator terminals, with throttle steam conditions of 255 bar and 565°C steam temperature and 0.1 bar back pressure. The steam turbine will be a reheat extraction condensing turbine. The STG output, at valve wide-open (VWO) condition could be 800 MW. Steam turbine will be a two/three/ cylinder reheat, extraction and condensing turbine.

The turbine-generator will comprise all accessories such as protection system, lube and control oil systems, seal oil system, jacking oil system, seal steam system, turbine drain system, 60% MCR HP / LP bypass system, electro-hydraulic control system, automatic

turbine run-up system, on-line automatic turbine test system and turbine supervisory instrumentation. The turbine-generator will also have all necessary indicating and control devices to permit the unit to be placed on turning gear, rolled, accelerated and synchronised automatically from the control room. Other accessories of the turbine-generator will include an oil purification unit with transfer pumps and clean and dirty oil storage tanks of adequate capacity.

A surface type gland steam condenser will be used to condense the gland steam exhausted from the turbine glands. The gland steam condenser will be of single-pass type with the main condensate flowing through the tubes to condense the steam. Exhausters will be provided to evacuate the air from the shell side and maintain the shell at the required negative pressure.

Table – 2.7: Steam Turbine & Auxiliaries

Specification	Unit	Design Data
Type	-	Tandem compound
Number of cylinders	-	4
Type of governing	-	Electro hydraulic
Speed	RPM	3000
Rated output (continuous)	kW	800,000
Steam pressure before Emergency stop valve	$Kg/cm^2(a)$	255
Main Steam temperature before emergency stop valve	°C	565
Reheat steam inlet pressure	Kg/cm^2	54
Reheat steam outlet temperature	°C	593
Number of LP exhaust connections	-	Two
Steam flow required for 800 MW	T/hr	2510 (max)
Rated pressure at exhaust of LP turbine	bar	77 mm of Hg
Temperature rise of circulating water	°C	10 (max)

Table – 2.8 : Parameters of Boiler and Auxiliaries

Particulars	Units	Boiler (Maximum continuous Rating)
SH Steam flow	TPH	2710
Outlet Pressure	Kg/cm^2	259.5(a)
Temperature	°C	569
RH Steam flow	TPH	1954 (approx)
RH Pressure	Kg/cm^2	58
Temperature at outlet	°C	593
FW flow	TPH	2710
Temperature at Econ inlet	°C	275
Ambient air temperature (design)	°C	40
Excess air	%	20
Gas temperature at APH outlet	°C	>130
SH temperature Control		By spray/as per manufacturer practice
RH temperature Control		As per manufacturers practice
Soot blowers (steam operated)		Adequate no of wall type, long retractable and half refractable
Safety valves		As per IBR
FD fans	Nos/type	2/Axial blade pitch/inlet guide vain control
ID fans	Nos/type	2/Axial; inlet vain control and variable frequency drive.

2.5.2 Feed Cycle Equipment

Condensing

The function of the condenser is to condense the steam exhausted from the LP cylinders and to produce and maintain as high a vacuum as possible in order to increase the enthalpy drop, which can be utilised in the turbine.

Condensate Pumps

Each unit will have 3 x 50% capacity motor driven condensate extraction pumps (two operating and one standby). The condensate pumps will be vertical canister type, multistage centrifugal diffuser design with a double suction first stage designed for condensate extraction service having low suction head requirement. The pumps will be capable of handling the condensate from the condenser together with feed heater drains when the machine is operating at maximum unit output with HP Heaters out with 1% make-up and discharging this quantity through the LP heaters to the deaerator. The pump will have adequate margins on capacity and head to cater for most adverse conditions of operation such as:

- *HP & LP bypass in operation.*
- *HP heaters out of service and unit operating at its maximum load during an under frequency operation.*

Boiler Feed Pumps

Feed water will be pumped from the de-aerator to the steam generator through the high pressure heaters by means of 3 x 50% capacity boiler feed pumps (Two working steam turbine driven pumps and one AC motor driven standby pump). The boiler feed pumps will be horizontal, multistage, centrifugal pumps of barrel type with variable speed hydraulic coupling. Motor drive BFP will be used during start-up.

High & Low Pressure Heaters

Regenerative feed heating cycle will consist of LP heaters, one drain cooler, deaerator and HP heaters. The number of LP & HP heaters will be based on the optimisation of feed heating cycle. Feed water will be heated by uncontrolled turbine extraction steam from turbine inter-stage tap-offs and cold reheat line in feed water heaters. The deaerator will normally be operated under variable pressure on extraction steam from IP-Turbine. Each feed water heater will be capable of handling the drains from the preceding heater under operating conditions of the unit. The equipment will be designed in accordance with latest applicable standard/codes of Heat Exchanger Institute. ASME, IBR etc. The feed water heaters will be of U-tube with all welded stainless steel tubes, surface type and horizontal with integral condensing and drain cooling zones. The HP heaters will also have de-superheating zone.

Deaerator

Horizontal spray cum tray type or spray type deaerator with a storage tank will be provided. The deaerator will be capable of de-aerating the dissolved oxygen and carbon dioxide in condensate & HP Heater drains. The minimum capacity of the deaerator will be 6 minutes between normal operating level and low level with a filling factor of 0.66. The deaerator will be normally operating by taking extraction steam from IP turbine except during low load operation and start up when the steam is drawn from the auxiliary steam header.

Gland Steam Condenser

A fully automatic gland sealing steam supply system will be provided for the TG Set and the turbine drives of BFPs. HP & IP turbine shaft glands will be sealed to prevent escape of steam into the atmosphere and the LP turbine glands will be sealed for preventing leakage of atmospheric air into the turbine. Steam will be used for sealing these spring backed labyrinth glands. During start-up and low loads (say 40% load), seal steam will be supplied to the turbine glands from the auxiliary steam header or cold reheat line through a seal steam-regulating valve. During normal operation (above 40% load), the HP and IP turbines will be of self-sealing type and under that condition the auxiliary/CRH steam source will be

cut off and the leak-off steam from HP and IP glands will be used for sealing the LP glands. The excess leak-off steam shall be led to the condenser. A gland steam condenser will be provided to condense and return to the cycle, all gland leaks off steam including that from BFP turbines. A de-superheating type bypass will be provided during outage of gland steam condenser. 2x100% capacity vapour exhausters will be provided to remove non-condensable gases from the gland steam condenser. The exhaust gases will be led over the TG hall roof level.

Turbine Lube Oil Purification System

A suitably sized centrifuge type turbine oil purification plant will be provided as an auxiliary of the proposed turbo-generator set to condition the turbine oil continuously to remove the water and other impurities. In addition, a common turbine oil storage unit comprising one clean oil tank, one dirty oil tank, one purifier unit with necessary pumps, vent fans etc. will be kept. This would also receive the refill of turbine oil from outside. The purification plant will be complete with oil purifiers, storage tanks, filters, necessary pumping sets and vent fans.

Condensate Polishing System

The proposed 2 x 800 MW station will be provided with 100% capacity condensate polishing system. To maintain high purity of water in the cycle, 3 x 50 % (2W+1Common standby) on-line condensate polishing unit for each unit will be provided. The Condensate Polishing unit will consist of mixed bed ion exchanger installed at the discharge of condensate extraction pumps, for treating the condensate to safely remove scale forming compound in water, if any, due to system contamination. Condensate polishing will ensure elimination of ammonia, silica, sodium or potassium from the condensate before being recycled to the feed water system. During normal operation all the polisher units will remain standby. In case of high condensate conductivity, it will be pressed in service when two (2) of the exchanger vessels will be working in parallel and the third one will remain isolated from the system. The third vessel will act as standby and will be brought into operation when regeneration is required or during any emergency period. The polishing unit would be located at the powerhouse building. The operation of the condensate polishing system will be semi-automatic, remote/manual. The regeneration system will be external. For regeneration, the resins from the exhausted exchanger vessel will be transferred hydraulically to this facility located at CPU Regeneration building and regenerated resin sent back in the same way.

Chemical Feed System

Although high purity water will be used as cycle make-up, careful chemical conditioning of the feed water, steam and condensate cycle is essential as a safeguard against corrosion and possible scale formation due to ingress of contaminants in the make-up system.

Chemical feed system will comprise of the following:

i) Ammonia dosing system

ii) Hydrazine dosing system

Low pressure chemical dosing system would be provided for feeding hydrazine solution to the deaerator feed tank, condensate pump discharge and boiler feed suction line to scavenge out excess O_2 in water and to control pH of the feed water system.

Ammonia Dosing System

Ammonia dosing system for each unit will consist of 2 x 100% dosing pumps (one working and one standby) and two independent tanks, one for the storage of concentrated ammonia and one for the preparation of a diluted ammonia solution. Ammonia is continuously fed into the main condensate system in order to establish the requisite pH value. For 2 x 800MW, totally four (4) nos. of dosing pumps (2 Working + 2 Standby) and four (4) nos of tanks (two (2) nos. of concentrated ammonia storage tanks + two (2) nos. of preparation of dilute ammonia solution tanks) will be provided.

Hydrazine System

The most harmful contaminant, which is always present in the make-up water, causing serious corrosion in the high pressure boiler is dissolved oxygen. Hydrazine solution will be used as a deoxygenator, to wipe off traces of dissolved oxygen left over in the feed water after deaerator. Hydrazine dosing system for each unit will consists of: Two (2) nos. of independent Hydrazine solution tanks (1 working + 1 standby) will be provided. Water from the condensate pump discharge header will be used as the diluting medium. Dosing pump will deliver hydrazine solution at controlled rates continuously at the condensate pump discharge headers and/or boiler feed pump suction lines of respective unit. Two (2) nos. of dosing pumps (1 working + 1 standby) will be provided for each unit. For 2 x 800MW, totally four (4) nos. of dosing pumps (2 Working + 2 Standby) and four (4) nos of tanks.(2 Working + 2 standby) will be provided

2.5.3 Evacuation of Power

Power generated in the Power Plant would be available at 400 kV level in the station switchyard bus and would be fed to Tamil Nadu Transmission Corporation Limited (TANTRANSCO) 400KVA Karaikudi substation which is about 40KMs North West of the proposed site and 400KVA Chekkanurani substation which is about 90KMs west of the proposed site.

2.6 Health and Sanitation Facilities

To ensure optimum hygienic conditions in the plant area, proper drainage network will be provided to avoid water logging and outflow. Adequate health related measures and a well-

equipped Safety and Environment Department will be established to ensure clean and healthy environment.

Temporary drinking water facility about 215 m^3/day and toilets will be provided for the labour force. The generated sewage will be drained to soak pits through sewer lines.

2.7 Man Power Requirement

The manpower in the major functional areas of production, utilities, maintenance, technical services, finance, administration, procurement, safety, quality control (QC), materials and marketing will be under respective departmental heads. The total manpower requirement for this project is estimated around 324 personnel.

STICS OF RAMANATHAPURAM DISTRICT

AREA 4233.4 Sq.km

DENSITY OF POPULATION 266 per sq. km

MAIN LANGUAGE SPOKEN TAMIL

MAP SERIES RAMANATHAPURAM

IONAL ATLAS & THEMATIC

PING ORGANISATION

ITMENT OF SCIENCE & TECHNOLOGY

RAMANATHAPURAM DISTRICT

district lies in the S-Ea. coastal tract of Tamil Nadu between 9°9' N and
ween 78° 15' E and 79° 27' E long. The district has an area of 4233.4 Km² (4.23
l population of 11,38,665 (1991).

In the early centuries was ruled over by the Pandian Kings.But for a brief
the control of Chola Kings, Muslim rulers and Nayak Kings. At later years the
nder the administration of Mahavas of Sethupathy under the Zamindari
uring the British rule.

ct came into being in 1985 with 2 subdivisions, 6 taluks, and 44 police
s plus 11 blocks, 11 panchayat unions, 444 village panchayats spread over
and 9 urban centres. The urban centres are Ramanathapuram, Rameswaram,
nd, Paramagudi, Mudukulathur, Kamudi, Nowkanchal, and Tondi.

ed by Vaigai, Gundar, Kamatherai, Virudi and Pamban rivers and may be
ographic divisions, such as, (i) the lower plains comprising of Paramagudi,
ankulam and Tiruvadanai taluks (ii) the higher plains with rocky
s, ridges, and (iii) the coastal zones. The Sn. coast is fronted by a chain of
which Rameswaram Island is the biggest. The general slope is NW to S-E.

rmations are classified as Archaean Sub-Recent and Recent. The major rock
calcareous sandstone, grey calcareous clay and marine formations. Limestone
gypsum and clay are profusely found in the district.

oils such as lateritic, red sandy, coastal alluvium and coastal sandy soils are
scrub/forest cover is noticed in the coastal area zone.

district receives hot throughout the year. The total annual rainfall (822 cm) is
r good cropping which faces drought at times.

wells and 3230 tanks of various sizes in the district. They are also the main
Condition of ground water can be evaluated by the latest map.Out of the
ea of 4,23,340 ha. net sown stands at 2,30,515 ha. Irrigated & unirrigated
152.8% ha. respectively.

ground, paddy, cumbu, ragi, and chillies form the chunk. The district has an
of fisheries including 86 marine fishing centres.

communication net work are developed. The newly constructed Anaai Indira
sland and Rameswaram island has widen the scope of trade and commerce.

work spinning mills and 1235 small scale industrial units among which a
agro-based industries. Tourism plays a vital role in the development of the
ekonomy temple of Rameswaram is renowned for its pilgrim corridors.

ossibilities to develop its industry by utilising its mineral resources and
ues). Artificial pearl culture can earn foreign exchange for the country which

REFERENCES

Taluk / Block ... ... RAMANATHAPURAM

District ... ... KAMUDI TIRUVADANAI

Taluk / Block ... ... Paramagudi

Town Headquarters ... ... Nedungulam Babul

Village / Number ... ...

Water coloured Tidal river ... ...

... ...

Wells, Tubewell ... ...

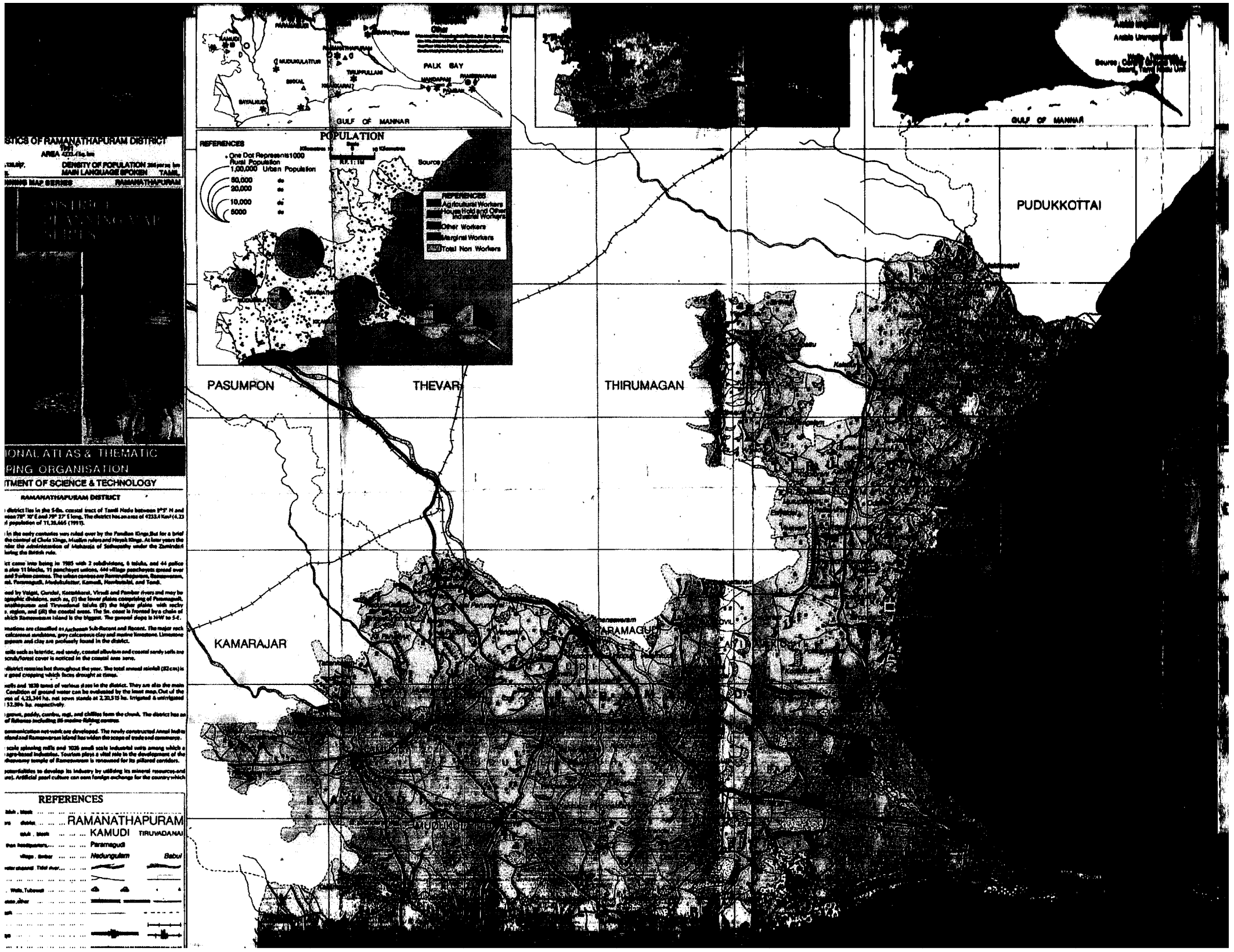
Canals, Other ... ...

... ...

... ...

... ...

... ...



Description of The Environment

Chapter – 3
Description of the Environment

3.0 Introduction

Baseline environmental status in and around proposed project depicts the existing environmental conditions of air, noise, water, and soil, biological and socio-economic environment. With proposed project as the center, a radial distance of 10 Km is considered as 'study area' for baseline data collection and environmental monitoring. Baseline data was collected for various environmental attributes so as to compute the impacts that are likely to arise due to proposed developmental activity.

The main aim of the impact assessment study is to find out the impact of the project on the environment. This study is carried out during the project planning stage itself, so that the proponent can implement the project in a technically, financially and environmentally viable way.

Existing environmental conditions are enumerated by collecting baseline data. The estimated impact due to the proposed project is superimposed over the existing conditions to arrive at the post project scenario. The scope of the baseline studies includes detailed characterization of various environmental components, which are most likely to be influenced by setting up an industry.

- Meteorological conditions
- Ambient Air Quality
- Noise Levels
- Water Quality (Surface and Ground water)
- Soil Quality
- Socio Economic studies and
- Land use

The baseline data generation for the EIA was carried out during the study period July, August & September 2012. The data generation with respect to meteorological conditions, air pollution levels, noise levels, water quality, soil quality and socio economic conditions were carried out during the study period. Secondary meteorological data collected from the nearest IMD station of Thondi at about 22 Km from the Uppur Plant site.

3.1 Air Environment

3.1.1 Meteorology

Dispersion of different air pollutants released in to the atmosphere has significant impacts on surrounding air environment. The dispersion/dilution of the released pollutant over a large area will result in considerable reduction of the concentration of a pollutant. The dispersion in turn depends on the weather conditions like the wind speed, direction, temperature, and relative humidity, mixing height, cloud cover and also the rainfall in the area. The impacts surrounding the project site are studied in detail.

Regional meteorological scenario helps to understand the trends of the climatic factors. It also helps in determining the sampling stations in predicting the post project environmental scenario. Meteorological Scenario exerts a critical influence on Air Quality as the pollution arises from the interaction of atmospheric contaminants with adverse meteorological conditions such as temperature inversions. Atmospheric stability and topographical features like hills, canyons and valleys.

The critical weather elements that influence air pollution are wind speed, wind direction, temperature, which together determines atmosphere stability. Hence it is an indispensable part of any air pollution studies and required for interpretation of base line information.

An automatic weather station was installed in the plant area to study the meteorological conditions of the study area. It was placed at a height of about 10 m above the ground level ensuring that there is no obstruction to the free flow of wind. Apart from the wind speed and direction, temperature, relative humidity and rainfall were also measured.

On site monitoring was undertaken for various meteorological variables in order to generate site-specific data. Hourly average, maximum and minimum values of wind speed, direction, relative humidity and temperature were recorded continuously for the study period. The meteorological data recorded and used for interpretation of the baseline information as well as for prediction analysis.

Hourly wind speed and direction recorded during the study period to identify the influence of meteorology on the air quality of the area. Wind rose on sixteen – sector basis i.e., N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW and NNW is prepared.

During the study period the maximum and minimum temperature, relative humidity and rainfall recorded and wind speeds and pre dominant wind directions observed are given in Table – 3.1.

Table–3.1
Observed Meteorological Data

Period	Temperature (°C)		Relative Humidity (%		Wind Pattern	
	Min	Max	Min	Max	Direction	Speed (m/s)
July 2012	24	38	32	95	South (Predominant)	2.2 (Average)
August 2012	24.4	37	35	100		
September 2012	24	36	44	100		

The frequency of occurrence of wind in various speed categories was calculated on the basis of total number of observations recorded. The average 24 hour wind rose diagram during July, August, & September 2012 reveals that the predominant wind direction during the study period is from South. The wind pattern during 00 to 23 hours is shown in **Figure-3.0.**

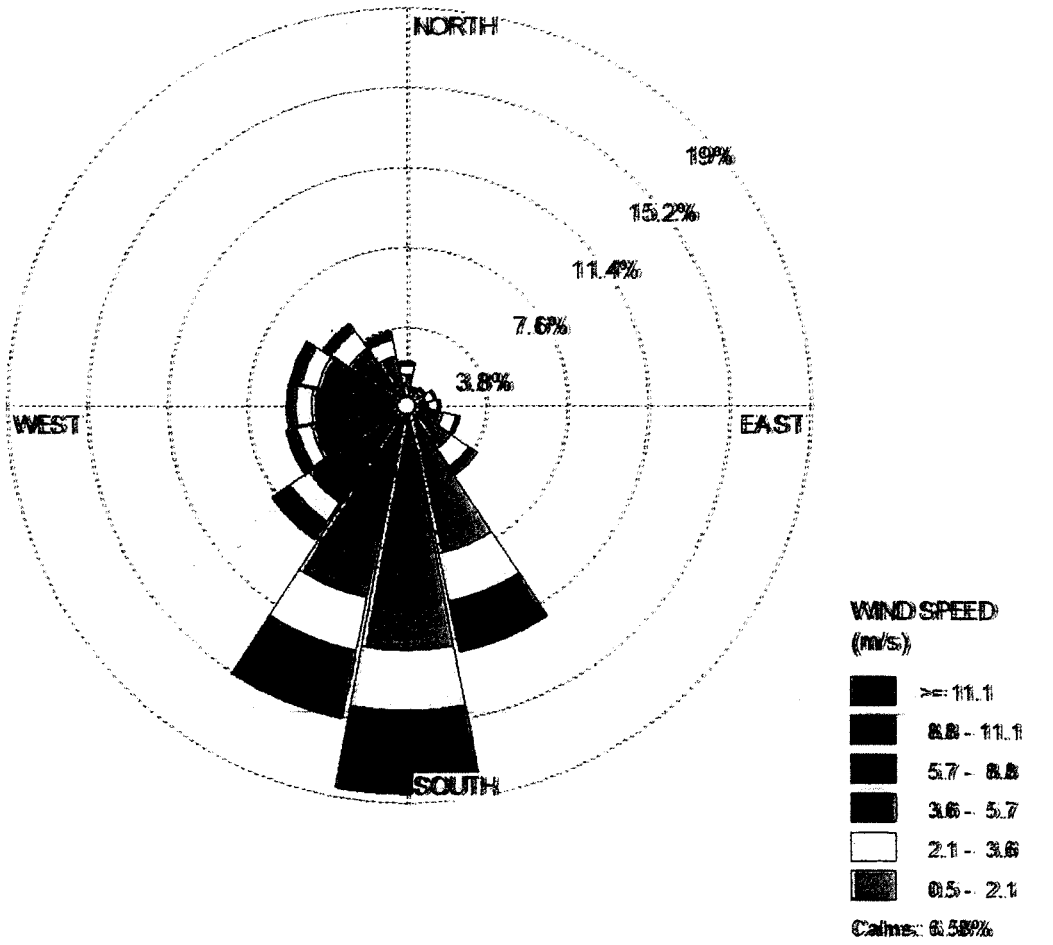


Figure – 3.0 Wind Rose Diagram (July, August & September 2012)

3.1.2 Ambient Air Quality

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

- Meteorological parameters
- Major human settlements
- Topography of the study area
- Representatives of likely impact areas

Ambient Air Quality Monitoring (AAQM) stations were set up at 8 locations with due consideration to the above mentioned points. AAQ locations were selected in downwind, cross wind and upwind direction of the proposed plant location. Ambient Air Quality Monitoring Location map is shown in **Figure-3.1**.The details of the monitoring stations are given in **Table -3.2**.

At each sampling station monitoring was carried for a frequency of twice a week for 4 weeks in a month for 3 months in a season in study area. The air pollutants suspended particulate matter (SPM), PM_{10} & $PM_{2.5}$, Sulphur dioxide (SO_2), Oxides of Nitrogen (NO_x), Carbon monoxide (CO), Mercury (Hg) and Ozone (O_3) were sampled, analysed and compared with the standards stipulated by CPCB.

Table-3.2
Ambient Air Quality Monitoring Locations

Code	Name of the Station	w.r.t. Plant Site	
		Direction	Distance (Km)
Plant Area			
AQ1	Proposed plant site-1	--	0.0
AQ2	Proposed plant site-2 (Valamavoor)	--	0.0
Study Area			
AQ3	Thirupalakudi	E	0.8
AQ4	Devipatinum	S	7.6
AQ5	Uppur	N	1.4
AQ6	Uranangudi	N	3.1
AQ7	Rajasingamangalam	NW	7.8
AQ8	Kalavamkudi	W	4.7

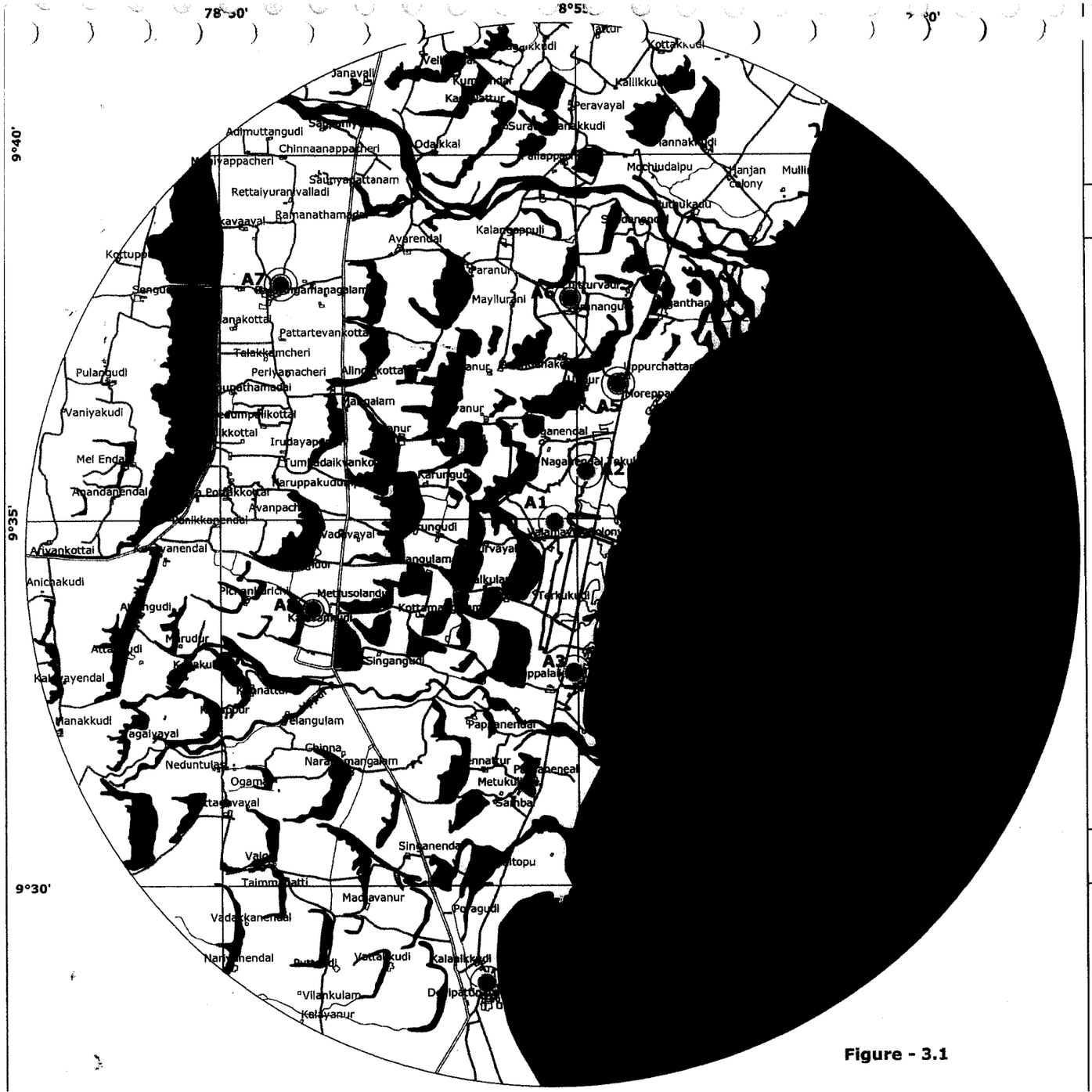


Figure - 3.1

N

AMBIENT AIR QUALITY MONITORING STATIONS

PLANT BOUNDARY

ROAD

NALA

WATER BODY

VILLAGE

1. 9°33'12.62"N,78°53'50.36"E
2. 9°36'2.58"N,78°55'17.84"E
3. 9°35'12.88"N,78°53'50.36"E

AMBIENT AIR MONITORING STATIONS

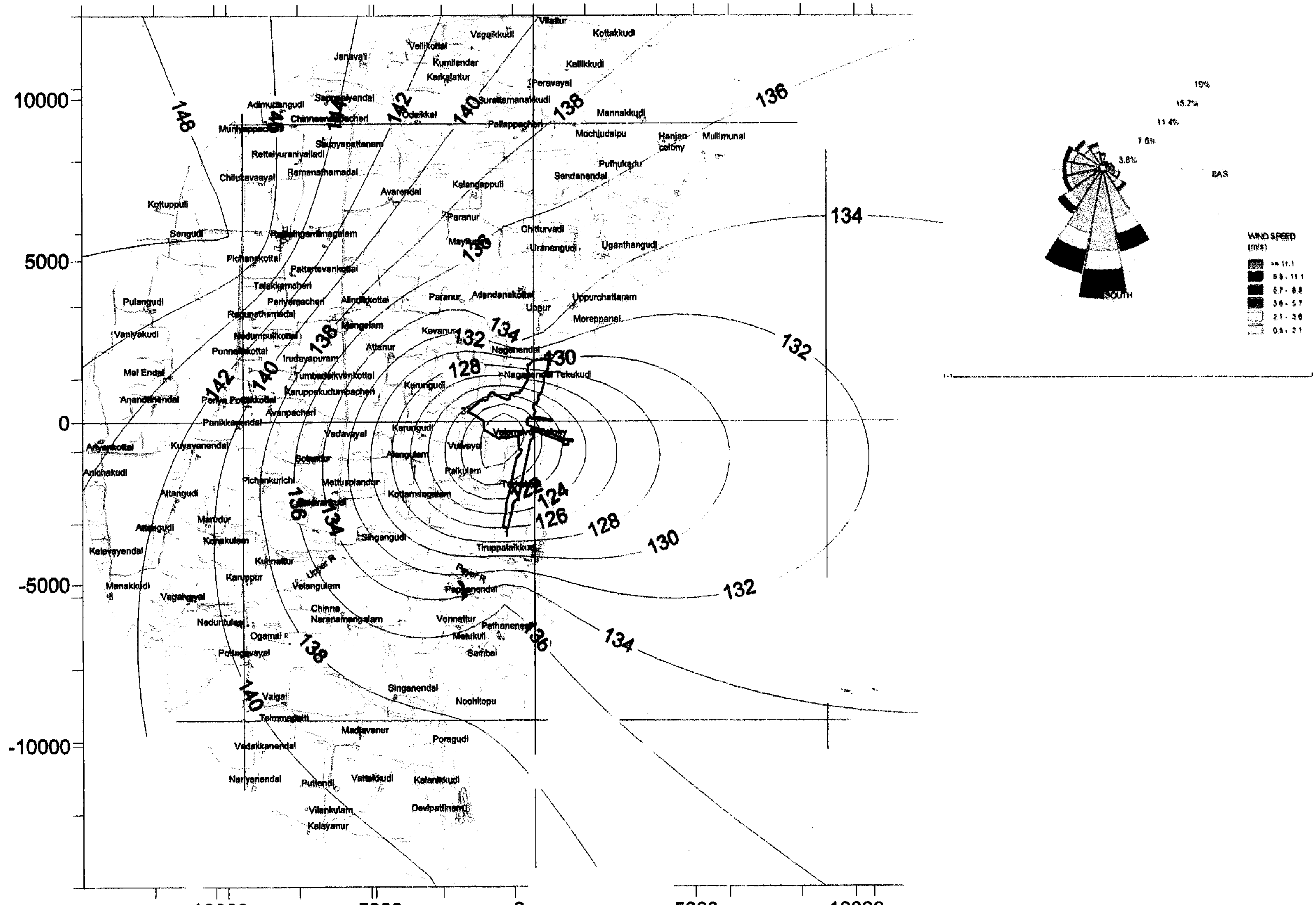
0 1 2 3 4 5KM

PROJECT:
UPPUR SUPER CRITICAL COAL BASED THERMAL POWER PF

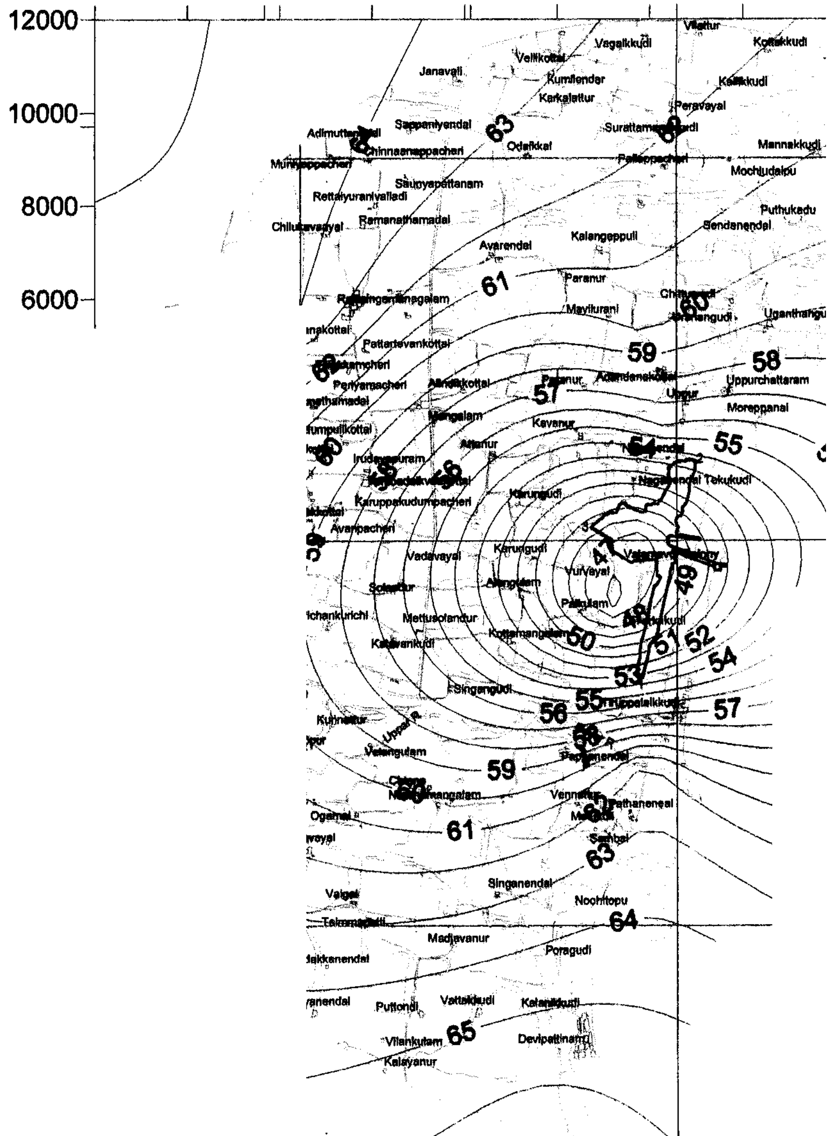
CLIENT:
TANGEDCO
(A Subsidiary of TNEB LTD)

TITLE:
AMBIENT AIR QUALITY MONITORING STATIONS

CONSULTANT:
BHAGAVATHI ANA LABS LTD,HYDERABAD



Spatial Distribution of Ambient Air Quality of Particulate Matter (SPM) in micro gram/cu.m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Kumlender
Karkalattur
Peravayal
Mannakkudi
Mochiudaipu
Puthukadu
Sendanendal
Kalangeppuli
Avarendal
Paranur
Mayilurani
Uganthangu
Uppurchattaram
Moreppanal
Pattarlevankottai
Periyarsacheri
Mangalam
Kavanur
Karuppakudumpacheri
Avanpacheri
Vadavayal
Karungudi
Vurvayal
Pallulam
Mettusotandur
Kallavankudi
Singangudi
Velangulam
Ogamal
Singanendal
Noohitopu
Poragudi
Madjavanur
Puttondi
Vattakkudi
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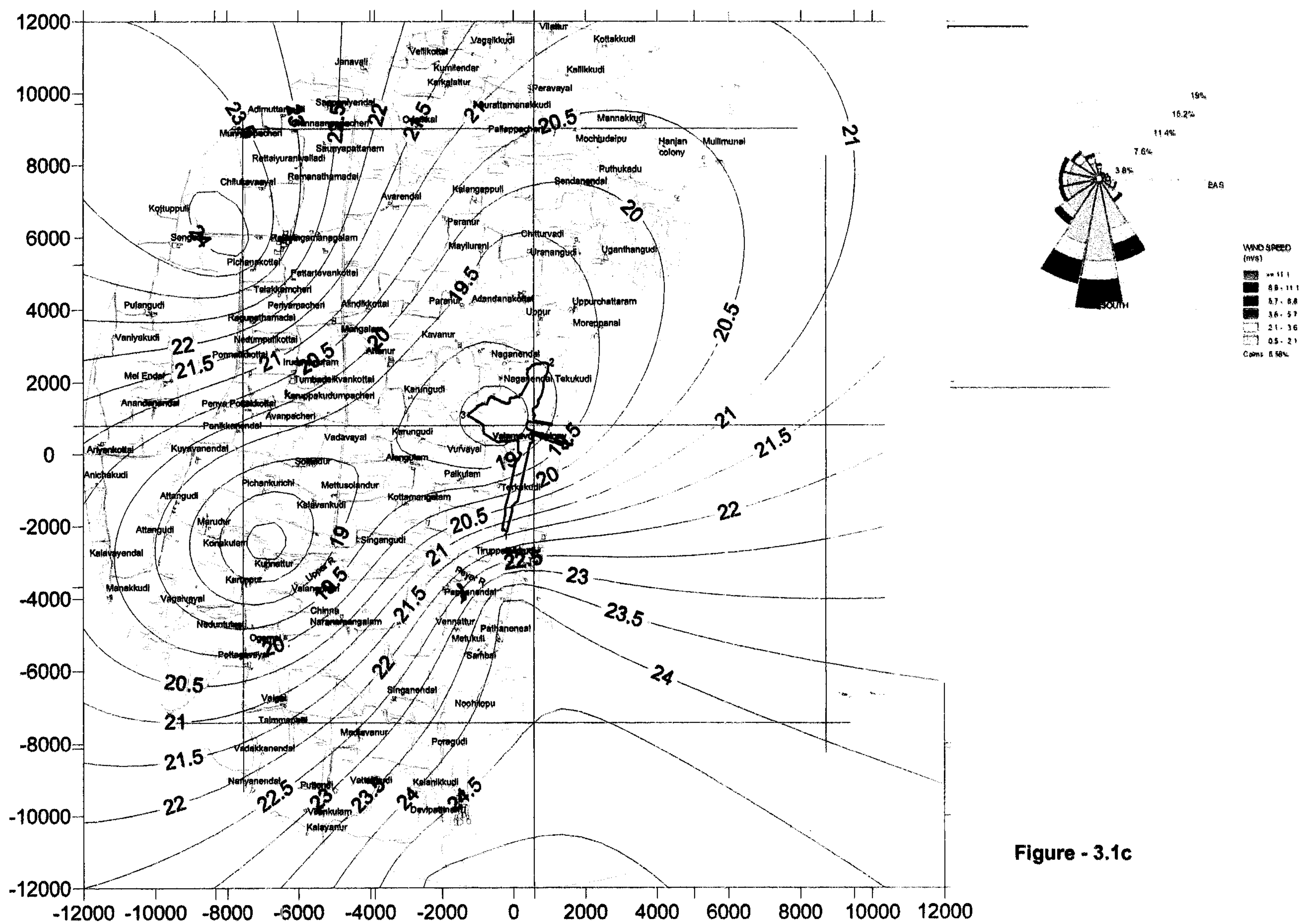


Spatial Distribution of Ambient Air Quality of Particulate Matter (PM2.5) in micro gram/cu.m

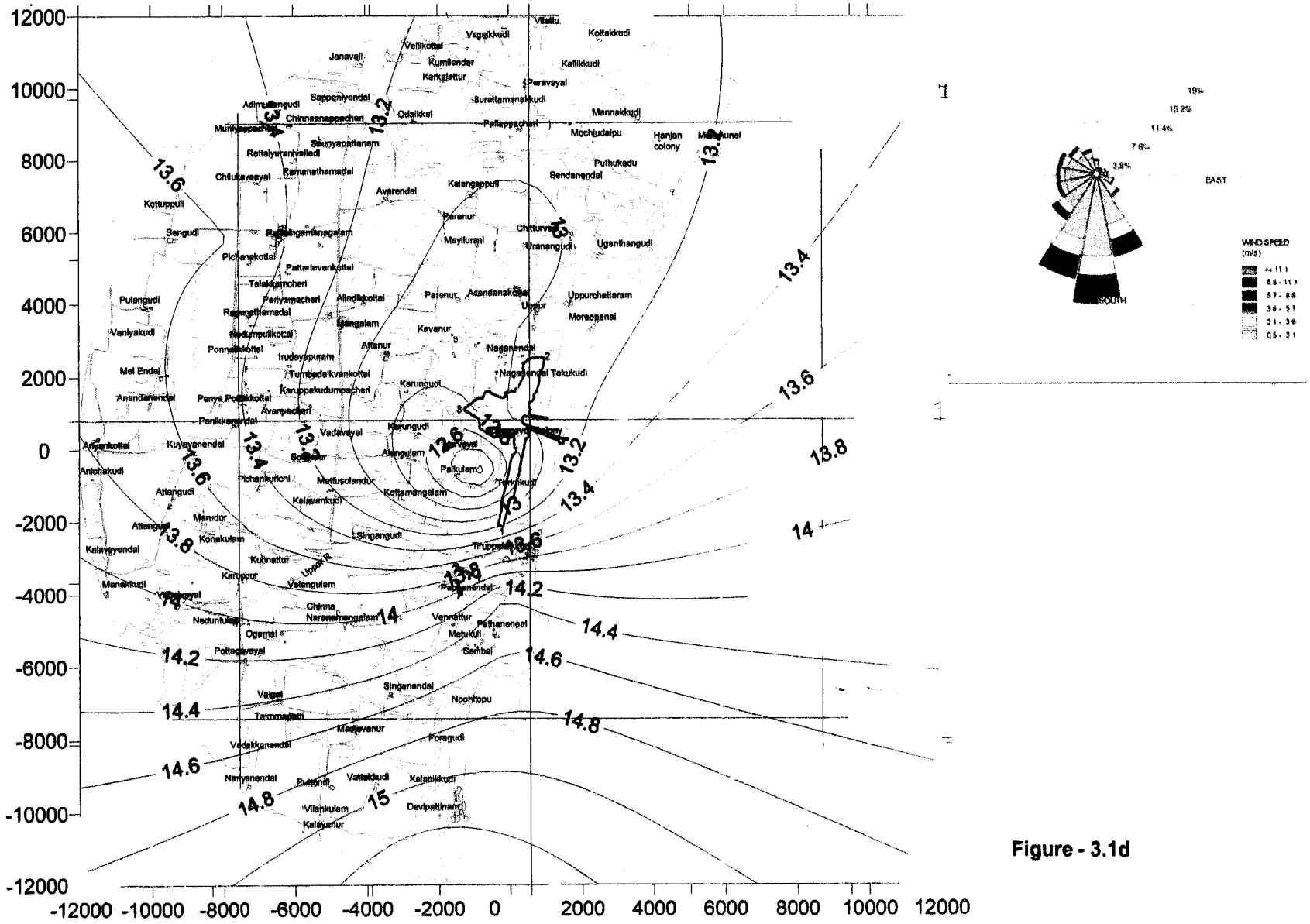


Figure - 3.1d

Spatial Distribution of Ambient Air Quality of Sulphur Dioxide (SO2) n micro gram/cu.m

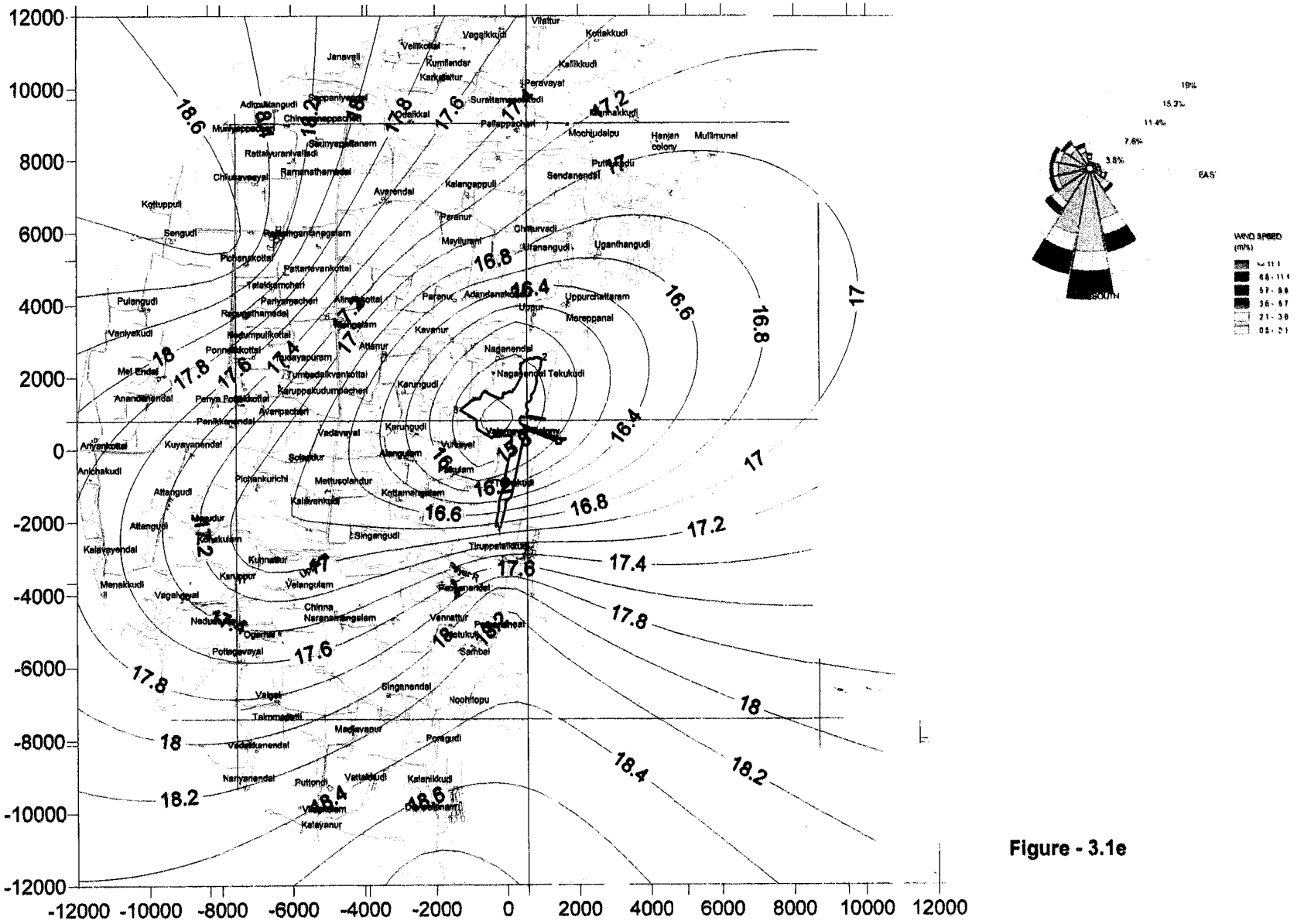


Figure - 3.1e

Spatial Distribution of Ambient Air Quality of Oxides of Nitrogen (NOx) in micro gram/cu.m

PLANT BOUNDARY

ROAD

NALA

WATER BODY

VILLAGE

1. 9°33'12.62"N,78°53'50.36"E

2. 9°36'2.58"N,78°55'17.84"E

3. 9°35'12.88"N,78°53'50.36"E

AMBIENT NOISE MONITORING STATIONS

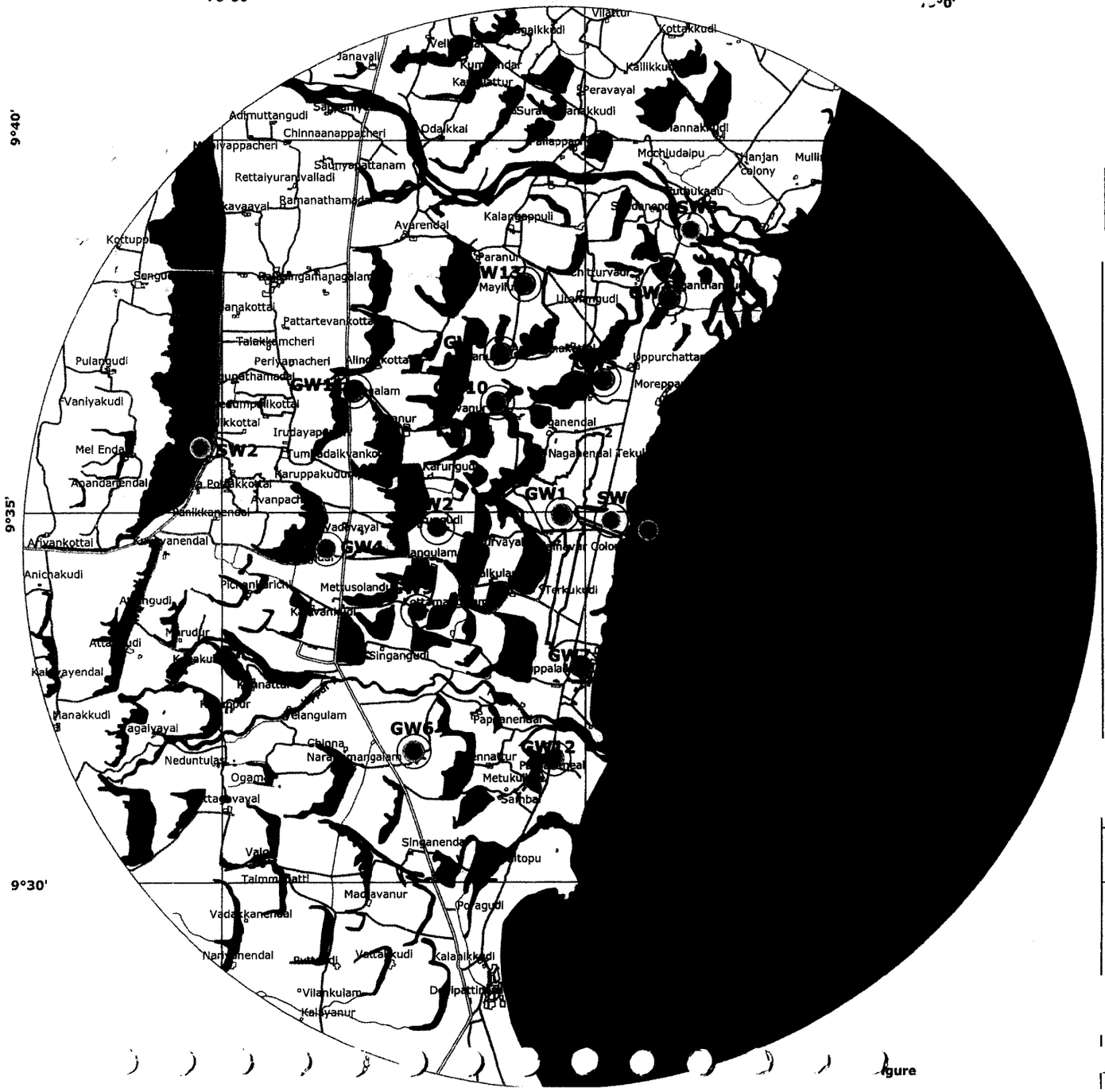
0 1 2 3 4 5KM

PROJECT:
UPPUR SUPER CRITICAL COAL BASED THERMAL POWER PROJECT

CLIENT:
TANGEDCO
(A Subsidiary of TNEB LTD)

TITLE:
AMBIENT NOISE LEVEL MONITORING STATIONS

CONSULTANT:
BHAGAVATHI ANA LABS LTD,HYDERABAD



N

WATER SAMPLING LOCATIONS

PLANT BOUNDARY

ROAD

NALA

WATER BODY

VILLAGE

1. 9°33'12.62"N,78°53'50.36"E
2. 9°36'2.58"N,78°55'17.84"E
3. 9°35'12.88"N,78°53'50.36"E

GW **GROUND WATER SAMPLING**

SW **SURFACE WATER SAMPLING**

0 1 2 3 4 5KM

PROJECT:
UPPUR SUPER CRITICAL COAL BASED THERMAL POWER PRO

CLIENT:
TANGEDCO
(A Subsidiary of TNEB LTD)

TITLE:
WATER SAMPLING LOCATIONS

CONSULTANT:

The existing levels of air pollutants are presented in **Table–3.3**. Various statistical parameters like minimum, maximum, Average, Standard deviation and 98th percentiles have been computed from the observed raw data for all sampling stations and the details are provided in **Annexure–II**. The parameters are compared with the standards prescribed by Central Pollution Control Board (CPCB).

Table–3.3
Ambient Air Quality in the Study Area

Air Quality Station	Code	Particulars	SPM µg/m^3	PM_{10} µg/m^3	$PM_{2.5}$ µg/m^3	SO_2 µg/m^3	NO_x µg/m^3	CO mg/m^3	Hg ng/m^3	O_3 µg/m^3
Plant Site-1	A1	Minimum	96	36.8	14.6	10.0	12.1	0.8	NT	19.9
		Maximum	116	46.3	18.0	13.0	15.5	1.4	NT	23.2
Plant site-2 (Valamavoor)	A2	Minimum	93	35.2	14.5	9.8	14.2	0.8	NT	19.6
		Maximum	118	45.6	19.1	12.1	15.8	1.4	NT	24.2
Thirupplaikudi	A3	Minimum	110	42.8	16.6	11.4	14.8	1.1	NT	20.6
		Maximum	136	62.3	24.2	14.4	18.2	1.7	NT	24.6
Devipattinum	A4	Minimum	115	52.3	16.6	11.3	16.0	1.2	NT	20.3
		Maximum	140	66.6	25.1	15.4	18.9	1.5	NT	25.2
Uppur	A5	Minimum	106	45.6	15.0	10.3	12.9	0.8	NT	19.2
		Maximum	136	56.2	19.2	13.0	15.9	1.6	NT	24.2
Uranangudi	A6	Minimum	110	45.2	15.4	10.5	13.2	0.9	NT	19.9
		Maximum	135	60.3	19.2	12.9	16.9	1.5	NT	25.3
Rajasingamangalam	A7	Minimum	119	46.2	16.9	10.4	10.2	1.0	NT	20.6
		Maximum	148	64.2	24.3	13.6	18.7	1.6	NT	26.2
Kalavamkudi	A8	Minimum	108	44.6	15.5	10.9	14.5	0.9	NT	19.6
		Maximum	138	58.9	17.6	13.6	16.8	1.5	NT	25.3
NAAQ CPCB Standards as on 18-11-2009			-	**100**	**60**	**80**	**80**	**4**	-	**180**

*NT: Not Traceable

3.2 Regional Scenario

Suspended Particulate Matter (SPM) & Respirable Particulate Matter (PM_{10}&$PM_{2.5}$)

The following main sources of Suspended Particulate Matter (SPM) / Respirable Particulate Matter (PM_{10}&$PM_{2.5}$) in the study area are identified:

- Emissions from existing units
- Emissions due to vehicular movement
- Dust generation from ground
- Fire wood burning.

Excessive exposure to dust causes breathing related diseases as it affects the lungs. Excessive concentration of smoke and dust also reduces the visibility. Particulate matter

affects the plants by settling on the leaves and preventing natural growth. The chemical matter in the dust will affect the structures due to slow reaction over a period of time.

The minimum levels of SPM recorded at proposed plant site were 93 $\mu g/m^3$ and maximum of148 $\mu g/m^3$ at Rajasingamangalam.

The minimum levels of PM_{10} recorded at Velamavoor were 35.2 $\mu g/m^3$ and maximum of 66.6$\mu g/m^3$ at Devipatinum.

The minimum levels of $PM_{2.5}$ recorded at Velamavoor were 14.5 $\mu g/m^3$ and maximum of 25.1$\mu g/m^3$ at Devipatinum.

Sulphur Dioxide

Sulphur dioxide gas is an inorganic gaseous pollutant. Sulphur dioxide emissions are expected to be emitted wherever combustion of any fuel containing sulphur takes place. The sulphur in the fuel will combine with oxygen to form sulphur dioxide. The following sources of Sulphur dioxide in the study area are identified:

- Emissions from existing coal fired power generating units
- Emissions from domestic burning of fuel (coal, diesel, etc.) and vehicle movement

The minimum levels of SO_2 recorded at Velamavoor were 9.8 $\mu g/m^3$ and maximum of 15.4 $\mu g/m^3$at Devipatinum.

Oxides of Nitrogen

Oxides of nitrogen are also an inorganic gaseous pollutant like Sulphur dioxide. Oxides of nitrogen emissions are expected to be emitted wherever combustion at high temperatures takes place.

In general some of the important sources of oxides of nitrogen are boilers (utilities) in any industry and Auto exhaust.

The following sources of oxides of nitrogen in the study area are identified:

- Emissions from industrial and domestic burning of coal
- Emissions from automobiles

The minimum levels of NO_x recorded at proposed plant site were 10.2 $\mu g/m^3$ and maximum of 18.9 $\mu g/m^3$ at Rajasingamangalam.

The minimum CO values were 0.8 $\mu g/m^3$ at plant site and the maximum CO values were 1.7 $\mu g/m^3$at Thirupalaikudi.

Mercury levels were not traceable in plant area as well as the study area.

The minimum values of Ozone as O_3 in ground level were 19.6 µg/m^{3}at Valamavoor and maximum levels were 26.2 µg/m^{3}at Rajasingamangalam.

The air quality contours are shown in **Figures–3.3a, 3.3b, 3.3c, 3.3d, 3.3e.**

3.3 Noise Environment

3.3.1 Sources of Noise

The main sources of noise in the study area are domestic activities, industrial activities and vehicular traffic. The main occupation of the towns & villages in the study area is Industrial labourers, fishery and trading etc.

3.3.2 Noise Levels in the Study Area

Ambient noise levels were monitored at 10 locations within the study zone, using noise level meter. Noise levels were measured at selected locations, keeping in view the land use pattern, residential areas in villages, schools, bus stands, etc., the day levels of noise have been monitored during 6 AM to 10 PM and the night levels during 10 PM to 6 AM. The noise monitoring stations are shown in Table-3.4 and shown in **Figure–3.2**. The results are presented in Table–3.5.

Table-3.4
Noise Monitoring Locations

Code	Name of the Station	W.R.T. Site	
		Direction	Distance (Km)
Plant Area			
N1	Proposed plant site-1	--	0.0
N2	Proposed plant site-2 (Valamavoor)	--	0.0
Study Area			
N3	Thirupalakudi	E	0.8
N4	Devipatinum	S	7.6
N5	Uppur	N	1.4
N6	Uranangudi	N	3.1
N7	Rajasingamangalam	NW	7.8
N8	Kalavamkudi	W	4.7

Table-3.5
Noise Levels in Study Area

Time	N1	N2	N3	N4	N5	N6	N7	N8
0.25	46.70	43.20	51.20	43.30	45.70	41.30	41.20	42.20
0.29	47.80	44.70	52.30	40.20	49.50	42.80	41.20	43.80
0.33	47.50	42.30	50.60	40.50	51.40	47.60	49.20	48.90
0.38	52.90	43.20	52.20	53.20	53.00	52.90	52.20	50.30
0.42	53.80	44.30	54.30	52.60	53.50	52.40	52.20	43.50
0.46	51.70	45.30	55.60	50.60	55.80	51.00	51.20	49.70
0.50	52.30	46.80	58.60	50.10	56.70	51.10	51.10	47.80
0.54	52.70	48.60	57.90	52.60	58.90	51.50	52.00	47.40
0.58	51.90	45.30	58.40	50.70	57.50	52.70	51.10	46.10
0.63	53.20	46.20	56.80	51.60	56.80	51.10	52.60	52.00
0.67	50.90	46.90	57.60	50.20	59.00	50.20	50.70	51.60
0.71	53.40	47.50	55.60	49.70	58.70	50.20	53.70	56.10
0.75	54.00	48.60	59.60	53.60	56.30	53.50	54.30	49.30
0.79	50.10	46.50	51.20	49.60	55.10	51.30	50.60	49.20
0.83	49.60	45.30	50.20	48.30	54.30	49.60	48.70	49.40
0.88	49.20	44.50	49.80	50.10	53.60	50.20	50.30	47.40
0.92	48.80	43.90	48.80	49.50	51.20	48.30	48.90	46.50
0.96	48.40	43.50	47.20	49.10	49.60	47.50	51.20	48.90
0.00	47.90	43.00	46.30	48.60	48.30	46.30	49.30	56.00
0.04	47.60	42.10	45.30	48.30	47.70	45.70	48.70	51.00
0.08	46.60	41.20	44.50	47.70	47.30	44.30	46.50	50.30
0.13	45.70	42.20	46.50	47.30	46.90	44.10	45.70	41.40
0.17	44.80	43.20	45.30	46.70	45.60	43.40	44.90	44.60
0.21	43.90	40.30	44.90	45.50	44.30	44.80	44.40	43.40
Min	**43.9**	**40.3**	**44.5**	**40.2**	**44.3**	**41.3**	**41.2**	**41.4**
Max	**54.0**	**48.6**	**59.6**	**53.6**	**59.0**	**53.5**	**54.3**	**56.1**
Ld	**52.8**	**47.4**	**58.4**	**52.4**	**57.1**	**52.3**	**53.1**	**53.9**
Ln	**47.1**	**42.3**	**49.3**	**47.8**	**49.3**	**46.5**	**49.3**	**54.1**

3.3.3 Regional Scenario

The values of noise observed in some of the rural areas are primarily owing to vehicular traffic, industries and other anthropogenic activities. The study area the day equivalents during the study period were in the range of 47.4 to 58.4 dB (A). The night equivalents were in the range of 42.3 dB (A) to 54.1 dB (A). From the results it can be seen that the Day

equivalents and the Night equivalents were within the Ambient Noise standards of industrial area at plant site locations and in other locations within the residential area standards.

3.4 Water Environment

The ground water samples were drawn from the hand pumps and open wells being used by the villagers for their domestic needs. Surface water sampling was carried out from River and Sea present in the study area. Sampling locations for water samples are shown in **Figure–3.3**and the details of the locations are given in Table 3.6.

Table 3.6
W Sampling Locat

S No.	Location Code	Location Name	Distance (kms) w.r.t. Plant	Direction w.r.t. Plant	Sample Source
1	GWQ1	Valamavoor	--		Ground water
2	GWQ2	Karangudi	2.0	W	Ground water
3	GWQ3	Uganthangugi	3.5	NE	Ground water
4	GWQ4	Solandur	4.9	W	Ground water
5	GWQ5	Uppur	1.2	N	Ground water
6	GWQ6	Erramaipatti	5.0	SW	Ground water
7	GWQ7	Thirupalakudi	1.7	S	Ground water
8	GWQ8	Paranur	2.7	NW	Ground water
9	GWQ9	Kothamangalam	3.2	SW	Ground water
10	GWQ10	Kavanur	2.2	NW	Ground water
11	GWQ11	Mangalam	5.7	NW	Ground water
12	GWQ12	Papanendal	1.5	SSW	Ground water
13	GWQ13	Pathaneneal	2.1	S	Ground water
14	GWQ14	Mayilurani	3.8	NNW	Ground water
15	SWQ1	Back Water Near Uppur Plant Site	1.2	E	Surface water
16	SWQ2	Mangalam tank	9.2	W	Surface water
17	SWQ3	Kotthiyar river	7.7	NE	Surface water
18	SWQ4	Sea Water Sample	1.6	E	Surface water

The water samples collected from the above locations were analyzed and compared with IS: 2296 Surface Water standards as well as IS:10500 drinking water standards and the results are given in Table–3.7.

Table – 3.7
Water Quality in the study area

S.No.	Parameters	Results Obtained		
		Valamavoor (GW1)	Karangudi (GW2)	Uganthangudi (GW3)
I.	**Essential Characteristics**			
1.	Colour (Hazen Units)	< 5	10	10
2.	Odour	Un - Objectionable	Un - Objectionable	Un – Objectionable
3.	Taste	Un - Agreeable	Agreeable	Agreeable
4.	Turbidity, NTU	< 1	20	20
5.	pH	8.15	7.21	8.00
6.	Total Hardness as $CaCO_3$, mg/l	520	85	610
7.	Iron as Fe, mg/l	0.06	0.25	0.28
8.	Chlorides as Cl, mg/l	1259	210	806
9.	Residual free, Chlorine, mg/l	Nil	Nil	Nil
II.	**Desirable Characteristics**			
1.	Dissolved Solids, mg/l	2660	850	1800
2.	Calcium as Ca, mg/l	104.2	18.0	66.1
3.	Magnesium as Mg, mg/l	63.2	9.7	108.2
4.	Copper as Cu, mg/l	<0.01	<0.01	<0.01
5.	Manganese as Mn, mg/l	<0.01	0.02	0.02
6.	Sulphate as SO_4, mg/l	100	59	57
7.	Nitrate as NO_3, mg/l	7	17	1
8.	Fluoride as F, mg/l	1.10	1.30	0.70
9.	Phenolic Compounds as C_6H_5OH, mg/l	<0.001	<0.001	<0.001
10.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001
11.	Cadmium as Cd, mg/l	<0.01	<0.01	<0.01
12.	Selenium as Se, mg/l	<0.01	<0.01	<0.01
13.	Arsenic as As, mg/l	<0.01	<0.01	<0.01
14.	Cyanide as CN, mg/l	<0.01	<0.01	<0.01
15.	Lead as Pb , mg/l	<0.01	<0.01	<0.01
16.	Zinc as Zn, mg/l	0.02	< 0.01	0.02
17.	Anionic detergents as MBAS, mg/l	<0.02	<0.02	<0.02
18.	Chromium as $Cr6^+$, mg/l	<0.01	<0.01	<0.01
19.	Mineral Oil, mg/l	Absent	Absent	Absent
20.	Alkalinity $CaCO_3$, mg/l	325	280	295
21.	Aluminium as Al, mg/l	0.01	0.02	0.03
22.	Boron as B, mg/l	0.21	< 0.1	0.12

S.No.	Parameters	Results Obtained		
		Solandur (GW4)	Uppur (GW5)	Errumaipatti (GW6)
I.	**Essential Characteristics**			
1.	Colour (Hazen Units)	5	10	10
2.	Odour	Un - Objectionable	Un - Objectionable	Un – Objectionable
3.	Taste	Agreeable	Agreeable	Un - Agreeable
4.	Turbidity, NTU	5	27	36
5.	pH	8.23	7.40	8.07
6.	Total Hardness as $CaCO_3$, mg/l	195	155	325
7.	Iron as Fe, mg/l	0.09	0.18	0.16
8.	Chlorides as Cl, mg/l	106	179	912
9.	Residual free, Chlorine, mg/l	Nil	Nil	Nil
II.	**Desirable Characteristics**			
1.	Dissolved Solids, mg/l	480	670	2540
2.	Calcium as Ca, mg/l	42	26.0	52
3.	Magnesium as Mg, mg/l	22	22	47
4.	Copper as Cu, mg/l	<0.01	<0.01	<0.01
5.	Manganese as Mn, mg/l	<0.01	<0.01	<0.01
6.	Sulphate as SO_4, mg/l	6	11	163
7.	Nitrate as NO_3, mg/l	1	5	13
8.	Fluoride as F, mg/l	0.90	0.80	0.90
9.	Phenolic Compounds as C_6H_5OH, mg/l	<0.001	<0.001	<0.001
10.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001
11.	Cadmium as Cd, mg/l	<0.01	<0.01	<0.01
12.	Selenium as Se, mg/l	<0.01	<0.01	<0.01
13.	Arsenic as As, mg/l	<0.01	<0.01	<0.01
14.	Cyanide as CN, mg/l	<0.01	<0.01	<0.01
15.	Lead as Pb , mg/l	<0.01	<0.01	<0.01
16.	Zinc as Zn, mg/l	0.02	0.02	0.02
17.	Anionic detergents as MBAS, mg/l	<0.02	<0.02	<0.02
18.	Chromium as $Cr6^+$, mg/l	<0.01	<0.01	<0.01
19.	Mineral Oil, mg/l	Absent	Absent	Absent
20.	Alkalinity $CaCO_3$, mg/l	215	245	485
21.	Aluminium as Al, mg/l	0.01	0.04	0.05
22.	Boron as B, mg/l	< 0.1	< 0.1	0.20

S.No.	Parameters	Results Obtained		
		Thirupalakudi (GW7)	Paranur (GW8)	Kothamangalam (GW9)
I.	**Essential Characteristics**			
1.	Colour (Hazen Units)	< 5	5	40
2.	Odour	Un - Objectionable	Un - Objectionable	Un – Objectionable
3.	Taste	Agreeable	Agreeable	Agreeable
4.	Turbidity, NTU	< 1	5	10
5.	pH	7.18	8.00	8.31
6.	Total Hardness as $CaCO_3$, mg/l	25	125	55
7.	Iron as Fe, mg/l	0.08	0.09	0.40
8.	Chlorides as Cl, mg/l	24	45	61
9.	Residual free, Chlorine, mg/l	Nil	Nil	Nil
II.	**Desirable Characteristics**			
1.	Dissolved Solids, mg/l	85	390	560
2.	Calcium as Ca, mg/l	10	36	12
3.	Magnesium as Mg, mg/l	< 1	8.5	6.1
4.	Copper as Cu, mg/l	<0.01	<0.01	<0.01
5.	Manganese as Mn, mg/l	<0.01	<0.01	<0.01
6.	Sulphate as SO_4, mg/l	4	26	34
7.	Nitrate as NO_3, mg/l	6	6	< 1
8.	Fluoride as F, mg/l	0.40	1.10	1.20
9.	Phenolic Compounds as C_6H_5OH, mg/l	<0.001	<0.001	<0.001
10.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001
11.	Cadmium as Cd, mg/l	<0.01	<0.01	<0.01
12.	Selenium as Se, mg/l	<0.01	<0.01	<0.01
13.	Arsenic as As, mg/l	<0.01	<0.01	<0.01
14.	Cyanide as CN, mg/l	<0.01	<0.01	<0.01
15.	Lead as Pb , mg/l	<0.01	<0.01	<0.01
16.	Zinc as Zn, mg/l	0.02	0.02	0.02
17.	Anionic detergents as MBAS, mg/l	<0.02	<0.02	<0.02
18.	Chromium as $Cr6^+$, mg/l	<0.01	<0.01	<0.01
19.	Mineral Oil, mg/l	Absent	Absent	Absent
20.	Alkalinity $CaCO_3$, mg/l	20	190	295
21.	Aluminium as Al, mg/l	0.01	< 0.01	0.02
22.	Boron as B, mg/l	< 0.1	< 0.1	< 0.1

S.No.	Parameters	Results Obtained		
		Kavanur (GW10)	Mangalam (GW11)	Pathanendal (GW12)
I.	**Essential Characteristics**			
1.	Colour (Hazen Units)	10	5	< 5
2.	Odour	Un - Objectionable	Un - Objectionable	Un – Objectionable
3.	Taste	Un - Agreeable	Agreeable	Agreeable
4.	Turbidity, NTU	9	5	< 1
5.	pH	8.08	8.14	7.64
6.	Total Hardness as $CaCO_3$, mg/l	755	165	45
7.	Iron as Fe, mg/l	0.12	0.09	0.06
8.	Chlorides as Cl, mg/l	1664	75	21
9.	Residual free, Chlorine, mg/l	Nil	Nil	Nil
II.	**Desirable Characteristics**			
1.	Dissolved Solids, mg/l	3880	420	75
2.	Calcium as Ca, mg/l	164	44	12
3.	Magnesium as Mg, mg/l	84	13	4
4.	Copper as Cu, mg/l	<0.01	<0.01	<0.01
5.	Manganese as Mn, mg/l	<0.01	<0.01	<0.01
6.	Sulphate as SO_4, mg/l	391	5	5
7.	Nitrate as NO_3, mg/l	3	2	2
8.	Fluoride as F, mg/l	1.10	0.70	0.40
9.	Phenolic Compounds as C_6H_5OH, mg/l	<0.001	<0.001	<0.001
10.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001
11.	Cadmium as Cd, mg/l	<0.01	<0.01	<0.01
12.	Selenium as Se, mg/l	<0.01	<0.01	<0.01
13.	Arsenic as As, mg/l	<0.01	<0.01	<0.01
14.	Cyanide as CN, mg/l	<0.01	<0.01	<0.01
15.	Lead as Pb , mg/l	<0.01	<0.01	<0.01
16.	Zinc as Zn, mg/l	0.02	0.02	0.02
17.	Anionic detergents as MBAS, mg/l	<0.02	<0.02	<0.02
18.	Chromium as $Cr6^+$, mg/l	<0.01	<0.01	<0.01
19.	Mineral Oil, mg/l	Absent	Absent	Absent
20.	Alkalinity $CaCO_3$, mg/l	370	205	20
21.	Aluminium as Al, mg/l	0.02	< 0.01	< 0.01
22.	Boron as B, mg/l	0.35	< 0.1	< 0.1

S.No.	Parameters	Results Obtained		
		Pathaneneal (GW13)	Mayilurani (GW14)	Sea Water (2028/18)
I.	**Essential Characteristics**			
1.	Colour (Hazen Units)	30	5	20
2.	Odour	Un - Objectionable	Un - Objectionable	Un – Objectionable
3.	Taste	Agreeable	Agreeable	Un - Agreeable
4.	Turbidity, NTU	110	5	25
5.	pH	7.45	8.15	7.24
6.	Total Hardness as $CaCO_3$, mg/l	25	220	6060
7.	Iron as Fe, mg/l	0.26	0.09	0.18
8.	Chlorides as Cl, mg/l	35	193	13013
9.	Residual free, Chlorine, mg/l	Nil	Nil	Nil
II.	**Desirable Characteristics**			
1.	Dissolved Solids, mg/l	165	505	24900
2.	Calcium as Ca, mg/l	6	72	297
3.	Magnesium as Mg, mg/l	2.4	2.4	323.4
4.	Copper as Cu, mg/l	<0.01	< 0.01	<0.01
5.	Manganese as Mn, mg/l	<0.01	< 0.01	<0.01
6.	Sulphate as SO_4, mg/l	21	17	2149
7.	Nitrate as NO_3, mg/l	< 1	1	5
8.	Fluoride as F, mg/l	0.40	1.00	1.30
9.	Phenolic Compounds as C_6H_5OH, mg/l	<0.001	< 0.001	<0.001
10.	Mercury as Hg, mg/l	<0.001	< 0.001	<0.001
11.	Cadmium as Cd, mg/l	<0.01	< 0.01	<0.01
12.	Selenium as Se, mg/l	<0.01	< 0.01	<0.01
13.	Arsenic as As, mg/l	<0.01	< 0.01	<0.01
14.	Cyanide as CN, mg/l	<0.01	< 0.01	<0.01
15.	Lead as Pb , mg/l	<0.01	< 0.01	<0.01
16.	Zinc as Zn, mg/l	0.02	< 0.01	0.02
17.	Anionic detergents as MBAS, mg/l	<0.02	< 0.02	<0.02
18.	Chromium as $Cr6^+$, mg/l	<0.01	< 0.01	<0.01
19.	Mineral Oil, mg/l	Absent	Absent	Absent
20.	Alkalinity $CaCO_3$, mg/l	50	95	225
21.	Aluminium as Al, mg/l	0.09	0.02	0.04
22.	Boron as B, mg/l	< 0.1	< 0.1	3.8

S.No.	Parameters	Results Obtained			
		Back Water near uppur plant site (SW1)	Mangala, Tank Water (SW2)	Kotthiyar River (SW3)	Sea Water (SW4)
I.	**Essential Characteristics**				
1.	Colour (Hazen Units)	5	40	5	20
2.	Odour	Un - Objectionable	Objectionable	Un – Objectionable	Un – Objectionable
3.	Taste	Un - Agreeable	---	Un – Agreeable	Un - Agreeable
4.	Turbidity, NTU	10	120	20	25
5.	pH	7.49	7.41	7.61	7.24
6.	Dissolved Oxygen	5.5	5.8	6.2	5.4
7.	Total Hardness as $CaCO_3$, mg/l	11500	245	8500	6060
8.	Iron as Fe, mg/l	0.20	0.60	0.08	0.18
9.	Chlorides as Cl, mg/l	32061	64	23103	13013
10.	Residual free, Chlorine, mg/l	Nil	Nil	Nil	Nil
II.	**Desirable Characteristics**				
1.	Dissolved Solids, mg/l	60100	470	43500	24900
2.	Calcium as Ca, mg/l	1603	16.0	1403	297
3.	Magnesium as Mg, mg/l	1824	50	1216	323.4
4.	Copper as Cu, mg/l	<0.01	<0.01	<0.01	<0.01
5.	Manganese as Mn, mg/l	0.02	0.04	0.03	<0.01
6.	Sulphate as SO_4, mg/l	5317	153	3374	2149
7.	Nitrate as NO_3, mg/l	28	13	3	5
8.	Fluoride as F, mg/l	2.00	1.00	1.80	1.30
9.	Phenolic Compounds as C_6H_5OH, mg/l	<0.001	<0.001	<0.001	<0.001
10.	Mercury as Hg, mg/l	<0.001	<0.001	<0.001	<0.001
11.	Cadmium as Cd, mg/l	<0.01	<0.01	<0.01	<0.01
12.	Selenium as Se, mg/l	<0.01	<0.01	<0.01	<0.01
13.	Arsenic as As, mg/l	<0.01	<0.01	<0.01	<0.01
14.	Cyanide as CN, mg/l	<0.01	<0.01	<0.01	<0.01
15.	Lead as Pb , mg/l	<0.01	<0.01	<0.01	<0.01
16.	Zinc as Zn, mg/l	0.06	0.01	0.05	0.02
17.	Anionic detergents as MBAS, mg/l	<0.02	<0.02	<0.02	<0.02
18.	Chromium as $Cr6^+$, mg/l	<0.01	<0.01	<0.01	<0.01
19.	Mineral Oil, mg/l	Absent	Absent	Absent	Absent
20.	Alkalinity $CaCO_3$, mg/l	165	95	135	225
21.	Aluminium as Al, mg/l	0.05	0.09	0.05	0.04
22.	Boron as B, mg/l	6.4	< 0.1	4.2	3.8
23.	Total Coliform, MPN/100ml	480	356	468	613

3.4.1 Regional Scenario – Water quality

In total 18 water samples were collected, out this 14 samples are from ground water sources and 4 samples from surface water samples. The water samples were analyzed as per Standard Methods for analysis of water and wastewater, American Public Health Association (APHA) Publication. The results were compared with the guidelines given by Bureau of Indian Standards, (BIS), and IS.10500 - 1991 as amended in 1993.

- The pH varying for ground water samples from 7.21 to 8.31 and in surface water the pH was observed 7.24-7.61.

- The Chloride levels in the ground water samples collected in the study area were ranging from 21 mg/l to a maximum of 1664 mg/l, whereas in surface waters levels are between 64 to 32061 mg/l.

- In the ground water samples collected from the study area, the hardness is varying from 24 mg/l to 755 mg/l. In surface waters the hardness levels are between 245 to 11500 mg/l.

- In the ground water samples of study area the fluoride value were in the range of 0.40 mg/l to 1.3 mg/l. whereas in the surface waters the fluoride levels are between 1.0 to 2.0 mg/l.

Overall all the ground water samples collected from the study area were found to be fit for human consumption, however the hardness, dissolved solids most of ground water samples seem to be above desirable limit but well within the permissible limits. Most of the heavy metals in all samples are below detectable limits.

3.5 Soil Quality

The present study on soil quality establishes the baseline characteristics in the study area surrounding the project site. The study has been addressed with the following objectives. To determine the base line characteristics

- To determine the existing soil characteristics around proposed project
- To determine the impact of industrialization/urbanization on soil characteristics
- To determine the impacts on soils from agricultural productivity point of view.

3.5.1 Criteria Adopted For Selection of Sampling Locations

For studying the soil types and soil characteristics, 14 sampling locations were selected to assess the existing soil conditions representing various land use conditions and geological features.

3.5.2 Methodology of Sampling

The homogenized soil samples collected at different locations were packed in a polyethylene plastic bag and sealed. The sealed samples were sent to laboratory for analysis. The physical, chemical parameter concentrations were determined from all samples.

3.5.3 Soil Sampling Locations

Details of the soil sampling locations are given in Table–3.8. Soil sampling location map is shown in **Figure–3.4**. The soil analysis results are shown in Table–3.9. The rating chart of soil data is given in Table–3.10.

Table-3.8

S. No	Sampling Location Code	Name of Sampling Location	Distance from project site (km)	Direction
1	S-1	Papanenedal	3.0	SW
2	S-2	Mayilurani	3.8	NW
3	S-3	Erumaipatti	5.0	SSW
4	S-4	Uppur	1.3	N
5	S-5	Plant Site -1	0.0	--
6	S-6	Naganendal	0.7	W
7	S-7	Thirupalakudi	1.7	S
8	S-8	Solandur	4.9	W
9	S-9	Kathamangalam	3.2	Sw
10	S-10	Karangudi	2.2	W
11	s-11	Plant Site -2	0.0	--
12	S-12	Uganthangudi	3.6	NW
13	S-13	Paranur	5.2	NW
14	S-14	Anandanakottai	2.7	NW

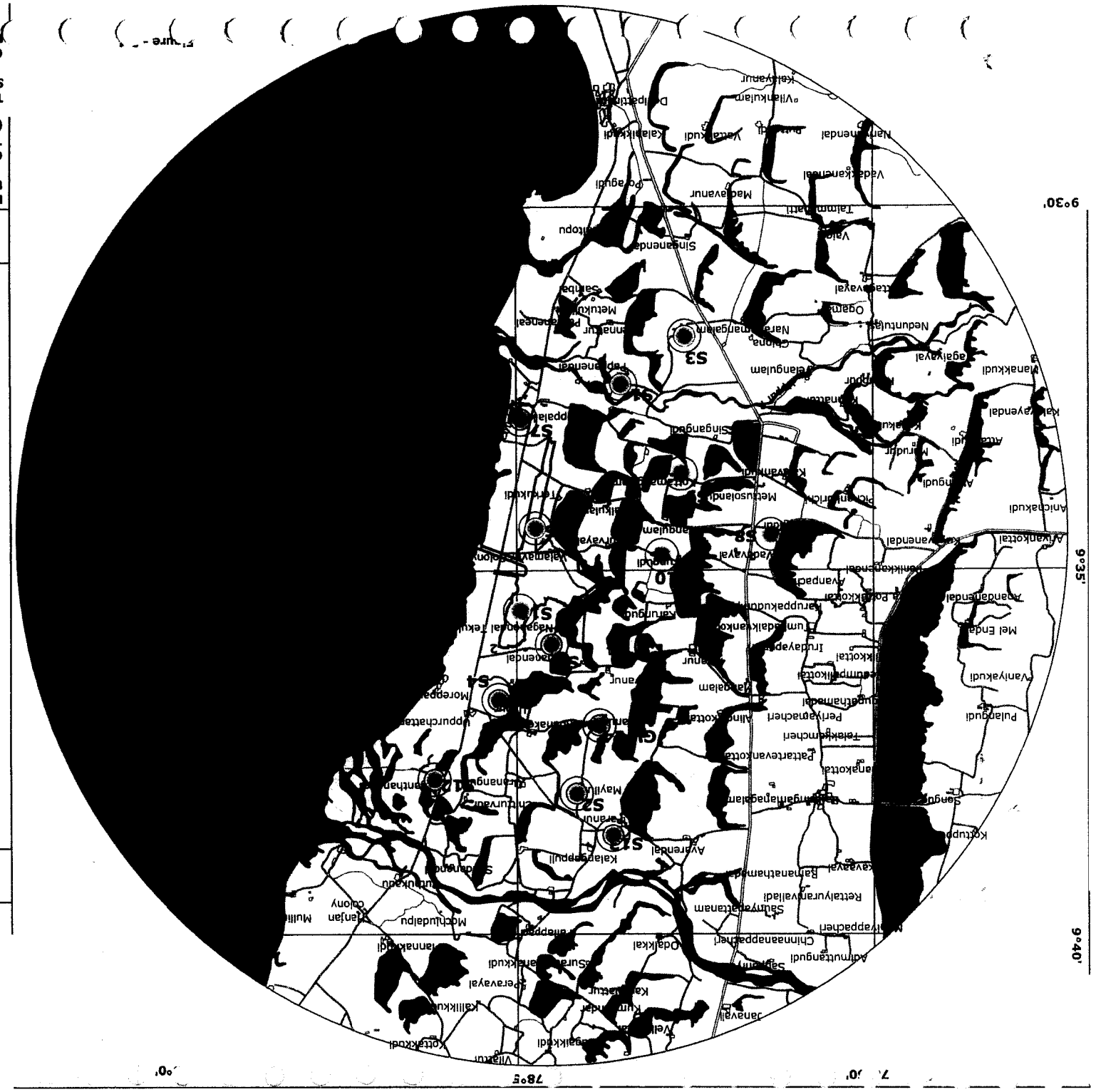
Table-3.9
Soil Analysis Results

S. No.	Test Parameters	Results		
		Papanenedal (S1)	Mavilangal (S2)	Erumaipatti (S3)
1.	pH (1.2 Soil Water Extract)	8.16	7.01	7.60
2.	E.C (μ mhos) (1:2 Soil water Extract)	112	630	148
3.	Available Nitrogen, Kg/Hec	60	80	100
4.	Available Phosphorous as P_2O_5,	5	7	11

	Kg/Hec			
5.	Available Potassium as K_2O, Kg/Hec	411	684	484
6.	Ex. Sodium as Na, ppm	140	239	196
7.	Ex. Calcium as Ca, ppm	1080	1480	2000
8.	Ex. Magnesium as Mg, ppm	268	243	292
9.	Sodium Absorption Ratio (SAR)	0.31	0.48	0.34
10.	Water soluble Chloride as Cl, ppm	25	150	40
11.	Organic Carbon,%	0.14	0.18	0.22
12.	Texture	Loamy Sand	Sandy Loam	Sandy Loam
	a) Sand, %	85	80	74
	b) Silt, %	6	8	10
	c) Clay, %	9	12	16

S. No.	Test Parameters	Results		
		Uppur (S4)	Site Sample – 1 (S5)	Naganendal (S6)
1.	pH (1.2 Soil Water Extract)	7.59	6.80	8.26
2.	E.C (μ mhos) (1:2 Soil water Extract)	70	65	852
3.	Available Nitrogen, Kg/Hec	50	40	110
4.	Available Phosphorous as P_2O_5, Kg/Hec	5	4	8
5.	Available Potassium as K_2O, Kg/Hec	179	326	916
6.	Ex. Sodium as Na, ppm	55	115	294
7.	Ex. Calcium as Ca, ppm	920	1160	2040
8.	Ex. Magnesium as Mg, ppm	195	243	657
9.	Sodium Absorption Ratio (SAR)	0.14	0.25	0.46
10.	Water soluble Chloride as Cl, ppm	15	15	210
11.	Organic Carbon,%	0.12	0.10	0.24
12.	Texture	Loamy Sand	Loamy Sand	Sandy Loam
	a) Sand, %	88	84	70
	b) Silt, %	5	7	11
	c) Clay, %	7	9	19

S. No.	Test Parameters	Results		
		Thirupalakudi (S7)	Solandur (S8)	Kothamagalam (S9)
1.	pH (1.2 Soil Water Extract)	6.74	7.96	8.03



SOIL SAMPLING LOCATIONS

N

PLANT BOUNDARY

ROAD

NALA

WATER BODY

VILLAGE

1. 9°33'12.62"N,78°53'50.36"E

2. 9°36'2.58"N,78°55'17.84"E

3. 9°35'12.88"N,78°53'50.36"E

SOIL SAMPLING LOCATION

0 1 2 3 4 5KM

PROJECT:
UPPUR SUPER CRITICAL COAL BASED THERMAL POWER PRO

CLIENT:
TANGEDCO
(A Subsidiary of TNEB LTD)

TITLE:
SOIL SAMPLING LOCATIONS

CONSULTANT:
BHAR ATHI TD,H ERAB

2.	E.C (μ mhos) (1:2 Soil water Extract)	48	1150	295
3.	Available Nitrogen, Kg/Hec	20	180	220
4.	Available Phosphorous as P_2O_5, Kg/Hec	2	19	25
5.	Available Potassium as K_2O, Kg/Hec	95	653	326
6.	Ex. Sodium as Na, ppm	44	469	276
7.	Ex. Calcium as Ca, ppm	520	3080	2160
8.	Ex. Magnesium as Mg, ppm	122	681	365
9.	Sodium Absorption Ratio (SAR)	0.14	0.63	0.46
10.	Water soluble Chloride as Cl, ppm	15	480	90
11.	Organic Carbon,%	0.10	0.44	0.60
12.	Texture	Sandy Soil	Sandy Clay Loam	Sandy Loam
	a) Sand, %	93	70	70
	b) Silt, %	3	21	12
	c) Clay, %	4	27	18

S. No.	Test Parameters	Results		
		Karangudi (S10)	Site Sample – 2 (S11)	Uganthangudi (S12)
1.	pH (1.2 Soil Water Extract)	7.36	7.31	6.98
2.	E.C (μ mhos) (1:2 Soil water Extract)	115	6040	250
3.	Available Nitrogen, Kg/Hec	80	190	160
4.	Available Phosphorous as P_2O_5, Kg/Hec	6	21	17
5.	Available Potassium as K_2O, Kg/Hec	411	705	326
6.	Ex. Sodium as Na, ppm	290	327	244
7.	Ex. Calcium as Ca, ppm	1440	4320	1680
8.	Ex. Magnesium as Mg, ppm	268	1143	559
9.	Sodium Absorption Ratio (SAR)	0.58	0.36	0.42
10.	Water soluble Chloride as Cl, ppm	30	3100	60
11.	Organic Carbon,%	0.20	0.54	0.48
12.	Texture	Sandy loam	Clay	Clay
	a) Sand, %	80	27	22
	b) Silt, %	7	31	34
	c) Clay, %	13	42	43

S. No.	Test Parameters	Results	
		Paranur (S13)	Anandanakottai (S14)
1.	pH (1.2 Soil Water Extract)	7.75	7.90
2.	E.C (μ mhos) (1:2 Soil water Extract)	170	350
3.	Available Nitrogen, Kg/Hec	140	210
4.	Available Phosphorous as P_2O_5, Kg/Hec	12	24
5.	Available Potassium as K_2O, Kg/Hec	516	726
6.	Ex. Sodium as Na, ppm	644	85
7.	Ex. Calcium as Ca, ppm	2960	3160
8.	Ex. Magnesium as Mg, ppm	243	462
9.	Sodium Absorption Ratio (SAR)	0.97	0.12
10.	Water soluble Chloride as Cl, ppm	40	85
11.	Organic Carbon,%	0.32	0.50
12.	Texture	Loamy Sand	Sandy Clay
	a) Sand, %	85	32
	b) Silt, %	7	28
	c) Clay, %	8	40

Table-3.10
Rating Chart of the Soil Test Data
(Indian Council of Agricultural Research, New Delhi)

Nutrient	Units	Low	Medium	High
Organic Carbon (as measure of available Nitrogen)	%	Below 0.5	0.5 – 0.75	Above 0.75
Available Nitrogen (N)	Kg/ha	Below 280	280-560	Above 560
Available Phosphorus (P)	Kg/ha	Below 10	10-25	Above 25
Available Potassium (K)	Kg/ha	Below 110	110-280	Above 280

PH			
Acidic	Normal to saline	Tending to become alkaline	Alkaline
Below 6.0	6.0-8.5	8.6-9.0	Above 9.0
Total Soluble salts (Conductivity in Millimhos/cm)			
Normal	Critical for germination	Critical for growth of the sensitive crops	Injurious to most crops
Below 1.0	1.0-2.0	2.0-4.0	Above 4.0

3.5.4 Regional Scenario

The analytical results of the soil samples collected during the study period are summarized below.

The soil samples were analyzed for all the important parameters from EIA point of view like pH, electrical conductance, calcium, magnesium, nitrogen, phosphorus, potassium, etc. The

NPK represents the nutrients available in the soil, which directly indicates the soil fertility.

The range of variation of different parameters found in the study area is depicted below.

The pH values in the study area are varying from 6.74 to 8.26 showing slightly alkaline during entire study period with slight changes during various seasons.

Based on the electrical conductivity the soils are classified into 4 groups (Normal, Critical for germination, Critical for growth of the sensitive crops, Injurious to most crops). The electrical conductivity in the study area is varying from 48 to 6040 µmhos/cm indicating that soils falling under Normal category.

The organic carbon in the study area is varying from 0.10 to 0.60 %,

The other important parameters for characterization of soil for irrigation are N,P,K. Nitrogen, Phosphorus and Potassium are known as primary nutrients, Calcium, Magnesium and sulphur as secondary nutrients. The primary and secondary nutrient elements are known as major elements. This classification is based on their relative abundance, and not on their relative importance.

The Nitrates as N value in the study area is varying from 20 to 220 kg/ha indicating that it requires addition of nitrates for proper growth.

In the study area Phosphorus is varying from 2 to 25 kg/ha.

The Available Potassium in the study area is varying between 95 to 916 kg/ha.

3.5.5 Land Use Pattern of Study Area (Based on Remote Sensing Data)

Land Use Classification in Study Area

The objectives of land use studies are:

- To determine the present land use pattern;
- To ascertain the temporal changes in land use pattern due to construction and operation phase; and
- To scrutinize the impacts on land use due to proposed plant activities in the study area.

Methodology

Material and methods: - The details of study area, collection of relevant satellite images, ground truth observation, and the use of software and analytical tools used in the current study.

Geographical location of the study area: -The project area comprising of Villages Uppur, Velamavoor, Thirupalaikudi, TehsilThiruvadanai, Ramanadhapuram District of Tamil Nadu. The total geographical location of study area is 56922.05ha.

Satellite data: - The Indian Remote Sensing satellite IRS R2 L4 FX was used for present analysis. One scene of satellite imagery covered the entire study area.

Topographical maps of the study area: -The Survey of India topographical map of 58 K/11, 58 K/13, 58 K/14, 58 K/15 on 1:50,000 scale covering Ramanadhapuram District of Tamil Nadu, was used as reference map for geo-referencing of the remote sensing data. These maps helped to select the ground truth collection sites.

Ancillary data: - Information derived from the remotely sensed data can only be verified using field data. Field data is used to improve the information extraction, to calibrate either data or the information and to assess the accuracy of the derived information. Field data used in the study was of different types such as maps of Survey of India, data collected in the field sampling, and information derived from statistical data from revenue department.

Software: - ERDAS IMAGINE 9 image analysis software was used for processing and analysis of the remote sensing data. Arc GIS version 9 was used for making landuse maps.

Image Processing: For digital image processing and analysis, preliminary work like collection of maps, reports, remote sensing images, collection and study of collateral and ground truth data were done first. ERDAS IMAGINE 9 software was used for processing and analysis of remote sensing data. The topo sheets of the study area on 1:50,000 scales were scanned and were geometrically corrected in the DATA PREPARATION panel of ERDAS IMAGINE. The IRS P6 LISS III Image of the study area acquired was loaded into the ERDAS IMAGINE using the IMPORT option. Later, geometric correction of the image was done with the help of the geometrically corrected SOI topo sheets. The raw image data when viewed the display showed the difficulty in distinguishing all features. Preliminary interpretation of the satellite data was conducted, which were distributed randomly throughout the image with minimum root mean square (rms) error of less than 0.5 were selected. Polynomial transformation of 1st order was used because the correction program runs faster with it and it also avoids geometric distortion in areas of very few GCPs. After completing geometric correction of the image, study area boundary overlay was done. The project area boundary comprising of Villages Uppur, Velamavoor, Thirupalaikudi, in Ramanadhapuram District was digitized from SOI topo sheets using AOI tools polygon and vector options, saved as AOI

layers. This AOI layer was used as administrative boundary mask and the subsets of the respective blocks was prepared using subset image option of data preparation panel. The unsupervised classification was used to prepare the LULC map of the study area.

The land use pattern of the study area is given Table-3.14. The satellite Imagery IRS R2 L4 FX is shown in **Figure -3.5** & Land Use/Land Cover map is shown in **Figure-3.6**.

Table-3.11

Land Use P f the Study Area as per satell IRS R2 L4 FX

S. No.	Particulars	Land Use pattern (In Ha)	Area %
1	Agriculture Double Crop	591.61	1.04
2	Agriculture Single Crop	17833.96	31.33
3	Agriculture Fallow Land	486.91	0.86
4	Agriculture Plantation	413.87	0.73
5	Land With Scrub	4597.28	8.08
6	Land Without Scrub	6538.13	11.49
7	Salt Pans	96.30	0.17
8	Aquaculture Pond	517.27	0.91
9	Settlements	1033.63	1.82
10	Mangrove forest	122.12	0.21
11	Water body/River	2522.52	4.43
12	Sea	22168.45	38.95
	Total	**56922.05**	**100.00**

From the above data it is evident that the study area, predominantly dominated by sea 38.95% followed by agriculture single crop land 31.33%, Land without scrub land 11.49%, Land with scrub land 8.08%, water body 4.43%, settlements1.82%, agriculture double crop 1.04%, aquaculture pond 0.91%, agriculture follow land 0.86%, agriculture plantation 0.73%, mangrove forest 0.21%, and salt pans0.17% in the study area.

The area covered by mangroves near the project site is 15.1 ha at a distance of 1.0 km.

3.6 Ecology

Information on available flora and fauna of areas is most important before utilization of the land for any developmental project as the biotic component is very much interrelated with the abiotic environment. Any change in abiotic component like land, air, water is having direct

impact on the existing flora and fauna. It is also imperative to know the endangered as well as endemic species distributed in the said region. Study for flora and fauna has been carried out in the core as well as buffer (10 km radius) area.

3.6.1 Flora

The dominant plant in the study area is *Prosopis juliflora,* which is found commonly near the nallas and village wastelands. *Azardirachta indica* is a common tree near the villages and on the hedge of agricultural field. Vegetation of the study area can be broadly categorized under inland and marine nature. The terrestrial vegetation of the study area can be broadly studied under two major groups:

- Scrub & Halophytic vegetation
- Mangrove vegetation

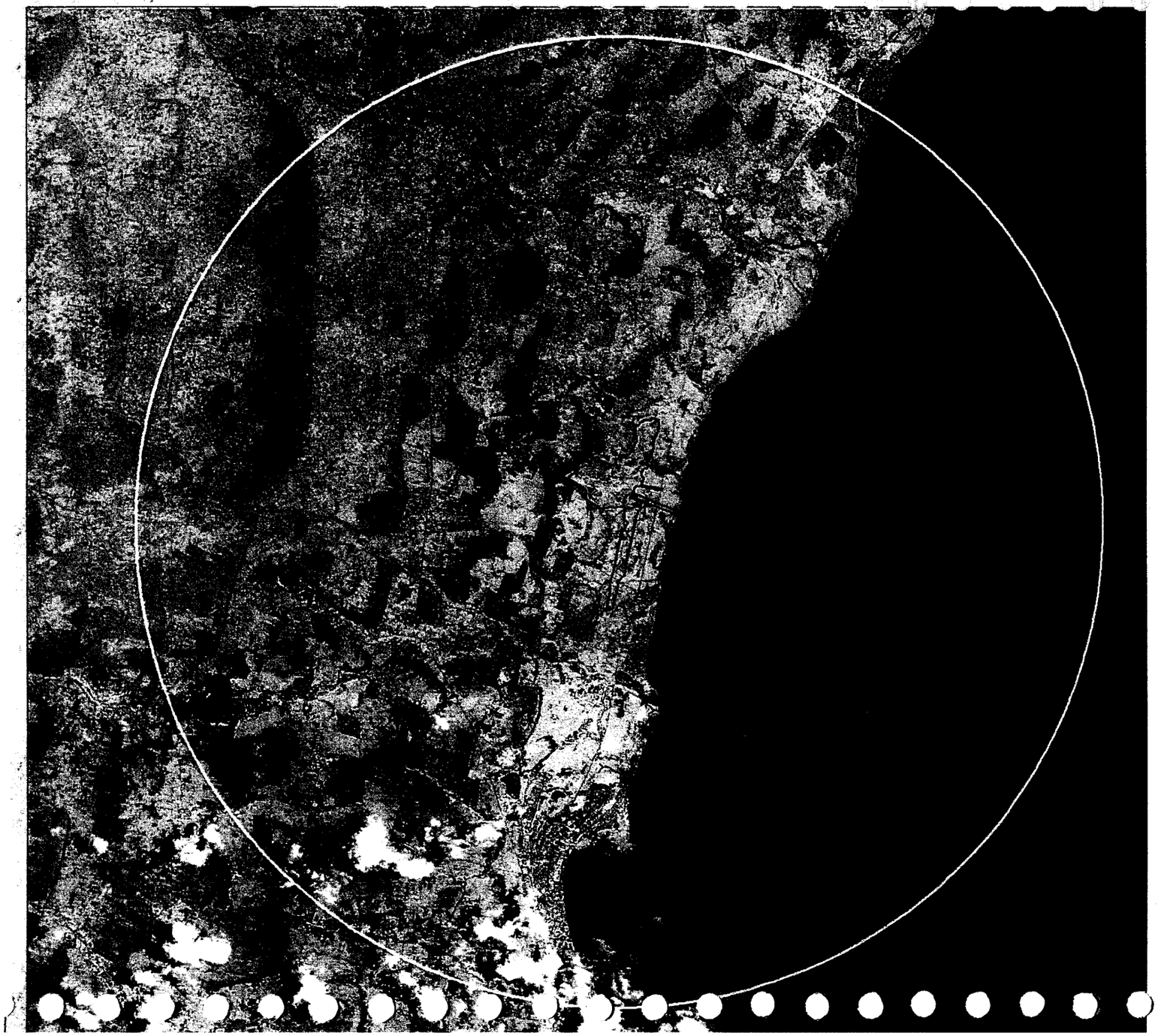
It is observed that the vegetation of study area is of marine habitat type. The existing species are well adapted to high salt tolerance and have some mechanism to conserve their body water. Due to intense interactions between land, sea and air, productivity of natural system along the coastal area is very high. There is no national park and wild life sanctuary within study area.

Scrub & Halophytic Vegetation

This type of vegetation mainly confined towards western part of the study area. The species are sparsely distributed. The common species observed herewere*Borassus flabelifer, Prosopis juliflora, Coccos nucifera, Salicornea brachiata, Suaeda maritima, Artiplex repens, Aeluropus lagopoides,* etc. Common grass species of the study area were*Cynodon dactylon,Chrysopogon fulvus, Heteropogon contortus,* etc.

Mangrove Vegetation

Mangrove scrubs are the salt water vegetation of tropical and subtropical intertidal regions of the world. Mangroves of this area are of fringing type confined to intertidal zones between lowtidal and high tide level. The mangrove vegetation was located near mouth of river and sea water. The most dominanting species of this mangrove vegetation was *Avicennia marina, Rhizophora mucronata.* Their height varies from 0.3 to 3.0 m. Besides *Excoecaria agallocha* and *Thespesia populnea* were also observed in some of the patches. The list of mangroves species found in the intertidal zones other than the species mentioned above was as follows:



IRS R2 L4 FX IMAGE OF BUFFER
OF UPPUR SUPER CRITICAL CC
BASED THERMAL POWER PROJ

Figure - 3.5

N
W E
S

Image shown in FCC

Satellite Data Details

IRS R2 L4 FX Path-Row 102-067 (29 May 2
IRS R2 L4 FX Path-Row 102-067 (02 Sep 20

Legend

Project boundary

Buffer boundary

Scale :

0 1 2 3 4 Kilometers

Project

UPPUR SUPER CRITICAL COAL BASED THE
POWER PROJECT

Client

TANGEDCO

(A Subsidiary of TNEB Ltd).

Consultant

BHAGAVATHI ANA LABS LTD,HYDERAI

Prepared by

Tecdatum Infoservices Pvt Ltd

78°50'0"E

79°0'0"E

9°40'0"N

9°35'0"N

9°30'0"N

LANDUSE LAND COVER MAP OF BU
ZONE OF UPPUR SUPER CRITICAL
BASED THERMAL POWER PROJE

Figure

N

W E

S

Legend

Map Symbol	Category	Area (Ha)
	Agriculture Double Crop	591.61
	Agriculture Single crop	17833.96
	Agriculture Fallow Land	486.91
	Agriculture Plantation	413.87
	Land With Scrub	4597.28
	Land Without Scrub	6538.13
	Salt pans	
	Aquaculture Ponds	517.27
	Settlement	1033.63
	Mangrove forest	122.12
	Water body/River	2522.52
	Sea	22168.45
	Project boundary	
	10 Km Buffer boundary	

Scale :

0 0.9 1.8 2.7 3.6 Kilometers

Project:

UPPUR SUPER CRITICAL COAL BASED THE POWER PROJECT

Client :

TANGEDCO

(A Subsidiary of TNEB Ltd).

Consultant :

BHAGAVATHI ANA LABS LTD,HYDERAI

Prepared by

Tecdatun Infoservices Pvt Ltd

- *Avicennia officinalis*
- *Suaeda maritima*
- *Suaeda monoica*
- *Salichornia brachiata*

Suaeda maritima of Chenopodiaceae family was found to be the most common species in all locations with grasses having a higher frequency of occurrence at all the locations. *Prosopis juliflora* of Mimosaceae family is relatively dominant near proposed site. A buffer of 50 m along the mangroves will be left at the project site. The list of flora in different ecosystem is presented in **Table 3.12.**

Table 3.12: List of flora in the study area

Tree	**Family**
Albizia lebbeck	Mimosaceae
Azadirachta indica	Meliaceae
Borassus flabellifer	Arecaceae
Coccos nucifera	Arecaceae
Ficus amplissima	Moraceae
Ficus benghalensis	Moraceae
Ficus religiosa	Moraceae
Prosopis juliflora	Mimosaceae
Prosopis spicigera	Mimosaceae
Thespesia populnea	Malvaceae
Scrub	
Calamus rotang	Arecaceae
Opuntia dilenii	Cactaceae
Opuntia variegate	Cactaceae
Phoenix sylvestris	Arecaceae
Salvadora persica	Salvadoraceae
Salvadora variegate	Salvadoraceae
Herbs	
Abrus precatoreus	Fabaceae
Aeluropus lagopoides	Poaceae
Aeschynemone indica	Fabaceae
Alloteropsis cimicina	Poaceae
Artiplex repens	Chenopodiaceae
Asparagus racemosus	Asparagaceae
Atriplex repens	Chenopodiaceae
Bergia sp.	Elatinaceae
Chrysopogon fulvus	Poaceae
Cressa cretica	Convolvulaceae
Cynodon dactylon	Poaceae
Cyperus iria	Cyperaceae
Dactyloctenium aegyptium	Poaceae
Digitaria bicormis	Poaceae
Enicostema axillare	Gentianaceae

Hemidesmus indicus	Periplocaceae
Heteropogon contortus	Poaceae
Impatiens sp.	Balsaminaceae
Jasminum sessiliforum	Oleaceae
Melanocenchris monoica	Poaceae
Mukia maderaspatana	Cucurbitaceae
Netpunia oleracea	Fabaceae
Ochna obtusata	Ochnaceae
Panicum paludosum	Poaceae
Plumbago zeylanica	Plumbaginaceae
Rauvolfia tetraphylla	Apocynaceae
Schoenoplectus articolatus	Cyperaceae
Sphearanthus indica	Asteraceae
Sporobolus coromandelianus	Poaceae
Wightania somnifera	Solanaceae
Aquatic	
Nymphaea sp.	Nymphacaceae
Eichhornia crassipes	Pontederiaceae
Mangroves	
Avicennia marina	Avicenniaceae
Avicennia officinalis	Avicenniaceae
Suaeda maritima	Chenopodiaceae
Suaeda monoica	Chenopodiaceae
Salichornia brachiata	Amaranthaceae
Rhizophora mucronata	Rhizophoraceae

The agricultural crops grown in the study area were as follows:

Cholam	Paddy
Coconut	Sugarcane
Cotton	Ground nut
Citrus	Pulses
Banana	Sapota
Pomegranate Mango	Papaya Guava and vine yards

The revenue generating plants of the study area are as follows:

Borassusflabellifer	Handicraft and brush making
Agave sp.	Making ropes and bags
Acacia nilotica and Acacia sp.	Timber
Bombaxmalabaricum	Plywood and match box
Tamarindiusindica	Yield of ripe tamarind

3.6.2 Fauna

The commonly found fauna in the study area were heron, crabs, cobra, hare, rat, fruit bats, etc. The study area has good avian diversity due to sufficient food availability in the form of crustaceans and small fish. The list of the fauna observed in terrestrial as well as aquatic habitats during the field studies were presented in **Table–3.13**. There are no endangered species found in study area.

Table 3.13: List of fauna observed during field study

Scientific Names	Common Names	Schedule in WPA, 1972
Birds		
Himantopus himantopus	Black winged stilts	IV
Actitis hypopleucos	Sandpiper	IV
Larus brumnnicephalus	Brown headed Gull	IV
Corvus splendens	House Crow	V
Adreyola grayii	Paddy Bird/Pond Heron	IV
Phalacrocorax pygmeus	Little Cormorant	IV
Phalacrocorax carbo	Great Cormorant	IV
Mycteria leucocephala	Painted Storks	IV
Hirundo smithii	Wire-tailed Swallows	IV
Recurvirostra avosetta	Avocets	IV
Charadrius hiaticula	Common Ringed Plover	IV
Anhinga melanogaster	Darter	IV
Passer domesticus	House sparrow	IV
Dicrurus macrocercus	Black drongo	IV
Neophron percnopterus	Scavenger vulture	IV
Haliastur Indus	Brahminy kite	IV
Alcedo atlhis	Small blue kingfisher	IV
Corcacias benghalensis	Blue Jay/Indian Roller	IV
Reptiles		
Naja naja	Cobra	II
Bungarus phasiotus	krait	IV
Echi scarinata	Viper	II
Mammals		
Macacus siricus	Bonnet Monkey	II
Helogale parvula	Mongoose	II
Felis chaus	Jungle Cat	II
Vulpes sp.	Fox	II
Sciurus carolinensis	Squirrel	IV
Muss booduge	Field Mouse	V
Cynopterus marginatus	Bat	IV

The list of arthropods observed during the study period is as under:

Meloidogyne arenaria	Root-knot Nematodes
Megasco lexmauritia	Earthworms
Scolopendra sp.	Centipedes
Tulus sp.	Millipedes
Gryllus sp.	Cricket Nymphs
Holotrichia sp.	Holotrichia grubs
Orcyctes rhinoceros	Rhinoceros beetle
Phyllium sp.	Leaf insect

3.7 Socio Economic Environment

The growth of industrial sectors and infrastructure developments in and around the agriculture dominant areas, village and towns is bound to create its impact on the socio-economic aspects of the local population of the area experiencing development. The impacts may be positive or negative depending upon the development activity. To assess the anticipated impacts of the project and industrial growth on the socio - economic aspects of people, it is necessary to study the existing socio-economic status of the local population, which will be helpful for making efforts to further improve the quality of life in the area under study. The sociological aspects of this study include human settlements, demography, and social strata such as Scheduled Castes and Scheduled Tribes and literacy levels besides infrastructure facilities available in the study area. The economic aspects include occupational structure of workers.

The Baseline Demographic and Socio economic characteristics with regards to demography, literacy and occupational status have been described based on the Primary Census Abstract, 2001. The relevant details of the Infrastructure Facilities have also been gathered from the Primary Census Abstract, 2001.

3.7.1 Socio- Economic Aspects of the Villages Falling In Total Corridor

The proposed project 2X800MW Uppur Thermal Power Station will come Uppur village, which falls in District Ramanathapuram of Tamilnadu.

Demography Details of the Study Area

Socio Economic Component

The information on socio-economic aspects of the study area (10 km radius) has been compiled from various secondary sources including various government and semi-government offices. A brief summary of the same is given in Table 3.14.

Table –3.14 Socio Economic detailes-10 KM study area

Description	Numbers
Demography	
Total Villages	41
Total no. of House Hold	27004
Total Population	113068
Total Male Population	56886
Total Female Population	56182
Total ST Population	23
Total SC Population	26409
Literacy Level	
Total Literate Population	80478
Employment Pattern	
Cultivators	19282
Agricultural Labour	8245
House Hold Workers	1036
Other Workers	13701
Total Main Workers	42264
Total Marginal Workers	10919
Total Non Workers	59885

Source: Census 2011

The total 41 villages comprises in the buffer zone, total population is 113068 among them 56182 are male and 56886 are female, among them 12420 are total children, male children are 6349 and female children are 6071.

Table – 3.15 Infrastructure Facilities*			
Water facilities*			
Tap	28	River	3
Well	22	Canal	0
Tank	17	Lake	1
Tube Well	2	Spring	0
Hand Pump	15	Others	2
P & T Facilities			
Post Office	15	Post & Telegraph Office	1

Telegraph Office	3	Telephone Connection	4
Power Supply*	Available in 38 villages		
Medical Facilities*			
Maternity & Child Welfare Center	6	Family Welfare Center	0
Public Health Center	2		
Education Facilities			
Primary School	59	College	0
Middle School	14		

**Services available in No. Villages Source: Census 2001*

Table – 3.16 Status of Literacy in the Study Area

S. No.	Particular	Population
1	Total Population	113068
2	Total Literates	80478
3	Total Literacy Rate	71%
4	Male Literates	43563
5	Male Literacy Rate	54%
6	Female Literates	36915
7	Female Literacy Rate	46%

Source: Census 2011

As per the 2011 census data the total literacy level in the buffer zone is 71% among them, male literates are 54% and female literates are 46%. it is concluded that people are poor and are not well educated; therefore the company need to focus on education and more on girl child and women education and development will provide the necessary alternate source of income generation in this area, which improves the standard of living of the population in the study area.

Status of Occupation

The economic status of the population is poor and mostly engaged in Cultivation agriculture local resources for their livelihood the details showing below table:

Table – 3.17: Status of Occupation in the Study Area

S.No.	Particular	Details of Study Area	%
1	Main workers	42264	37%
2	Marginal workers	10919	9.6%

3	Total workers (Main +Marginal)	53183	47%
4	Non Workers	59885	53%

Source: Census 2011

The above table shows the percent of non-workers is 53%; the total workers are 47% i.e. main and marginal workers in the study area. It may also be seen from the table. The socio-economic analysis of the study area shows that in terms of education and employment, the area is not developed. The overall socio-economic status of the target population is low in terms of literacy; and less work participation rate.

More attention and care should be taken so that the needs and demand of these marginalized classes of the influence area population can get more exposure to modern facilities of education and development.

Table–3.18: Vulnerability Groups

S. No.	Particular	Details of Study Area
1	Total Population	113068
2	Total SC Population	26409
3	% of SC Population	23%
4	Total ST Population	23
5	% of ST Population	0.02%
6	Others	86636
7	% of others	77%

Source: Census 2011

The above table shows that the marginalized population of Scheduled Caste (SC) and Scheduled Tribe (ST) in the study area and special attention has to be given towards these groups. Among the total population, the Scheduled Caste (SC) is 26409 (23%) and Scheduled Tribe (ST) is 23 (0.02%).

Marginal groups are important to identify the population who fall under the marginalized and vulnerable groups and special attention has to be given towards these groups while making action plans. Special provisions should be made for them.

Table–3.19: Land Use Pattern in the Study Area (in Ha)

S. No.	Particulars	Land Use pattern (In Ha)
1	Irrigated Area	5285.52
2	Un-irrigated area	11307.64
3	Cultivable Waste	2388.2
5	Area Not Available for Cultivation	25059.99
	Total Area	**44041.35**

Source: Census 2001

As per the 2001 census data the land use pattern is like this total area 44041.35 ha comprises in the buffer zone among that Irrigated land is 5285.52 ha, un irrigated land is 11307.64 ha, and cultivable waste 2388.2 ha area not available land for Cultivation is 25059.99 ha.

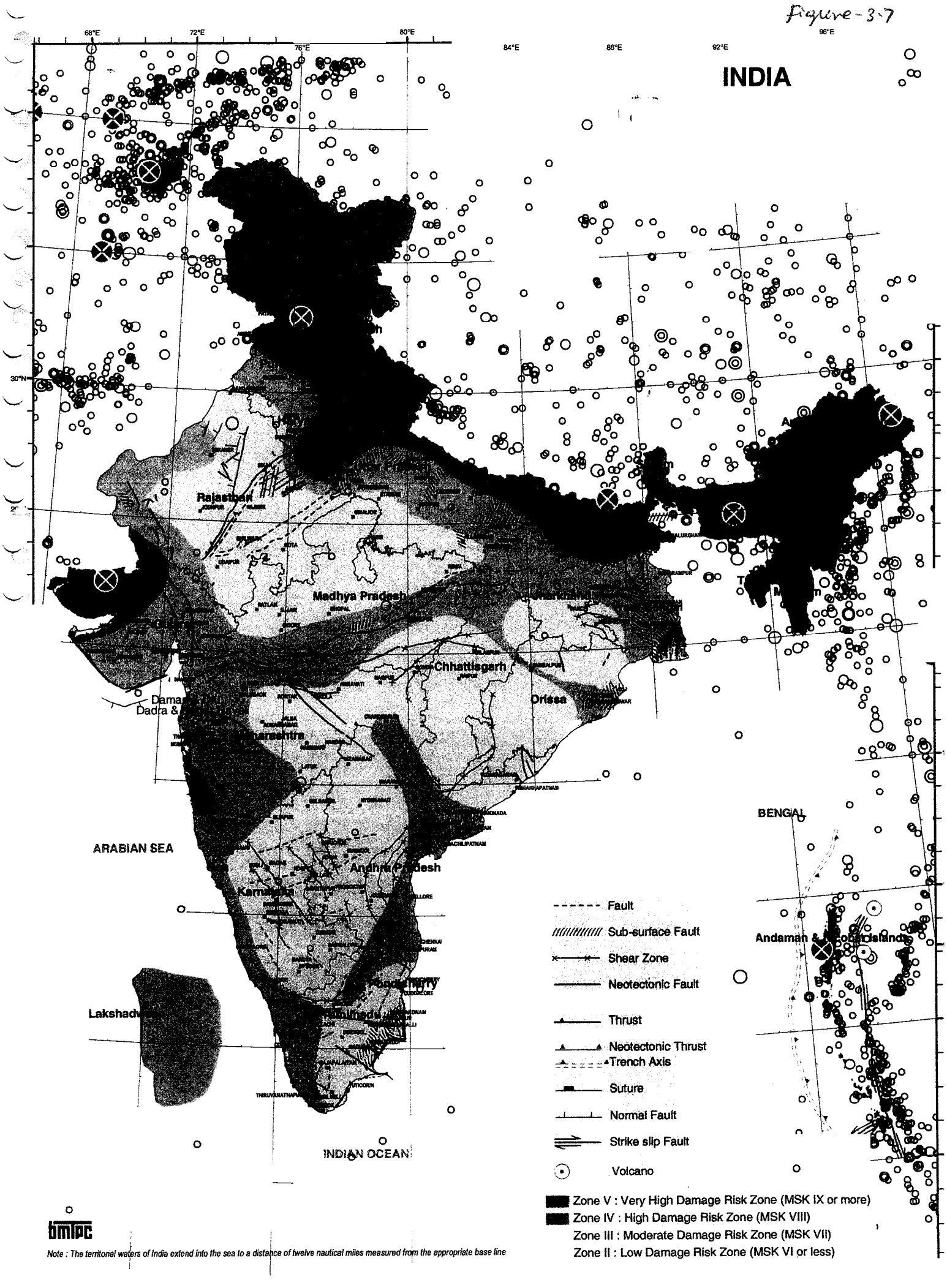
Health Facilities: In the buffer zone of 10 km area Health facilities comprise 2 Primary Health Centres, 1 Primary Health Sub centres are here, no Maternity & Child Welfare Centre and here is need to focus on Health Care infrastructure facilities.

Educational Facilities: In the 10 km radius buffer zone comprises 59 primary schools and 14 are middle schools no Colleges. Here is need to focus on Higher and Technical education and educational infrastructure i.e. toilets, drinking water and RCC building for all schools, library facilities, Girl child and Adult education.

3.8 SEISMICITY

The study area fall under seismic zone III as per IS:1893-2002 Seismic zoning map of India Meteorological Department shown in **Figure–3.7**

Figure-3.7



bmtpc

Note : The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line

Anticipated Environmental Impacts & Mitigation Measures

Chapter – 4
Anticipated Environmental Impacts & Mitigation Measures

4.0 Identification of Impacts

This chapter presents identification and appraisal of various impacts due to the proposed power plant. The environmental impacts can be categorized as either primary or secondary. Primary impacts are those, which are attributed directly to the project and secondary impacts are those, which are indirectly induced and typically include associated investment and changed pattern of social and economic activities due to the project.

The impacts have been assessed during the construction and operation phase of the power plant on different environmental components:

4.1 Impacts during Construction Phase and Mitigation Measures

Probable environmental impacts during construction phase are typically due to activities related to clearing of vegetation, leveling of site, civil constructions erection of structures and installation of equipment.

4.2 Air Environment

4.2.1 Impact on Air Quality

The main sources for impact of air quality during construction period is due to movement of vehicles and construction equipment at site, dust emitted during leveling, grading, earthmoving, foundation works, transportation of construction material etc. Dust would be generated during activities such as loading and unloading, top soil removal, movement of vehicles over dirt roads and windblown dust from exposed project site. Hence, during the construction phase, particulate matter (PM_{10}& $PM_{2.5}$) would be the main pollutants. The emissions from vehicles and construction equipment could also be of some concern on a local level.

4.2.2 Air Pollution Mitigation Measures

The dust generated will also be fugitive in nature, which can be controlled by sprinkling of water. The impacts will be localized in nature and the areas outside the project boundary are not likely to have any major impact with respect to ambient air quality.

There will not be any major leveling operations required as the plant site is plain with a gradual gradient. Hence, no significant excavation in the area except for foundations for civil constructions and foundations of equipment are proposed. Nevertheless, it is necessary to control the dust emissions particularly during dry weather. This will be achieved by regular

water sprinkling all over the exposed area, twice a day by using truck-mounted sprinklers. due to which 50% reduction in dust generation from the exposed surface can be achieved.

Ambient air quality levels of SO_2 and NO_x could increase due to operation of construction machinery such as bulldozers, pay loaders, trucks etc. However, increase in levels of these contaminants is expected to be insignificant since these machines will be operated intermittently and the equipment being on the move, there will not be concentration of emissions at a single location. Nevertheless, it will be ensured that both petrol and diesel powered construction vehicles are properly maintained to minimize exhaust emissions.

Since electrical power is available near to plant site, attempts will be made to utilize the electrically powered machinery to the extent possible to minimize the emissions of SO_2 and NO_x from vehicles during construction of the power plant.

4.3 Noise Environment

4.3.1 Impact on Noise Levels

The major sources of noise during the construction phase are vehicles and construction equipment like dozers, scrapers, concrete mixers, cranes, pumps, compressors, pneumatic tools, saws, vibrators etc. The operation of the equipment can generate noise in the range 85-90 dB (A) near the source. The noise will be generated within the plant boundary and will be temporary in nature.

4.3.2 Noise Levels Mitigation Measures

The noise control measures during the construction phase include provision of caps on the construction equipment and regular maintenance of the equipment. Equipment will be maintained appropriately to keep the noise level within 75 dB (A). Wherever possible, equipment will be provided with silencers and mufflers. High noise producing construction activities will be restricted to day time only. Greenbelt development will be undertaken from the construction stage itself. Further, workers deployed in high noise areas will be provided with necessary protective devices such as ear plug, ear-muffs etc. Overall, the impact due to increase in noise on the environment would be insignificant, localized and confined to the day hours.

4.4 Water Environment

4.4.1 Impact on Water Resources and Quality

Impact on water quality during construction phase is due to non-point discharges of sewage generated from the construction work force stationed at the site. Sanitation facilities (septic tanks) will be provided for treatment and disposal of sanitary sewage generated by the work force.

Runoffs from the construction yards and worker camps during monsoon could affect the quality of water bodies in the project area. Further there is possibility of water stagnation in ponds and ditches which can create an environment conducive to disease carrying vectors. Impact on water quality during the construction phase may be arise due to non-point discharges of sewage (around 60 m^3/day) from the construction work force stationed at the project site.

4.4.2 Water Pollution Mitigation Measures

The earth work (cutting and filling) will be avoided during rainy season and will be completed during the winter and summer seasons. Stone pitching on the slopes and construction of concrete drains for storm water to minimize soil erosion in the area will be undertaken. Settling pond is planned for storage and recycling of surface water for use in the plant area. Also development of green belt in and around plant will be taken up during the monsoon season. Soil binding and fast growing vegetation will be grown within the plant premises to arrest the soil erosion. In-plant roads will be concreted. Toilets with septic tanks will be constructed at site for workers and it will be ensured that domestic wastewater generated in worker colonies does not flow to water bodies. The overall impact on water environment during construction phase due to proposed activity likely to be short term and insignificant with the proposed mitigation measures the overall impact on water environment during construction phase of the power plant will be temporary and insignificant.

4.5 Land Environment

4.5.1 Impact on Land use

The proposed project with a capacity of 2x800 MW super critical coal based thermal power plant is proposed in 912 acres (369 ha) of land at Uppur, Valamavoor and Thiruppalaikudi, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu.

The site elevation is + 4.5m above MSL. It is proposed to level the site to + 5.0 above MSL. About 10 lakh cubic metres of filling material will be required for leveling. The earthen mud for filling can be obtained from Sadaveli and Varavani villages near R.S.Mangalam, which is at a distance of about 15 – 20 km from the project site.

Hence, there will be a marginal impact on the surrounding land use during the construction activity.

4.5.2 Impact on Topography

The proposed project site is a flat terrain with a gentle slope. The development of this land is not expected to change the topography of the study area. Adequate storm water drains will be provided to collect and carry the surface runoff during monsoon to the natural drainage system of the project area. The runoff will be diverted to the village tanks/ponds through pipelines.

4.5.3 Impact on Soil

The activities involved in clearing the site for the various units of power plant such as buildings, boiler and auxiliaries, cooling tower, pump house, raw water storage tank, utilities (DM plant and cooling tower), ash handling system, fuel storage & handling system, raw materials & finished goods sheds effluent treatment plant as well as construction of roads, laying of the pipelines (water supply, effluent, telephone, power supply, etc).

4.5.4 Mitigation Measures

- After completion of the construction phase, the surplus soil will be utilized to fill up the low lying areas, the rubble will be cleared and all un-built surfaces will be reinstated;
- The top soil from the excavated areas will be preserved in separate stacks for re-use during plantations;
- Green belt development and related activities will be taken up during construction phase so that the plantations grow to adequate height by the time of commissioning of the power plant. Thus, green belt will be effective in containing the fugitive emissions during operation.
- Species selected for plantation will be fast growing, adaptable to local conditions and the ability to survive in the environment.
- There will be minimum concreting of the top surfaces so that there is a scope for maximum ground water recharge due to rainfall;

4.6 Socio-economic Environment

The socio-economic impacts during the construction phase of the proposed power plant could result due to migrant workers, worker camps, induced development etc. Increase in floating population.

The local population will have employment opportunities in related service activities like petty commercial establishments, small contracts/sub-contracts and supply of construction

materials for buildings and ancillary infrastructures etc. consequently, this will contribute to economic up liftment of the area.

The construction activity will be benefited to the local people in a number of ways, which include the increase in requirement of construction skilled, semi-skilled and un-skilled workers, tertiary sector employment and provision of goods and services for daily needs including transport.

- Local people will be given preference for employment depending on their suitability;
- All the applicable guidelines under the relevant Acts and Rules related to labour welfare and safety will be implemented during the construction phase;
- The contractor shall be advised to provide fire wood/kerosene/LPG to the workers to prevent cutting of nearby trees for firewood; and
- The construction site will be secured with fencing and will have guarded entry points.

4.7 Storage of Hazardous Material

The hazardous materials used during construction may include petrol, diesel, welding gas and paints. These materials will be stored and handled carefully under applicable safety guidelines.

Some of the precautions of storage include the following:

- Dyked enclosures will be provided so as to contain complete contents of the largest tank;
- Diesel and other fuels will be stored in separate dyke enclosures;
- Tanks having large storage capacity will be separated by fire insulating walls from other storage tanks; and
- The distance between the storage tanks will be at least half their height.

4.8 Facilities to be provided by Labour Contractor

The contractor will be made to provide the following facilities to construction work force:

First Aid

At work place, first aid facilities will be maintained at a readily accessible place where necessary appliances including sterilized cotton wool etc. Ambulance will be kept at the site and made available at workplace to take injured person to the nearest hospital.

Potable Water

Sufficient supply of water fit for drinking will be provided at suitable places.

Sanitary Facility

Sanitary facilities will be provided at accessible place within the work zone and kept in a good condition. The contractor will conform to requirement of local medical and health authorities at all times.

Canteen

The canteen will be provided for the benefit of workers.

Security

Project proponent will provide necessary security to work force.

4.9 Impacts during Operation Phase

During the Operation Phase of 2x800 MW super critical imported coal based thermal power plant, the environmental concerns result from air emissions, water pollution, noise emissions and solid waste generation as listed in **Table-4.1**.

Table–4.1

Environmental Concerns during Operation of Coal based Thermal Power Plant

Environmental Component	Impact
Air emissions	Impact on flora and fauna, Impact on soil Impact on surrounding community
Wastewater	Impact on soil and surface and groundwater
Noise Levels	Impact on community Impact on fauna
Solid Waste	Impact on ground water Impact on community Impact on flora & fauna

4.10 Air Pollution

Major sources of air pollution in power plant are boilers, crushers and stockpiles. Fugitive dust emissions are also inevitable from coal handling system, ash handling system and transportation.

With the provision of high efficiency electrostatic precipitators through which the flue gases from the boilers would exit, it will be ensured that the particulate matter levels do not exceed

50 mg/Nm^3. The stack emission details from the proposed power plant are given in **Table 4.2**.

Table-4.2
Stack & Emission Details of 2x800 MW Super Critical Coal based Thermal Power Plant

Parameter	2x800 MW	
	100% Imported Coal	Blended Coal (70:30) 70% imported coal 30% indigenous coal
Coal Quantity (TPD)	14939	17934
Sulphur content (%)	0.8	0.6
Number of stacks	1	1
Number of flues	2	2
Stack Height from Ground Level (m)	275	275
Stack Dia. (m)	7.5	7.5
Exhaust Gas Temperature (0C)	140	140
Exit Gas Velocity (m/s)	22	22
Volumetric flow rate (m^3/s)	971.3	971.3
APCE Proposed (99.9%)	ESP	ESP
Emission Rate of PM (gm/sec) each flue	35.06	35.06
Emission Rate of SO_2 (gm/sec) each flue	1383.25	1245.43
Emission Rate of NO_x (gm/sec) each flue	597.31	650.57

4.10.1 Simulation Model for Prediction using Industrial Source Complex AERMOD View

The pollutants released into the atmosphere will disperse in the down wind direction and finally reach the ground at farther distance from the source. The magnitude of the Ground Level Concentration (GLC) of a pollutant mainly depends upon the strength of the emission source and micrometeorology of the study area. In order to estimate the GLCs due to the emission from the proposed project, EPA approved Industrial Source Complex (ISC)-AERMOD View Model has been employed. It is the next generation air dispersion model, which incorporates planetary boundary layer concepts.

The AERMOD is actually a modeling system with three separate components: AERMOD (AERMIC Dispersion Model), AERMAP (AERMOD Terrain Preprocessor), and AERMET (AERMOD Meteorological Preprocessor).

Special features of AERMOD include its ability to treat the vertical in homogeneity of the planetary boundary layer, special treatment of surface releases, irregularly-shaped area

sources, a plume model for the convective boundary layer, limitation of vertical mixing in the stable boundary layer, and fixing the reflecting surface at the stack base.

The AERMET is the meteorological preprocessor for the AERMOD. Input data can come from hourly cloud cover observations, surface meteorological observations and twice-a-day upper air soundings. Output includes surface meteorological observations and parameters and vertical profiles of several atmospheric parameters.

The AERMAP is a terrain preprocessor designed to simplify and standardize the input of terrain data for the AERMOD. Input data include receptor terrain elevation data. Output includes, for each receptor, location and height scale and elevations, used for the computation of airflow around hills.

4.11 Post Project Scenario (Projected)

Predicted maximum ground level concentrations considering micro meteorological data of July, August & September 2012 are superimposed on the maximum baseline concentrations obtained during the study period to estimate the post project scenario, which would prevail at the post operational phase. The overall scenario with predicted concentrations over the maximum baseline concentrations is shown in the following table along with isopleths **Figures-4.1-4.6**.

Predicted 24 hourly Ground Level Incremental Concentrations (GLCs) for July, August, and September months are given in **Table 4.3**.

Table–4.3a

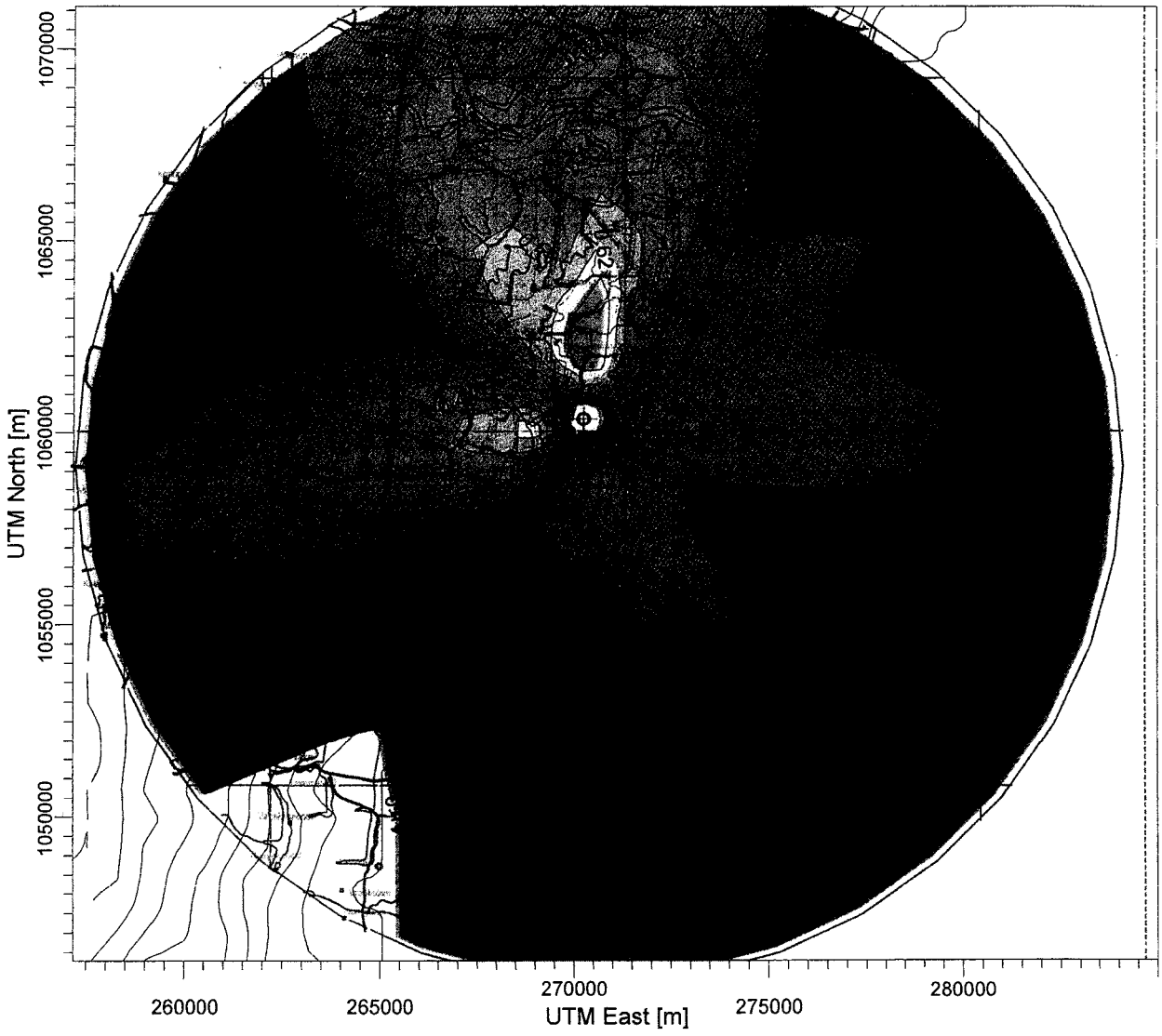
Predicted Ground Level Concentrations (GLCs) for using 100% imported Coal

	GLCs for 2x800 MW with Imported Coal		
Study period	**July, August & September 2012**		
Baseline Scenario (max)	**PM_{10}**	**SO_2**	**NO_x**
	66.6	15.4	18.9
Predicted Ground Level Concentrations (GLCs-max)	0.80	35.32	14.60
Over All Scenario (worst case)	67.40	50.72	33.50
NAAQ Standards for rural and residential areas (2009)	100	80	80

Figure - 4.1

PROJECT TITLE:

Uppur 2x800 MW Thermal Power Plant (with 100% Imported Coal)
24 Hourly Predicted GLCs of Particulate Matter (PM10)



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

0.101 0.177 0.266 0.355 0.443 0.532 0.621 0.709 0.798

COMMENTS:

4140

OUTPUT TYPE:

Concentration

MAX:

0.79807 ug/m^3

SCALE: 1:175,000

0 5 km

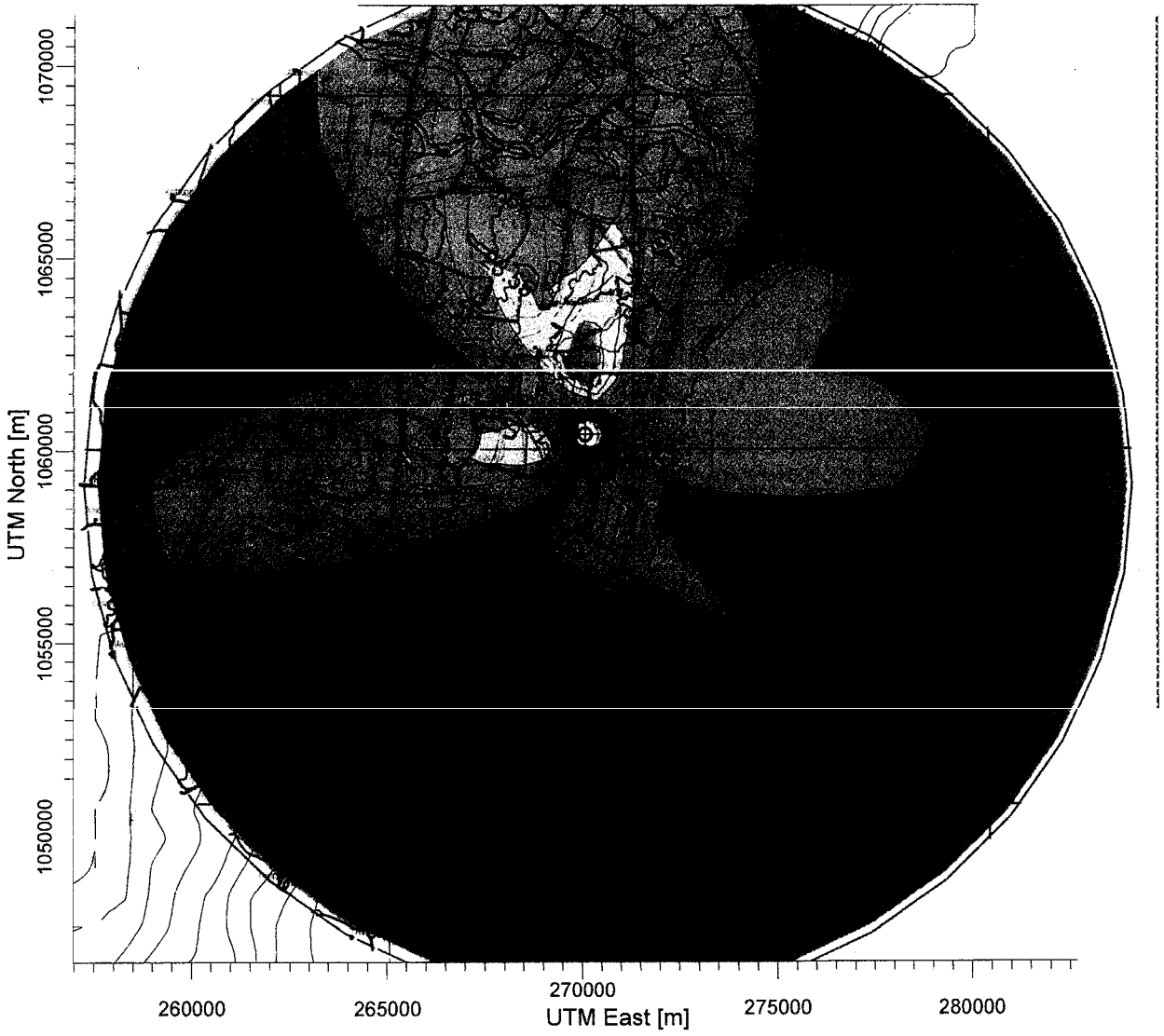
PROJECT NO.

AERMOD View - Lakes Environmental Software

Figure -4.2

PROJECT TITLE:

Uppur 2x800MW Thermal Power Plant (with 100% Imported Coal)
24 Hourly Predicted GLCs of SO2



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

2.501 3.925 7.849 11.773 15.698 19.622 23.546 27.470 31.394 35.319

COMMENTS:

SOURCES:

2

RECEPTORS:

4140

OUTPUT TYPE:

Concentration

SCALE: 1:175,000

0 5 km

MAX:

35.31852 ug/m^3

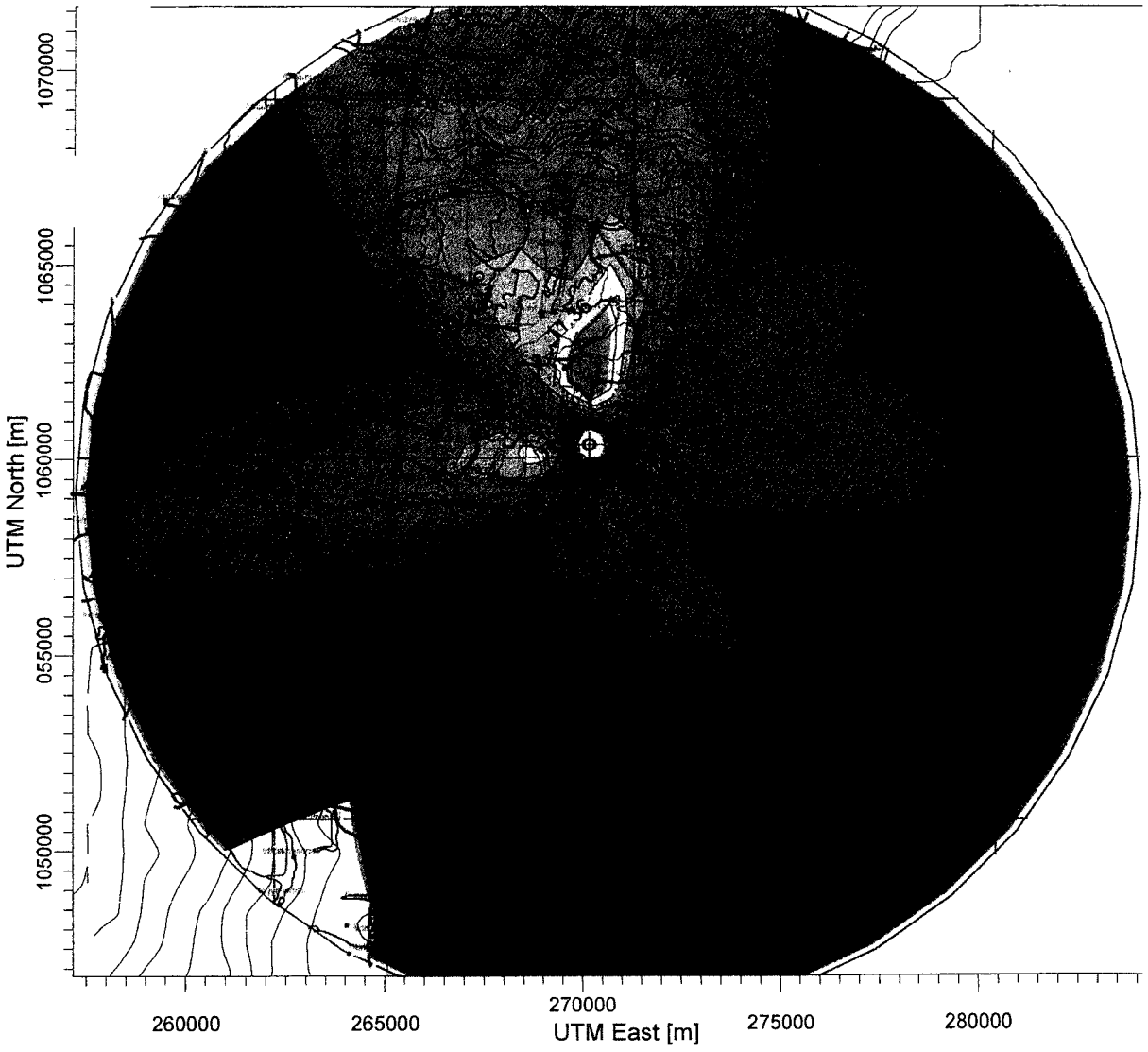
PROJECT NO.

AERMOD View - Lakes Environmental Software

Figure - 4.3

PROJECT TITLE:

Uppur 2x800 MW Thermal Power Plant (with 100% Imported coal)
24 Hourly Predicted GLCs of NOx



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

1.650 3.245 4.867 6.489 8.112 9.734 11.356 12.979 14.601

COMMENTS:

SOURCES:
2

RECEPTORS:
4140

OUTPUT TYPE:
Concentration

MAX:
14.60098 ug/m^3

SCALE: 1:175,000
0 5 km

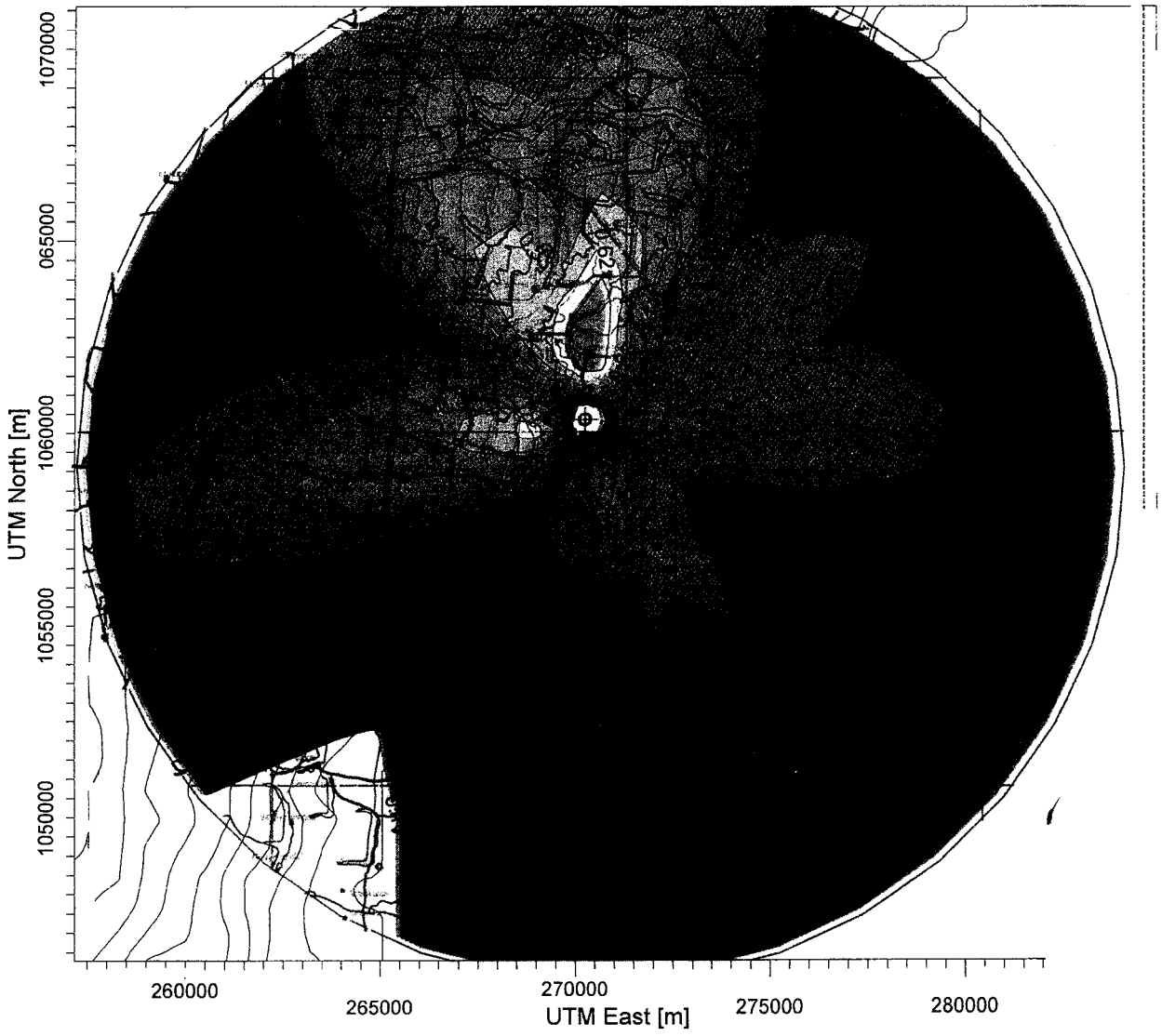
PROJECT NO.

AERMOD View - Lakes Environmental Software

Figure - 4.6

PROJECT TITLE:

Uppur 2x800 MW Thermal Power Plant (with Blended Coal)
24 Hourly Predicted GLCs of Particulate Matter (PM10)



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

0.101 0.177 0.266 0.355 0.443 0.532 0.621 0.709 0.798

COMMENTS:

SOURCES:
2

RECEPTORS:
4140

OUTPUT TYPE:
Concentration

MAX:
0.79807 ug/m^3

SCALE: 1:175,000
0 5 km

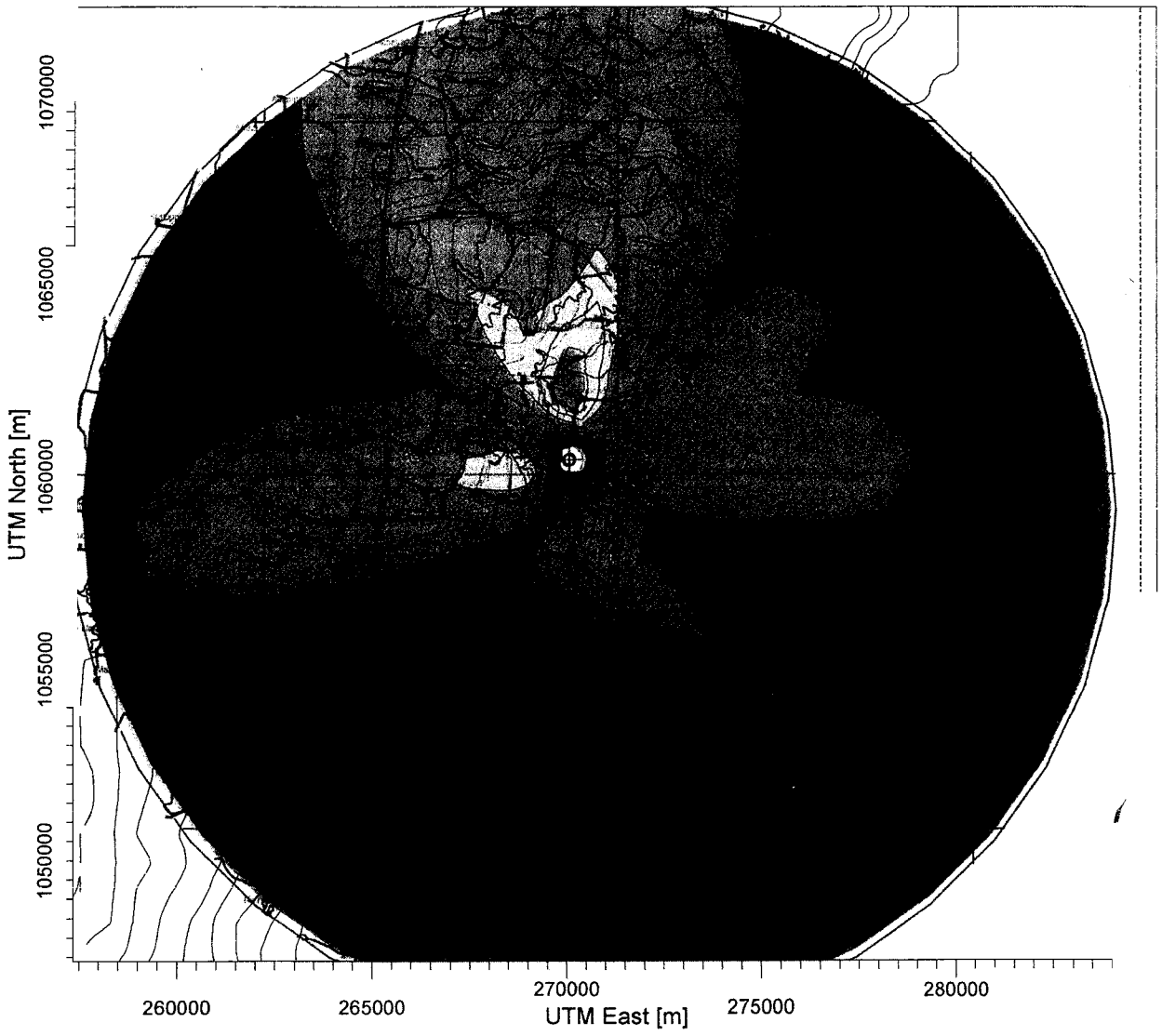
PROJECT NO.

AERMOD View - Lakes Environmental Software

Figure - 4.5

PROJECT TITLE:

Uppur 2x800MW Thermal Power Plant (with Blended Coal)
24 Hourly Predicted GLCs of SO2



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

2.501 3.535 7.070 10.604 14.138 17.673 21.207 24.741 28.276 31.810

COMMENTS:

SOURCES:

2

RECEPTORS:

4140

Concentration

MAX:

31.81023 ug/m^3

SCALE. 1:175,000

0 5 km

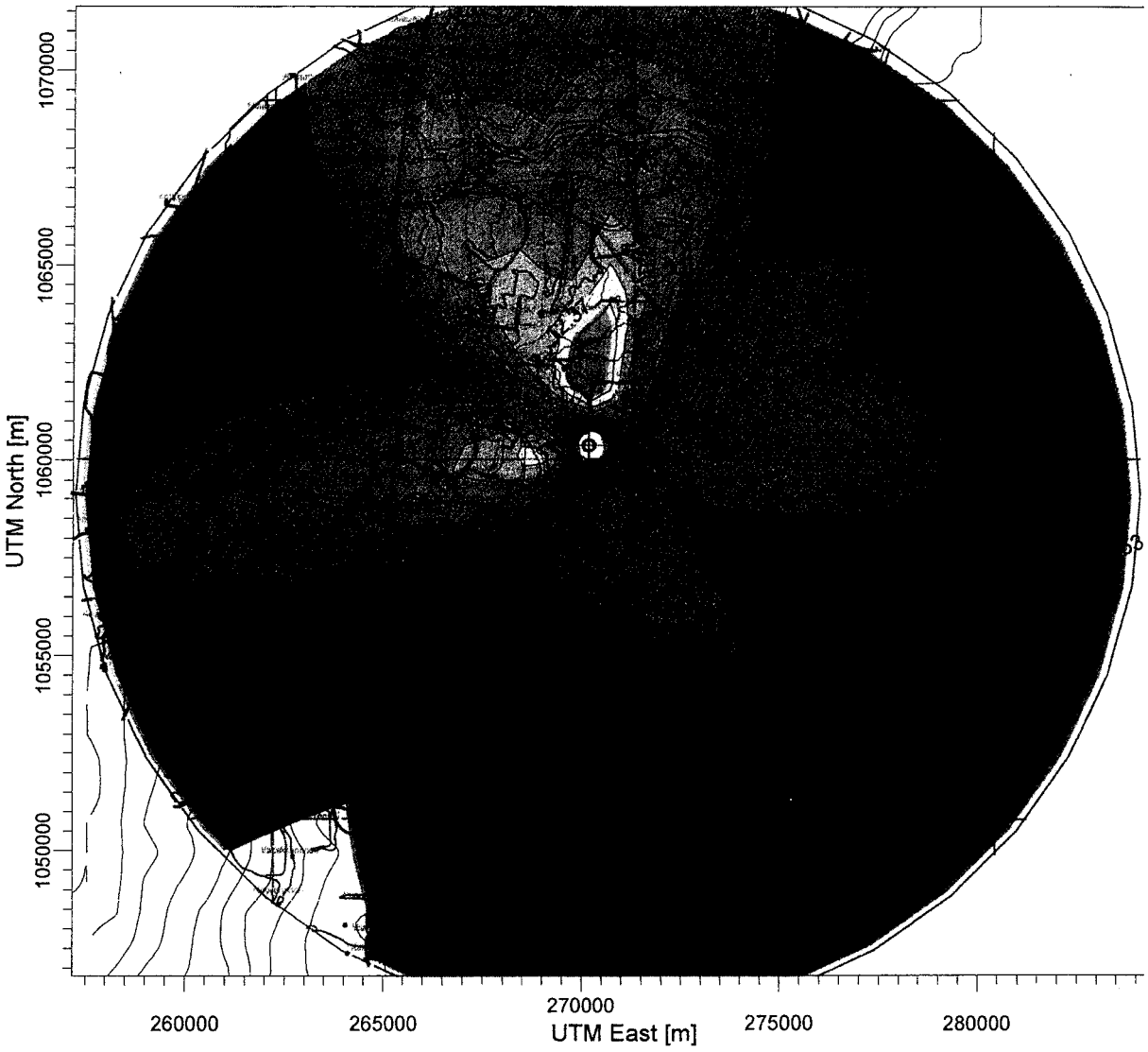
PROJECT NO..

AERMOD View - Lakes Environmental Software

Figure-4.6

PROJECT TITLE:

Uppur 2x800 MW Thermal Power Plant (with Blended coal)
24 Hourly Predicted GLCs of NOx



PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL

ug/m^3

1.781 3.534 5.301 7.068 8.835 10.602 12.369 14.136 15.903

COMMENTS:

SOURCES:
2

4140

OUTPUT TYPE:
Concentration

MAX:
15.9029 ug/m^3

SCALE: 1:175,000
0 5 km

PROJECT NO.

Table–4.3b

Predicted Ground Level Concentrations (GLCs) for using blended Coal

	GLCs for 2x800 MW with blended Coal		
Study period	**July, August & September 2012**		
Baseline Scenario (max)	**PM_{10}**	**SO_2**	**NO_x**
	66.6	15.4	18.9
Predicted Ground Level Concentrations (GLCs-max)	0.80	31.81	15.90
Over All Scenario (worst case)	67.40	47.21	34.8
NAAQ Standards for rural and residential areas (2009)	100	80	80

The predicted ground level concentrations obtained when superimposed on the baseline concentrations are within the prescribed NAAQ Standards for residential areas.

4.12 Mitigation Measures

Stack Emissions

The following measures will be adopted for the control of emissions from the power plant.

- Suitably designed ESP with efficiency of 99.9% will be placed downstream of the stack which will separate out the incoming dust in flue gas and limit the dust concentration at its designed outlet concentration of 50 mg/Nm^3.
- For effective dispersion of the pollutants stack height of 275 m is proposed based on the CPCB requirements.
- The dust generated from coal handling plant will be minimised by handling of fine coal in closed circuit. For further suppression of dust adequate water spray system will be provided;
- A well-designed burner system, will limit the temperature to a reasonably low value of NO_x.
- Adequate thickness of insulating material with proper fastening will be provided to

control thermal pollution;

4.13 Impacts of Fugitive Emissions

Emission of fugitive dust from coal handling plant will be controlled through adequate dust suppression and/or extraction system so that the impact will be considerably reduced.

4.14 Mitigation Measures

The following measures will be adopted to control fugitive emissions:

- Dust suppression system by water sprinkler at dump hopper of coal
- Regular dust suppression with water sprinkler on the haul roads;
- Control of fugitive emissions from the ash pond through maintaining a permanent blanket of water to cover the deposited ash
- Green belt development and afforestation in the plant and surroundings of the ash disposal area.
- Dust suppression/extraction system at the coal handling plant to control fugitive emission

Table – 4.4
Air Pollution Control Measures

S. No.	Section	Control Measures
1	Around the track hopper and wagon tippler;	Plain water type Dust Suppression System
	Stock pile;	Plain water type Dust Suppression System with swiveling nozzles
2	Wagon Tippler hopper complex; Crusher receipt and discharge points; All Transfer points; Boom belt discharge of stacker-recliamer;	Dry Fog type Dust Suppression System
3	Bunker floor; Crusher house;	Dust extraction–Venturi scrubber system
4	Bunker bays	Belt Sealing arrangement
5	Fly Ash in flue gas	Electro Static Precipitator (ESP)

4.15 Impact on Noise Levels

4.15.1 Prediction of Impacts on Noise Levels

Impact on Ambient Noise

During the operation phase noise will be generated from all sources. 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. For hemispherical sound wave propagation through homogeneous medium, one can estimate the noise levels at various locations due to different sources using a model based on the following principle:

$L_{p2} = L_{p1} - 20 \text{ Log } (r_2 / r_1)$, where L_{p1} and L_{p2} are the sound levels at points located at distance r_1 and r_2 from the source. Combined effect of all sources (A,B,C,...etc.) can be determined at various locations by the following equation:

$L_{ptotal} = 10 \text{ Log } (10^{lpa/10} + 10^{lpb/10} + 10^{lpc/10} .....)$, where L_{pa}, L_{pb} and L_{pc} are noise pressure levels at a point due to different sources.

Noise Predictions:

Based on the above principle a Noise Model "Dhwani" has been developed by National Environmental Engineering Research Institute (India). This model is recommended by the Ministry of environment & Forests, Government of India in the EIA Manual. The details of the model are as follows:

a. Maximum number of sources that can be modelled is 25.
b. Noise levels can be predicted at any distance from the sources.
c. Model is designed for flat terrain
d. Coordinates of the sources with respect to locations can be fixed
e. Isopleths can be drawn
f. Attenuation factors are not incorporated hence the modelled results are overestimate.

Input to the Model

Noise generating sources and its noise levels are presented in **Table 4.5**

Table – 4.5

Noise G Sources and its Noise L

S. No.	Sources	Sound pressure level, dB(A)
1	Rotating equipment like ID, SA and PA fans	85-100
2	Feed pumps	85-100
3	Boiler and super heater safety valves	60
4	Steam turbine	55
5	Startup Vent	65
6	Compressors	82-105
7	Air Compressor	95

The noise level monitored at various locations (1.5 m away from the respective unit boundary, L_{max}) in the existing road is about 85 dB(A). For noise modeling purpose these L_{max} values are considered at 10m distance away from the unit (to obtain worst case incremental level). Noise generation is assumed 1 m above ground and spreading on a flat terrain devoid of any barriers.

Coordinates of the 21 sources of noise from proposed sources were considered for modeling. Since the plant extends over a wide area, the whole plant area and its immediate surrounding was divided into Grids of 100 m spacing. The cumulative noise impact of the identified noise sources has been modelled for 1000 number of grid points. The grid points included the human settlements located outside project boundary. The predicted noise levels are observed to be within the standards.

Noise attenuation effects due to barriers like the 8 feet tall boundary wall, shrubs, bushes and trees, absorption by air, wind, temperature and humidity, were not considered for modelling, hence the values depict worst case scenario. Therefore the impact of the project operation on the ambient noise level of study area will be insignificant. The noise levels will remain well within the prescribed CPCB standards.

Predictions have been made for worst-case scenario considering all the operations and utilities are in operational conditions. The predicted Noise Levels at the proposed plant boundary are 36 dB (A) which are below the ambient noise standards and the isopleth is shown in **Figure–4.7**. It is predicted that the high noise levels will be limited to work zone only and the noise levels gradually decreases further away from the source. Therefore the impact of noise due to proposed power plants will be insignificant.

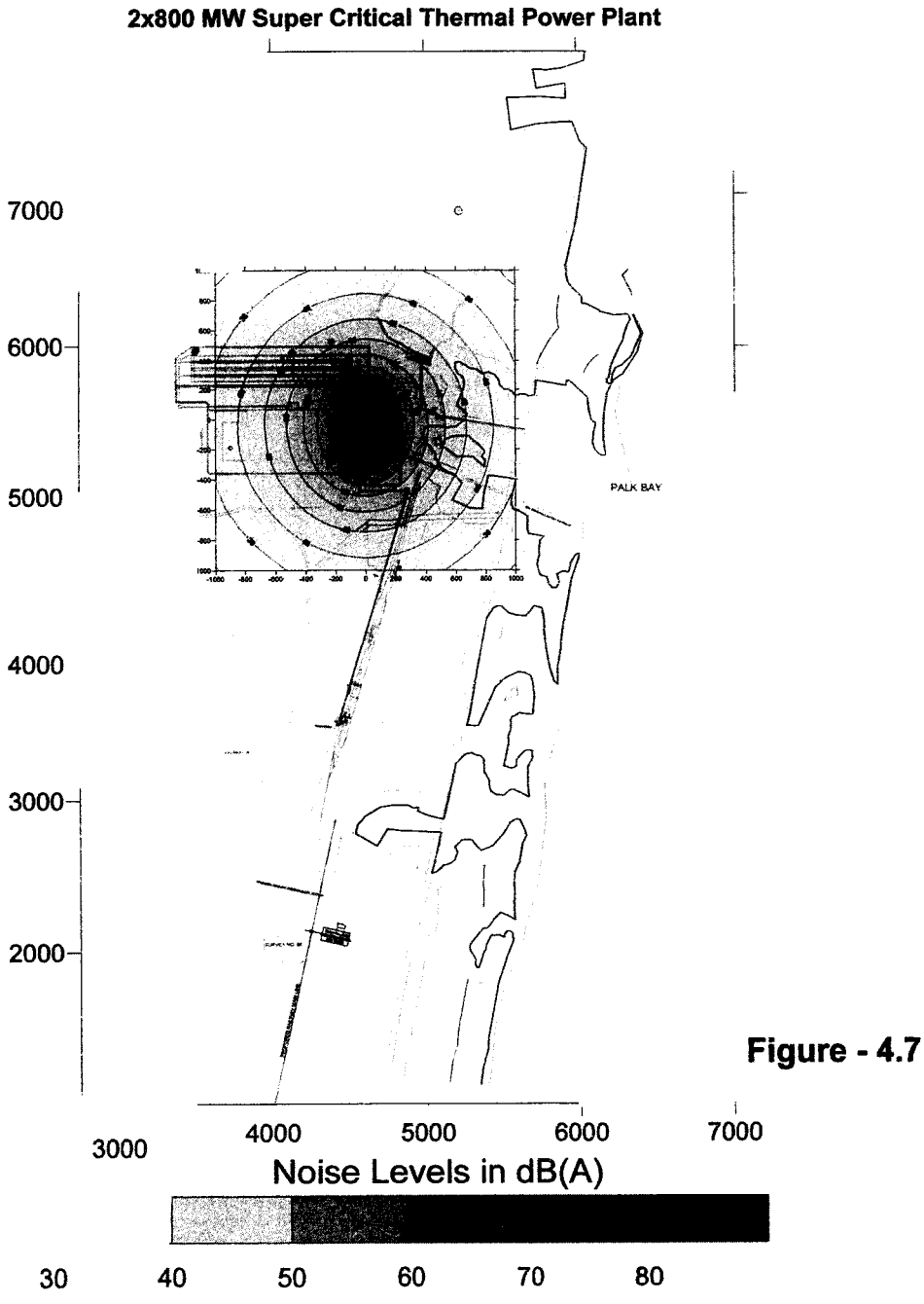
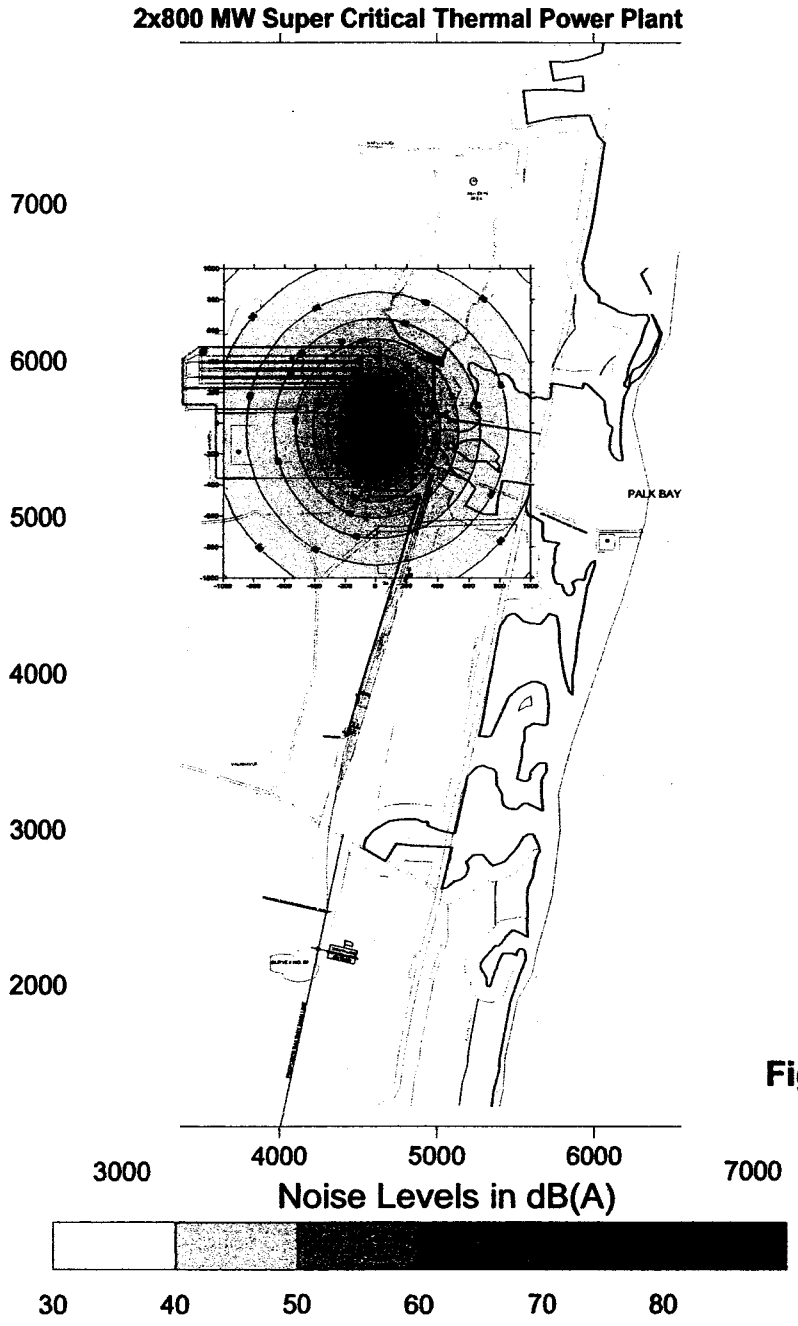

2x800 MW Super Critical Thermal Power Plant
7000
6000
5000
4000
3000
2000
PALK BAY
3000
4000
5000
6000
7000
Noise Levels in dB(A)
30
40
50
60
70
80

Figure - 4.7


2x800 MW Super Critical Thermal Power Plant
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3000
2000
PALK BAY
3000
4000
5000
6000
7000
Noise Levels in dB(A)
30
40
50
60
70
80

Figure - 4.7

The recommendations given by OSHA with respect to noise are given in **Table–4.6.**

Since most of the noise generating equipment will be in closed structures, the noise level at the plant boundary will be much lower and within the plant where noise level exceeds 85 dB(A) ear muffs will be provided to all the workmen/staff.

Table–4.6
Permissible Noise Levels

Sound Pressure Level dB (A)	Maximum Permissible Exposure Time per Day (Hours)
90	8
92	6
95	4
97	3
100	2
102	1 ½
105	1
107	¾
110	½
115	¼
>115	0

4.15.2 Mitigation Measures

The ambient noise levels in the study area are within permissible limits and will be maintained within the permissible limits even after commissioning of the proposed project. The equipment will have inbuilt noise control devices and the measured noise produced by any equipment will not exceed 85 dB(A) at a distance of 1.0m 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 measures for the attenuation of noise are given below:

- Noise will be reduced by preventing leakages from steam lines, compressed air lines and other high pressure equipment.
- Suitable padding will be provided at required locations to avoid rattling due to vibration
- Noise generating equipment will be encased where otherwise noise cannot be controlled.
- Noise proof cabins will be provided to operators wherever remote control for

operating noise generating equipment is feasible.

- The air compressor, process air blower, pneumatic valves etc will be provided with acoustic enclosure;
- Design/installation precautions will be taken as specified by the manufacturers with respect to noise control and will be strictly adhered to.
- High noise generating sources will be insulated adequately by providing suitable enclosures.
- Sound attenuation panels will be installed wherever required around noise generating equipment.
- Noise control will form an integral part of the plant design.
- Other than the regular maintenance of the various equipment, ear plugs/muffs will be provided to personnel working close to the noise generating units.
- All openings like covers and partitions will be designed properly
- Inlet and outlet mufflers will be provided wherever required.
- All rotating equipment / parts will be well lubricated and provided with enclosures as far as possible to reduce noise transmission.
- Vibration monitoring system will be provided to check and reduce vibrations and vibration isolators will be provided wherever possible.

4.16 Water Environment

4.16.1 Impact on Surface Hydrology and Water Regime

The proposed site is a flat terrain with gentle slopes. As per contours map, the natural ground level in the vicinity of proposed project varies from 1.5 to 4 m above MSL sloping down towards the East. The drainage pattern of the study area is shown in **Figure-4.8**. Water will be drawn from Palk Bay at 4.5 m depth and at a distance of 5.8 km from sea shore. The outfall will be at a depth of 5.0 m at a distance of 6.5 km from sea shore.

The existing ground level and other water levels near to the plant are given below.

(i)	RL of ECR	MSL + 5.300 m
(ii)	RL of Project Site (Average)	MSL + 4.800 m
(iii)	High Flood Level in River	1.542 m
(iv)	RL of River Bed	MSL + 3.380 m

(v)	RL of High Flood Level in River	MSL + 4.922 m
(vi)	Free Board	0.300 m
(vii)	Safe Grade Elevation of Project Site Board	RL of River Bed + HFL + Free = MSL +5.230

The hydrogeological study of the project area has been carried out through Anna University, Chennai.

The plant area will be designed with a network of drains to channel runoff during the rainy season. Surface drainage would be either open RCC rectangular drains or brick lined drains with trapezoidal shape. All drains will be covered in the proposed plant and building areas. The surface water run-off from the coal stack yard will be led to a sump for settling and the overflow will be discharged to storm water drain after treatment if required to meet the effluent discharge norms.

4.16.2 Impact on Water Quality

The total water requirement for the proposed thermal power plant is 15376 m^3/hr against which sea water outfall is 10508 m^3/hr the wastewater generated would be 3574 m^3/day.

- 500 m^3/hr of Cooling Tower blow down will be used for Coal handling plant dust suppression and Ash handling plant wash water. The run-off from coal stack yard and dust suppression system will be taken to settling tank and 120 m^3/day will be sent to guard pond.
- 304 m^3/hr of Clarifier sludge will be taken to ash pond and the supernatant water from ash pond will be treated and taken to ash water tank for recirculation.
- The DM Plant Regeneration waste of 2 m^3/hr and CPU Regeneration waste of 10 m^3/hr will be taken to neutralisation pit where it will be neutralised and then taken to guard pond.
- Wastewater from floor cleaning of plant area (10 m^3/hr, ie., 240 m^3/day), oil wastewater from power house, etc., (about 600 m^3/day) will be treated in oil separator and will be sent to guard pond.
- RO Plant rejects of 26 m^3/hr (624 m^3/day) will be sent to CT Blow down cum rejected storage tank, treated waste service water (about 840 m^3/day), DM Plant and CPU Regeneration waste (288 m^3/day) and 75 m^3/day of treated effluent from sewage treatment plant can be used for green belt.

- Green belt will be developed in 275 acres of project site. Further, green belt will be developed around the plant area. The treated wastewater as well as village tank water will be utilized for green belt development around plant site.

Table – 4.7
Sea Water Outfall

S. No.	Description	Wastewater Generation (m^3/hr)	Disposal
1.	Ultrafiltration	122	Discharge to the outfall point in the Palk Bay
2.	Desalination plant	660	
3.	RO plant	26	
4.	CT Blow down cum Reject water	9700	
Total		**10508**	

Table – 4.8
Wastewater and Reuse

S. No.	Type of water	m^3/day
1	Boiler Blow down	1200
2	DM Regeneration	259
3	CPU Regeneration	
4	Waste from floor cleaning of plant area	240
5	Oil wastewater from power house	600
6	Oil handling area run off	
7	CTBD	1200
8	Sewage Treatment Plant	75
	Total	**3574**

Table –4.9
Wastewater Characteristics

Parameter	Filtration Plant Back wash	DM plant Regeneration Waste	CT Blow Down	Other sources	Sanitary waste
pH	8.0 - 8.3	6.0 – 10.5	8.0 – 8.3	8.0-8.5	6.5 – 7.0
Oil & Grease(mg/l)	Nil	-	Nil	<12	<12
TSS (mg/l)	500 – 550	20 – 30	<2	10-20	150 – 200
TDS (mg/l)	450	3000 – 3500	35,000	350 –375	400 – 450
COD(mg/l)	-	<25	<5	<5	300 – 400
BOD(mg/l)	-	<2	<1	<2	200 – 275
Temperature	-	-	<5°C above raw water	-	-
Free available chlorine	-	-	<0.5	-	-
Phosphates	-	-	<5.0	-	-

Table –4.10
Final Discharge Charact...

S.No.	Parameter	Value
1	pH	7.0 – 8.5
2	Oil & Grease (mg/l)	<10
3	TSS (mg/l)	<20
4	TDS (mg/l)	<35,000
5	COD (mg/l)	<250
6	BOD (mg/l)	<30
7	Temperature, °C	Not exceeding 5°C above the receiving water temperature
8	Free available chlorine (mg/l)	<0.5
9	Phosphates (mg/l)	<5.0

Treated wastewater will be used for greenbelt development and dust suppression. Since final discharge is meeting the effluent discharge standards and the impact on water environment is insignificant. Treatment method of wastewater from different systems are as follows.

Table –4.11
S ...f... ...d...

Source of Wastewater	Treatment Method
Filtration plant back wash	The sea water filtration plant filters are periodically backwashed with filtered sea water.
DM plant regeneration waste	The generation of the DM plant will be carried with 33% HCl and 48% NaOH solution and the effluents will be let in to the neutralizing pit
Sanitary waste from plant toilets	The sewage from the plant will be conveyed through closed drains to septic tanks from where they will be treated in the ETP and used for gardening purpose.
Boiler blow down	Boiler blow down water will be let into the guard pond.
Miscellaneous plant service water	This will be conveyed to closed drains to the guard pond.
Fuel oil storage and handling area runoff	The effluents will be collected in a pit and after treatment will be let into the ETP
Dust suppression / extraction system runoff	The dust extraction system runoff water will be let into the guard pond and after settling down the water will be allowed in to the ash water tanks.
Coal pile area runoff	The Coal pile area runoff water will be let off into a guard pond and after settling down the clear water will be allowed to flow into the ash water tank.
Cooling tower blow down	The Cooling tower blow down water will be sent through the CW system return line directly to the sea.

Source of Wastewater	Treatment Method
Ash pond effluent	The ash recovery water from the ash pond will be pumped to the proposed clarifier. The recovered water will be pumped to the raw water storage tank.

4.16.3 Impact on Ground Water

The effluents after treatment will be routed to guard pond before it is reused for green belt and dust suppression purposes. The guard pond will be made of plain cement concrete with epoxy coating to make impermeable bottom surface which prevents percolation to ground water table.

4.17 Impact of Solid Waste

The main solid waste from the power plant will be ash (Fly ash and Bottom ash). The average coal consumption rate from the power plant along with ash generation is provided in the following table.

Table – 4.12
Details of Ash Generation

Description	2x800 MW TPP	
	100% Imported Coal	Blended Coal (70% imported coal & 30% indigenous coal)
Coal consumption	4.64 MTPA	5.57 MPTA
Total Ash	0.464 MTPA (10%	1.8938 MTPA(34%
Fly Ash (@80%)	0.3712 MTPA	1.515 MTPA
Bottom Ash (@20%)	0.0928 MTPA	0.3788 MTPA

It is proposed to utilize 100% of the fly ash for which ash utilization plan is ready. During emergency the ash will be disposed off safely in ash pond area. The proposed ash pond area is 138 acres. The average ash dump height is 9.0 m. Bottom ash and unutilized fly ash will be disposed off in the ash pond. To control fugitive dust emission from the ash pond area water layer will be maintained above the ash pond.

4.18 Impact on Ecology

High efficiency ESPs are proposed to control particulate emissions. ETP with recycling arrangement is provided to control water pollution. Cooling towers are proposed to prevent thermal pollution. Adequate greenbelt will be developed. No additional land is required for plant. Hence impact on ecology will be limited.

The consumptive water required for the power plant is proposed to be drawn from Palk Bay which is within 1.0 km. Sea water will be pumped to the proposed site through pipe lines.

The sea water will be used for condenser cooling and portion of it will be desalinated and used for other purpose.

The concentrated sea water will be produced from cooling tower blow down and desalination & RO-DM plant, which will be collected in CT blow down cum reject water storage tank and then pumped to sea with diffuser arrangement to dilute the effluent without affecting ocean atmosphere.

4.19 Socio-economic Environment

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 employment opportunities
- Growth in service sectors
- Improvement in transport, communication, health and educational services
- Increase in employment due to increased business, trade commerce and service sector

The overall impact on the socio economic environment will be beneficial

4.20 Impact on Land

The proposed project site elevation is + 4.5m above MSL. It is proposed to level the site to + 5.0 above MSL. The project area is 912 acres of land, after deleting the green belt area (275 acres) and ash dyke area (138 acres), the balance area need to be filled is 499 acres. The quantity of 10 lakh m^3 of filling material will be required. The fill earth can be obtained from Sadaveli and Varavani villages near R.S.Mangalam, which is at a distance of about 15 – 20 km from the project site. The filling earth material will be transported by trucks.

4.21 Impact on Health

Adequate air pollution, water and noise control measures will be provided in proposed expansion of power plant. The environmental management and emergency preparedness plans are proposed to ensure that the probability of undesired events and consequences are greatly reduced, and adequate mitigation is provided in case of an emergency. Mobile dispensary facilities/health camps will be organized by the proponent in the surrounding villages. The overall impact on Human health is negligible during operation of power plant.

4.22 Corporate Social Responsibility (CSR)

The project cost is Rs.9600 crores and 0.4% will be provided budget for CSR activities. Rs.38.00 crores as capital cost and 1.00 crore as annual recurring cost will be earmarked for

the activities to be taken up under CSR in consultation with Local bodies and Revenue department/Government of Tamil Nadu.

4.23 Summary of Impact

Based on the assessment made in the preceding sections the overall impacts due to the proposed power project are summarized in Table-4.13.

Table –4.13
Assessment of Impacts of Proposed Power Project on Environment

S. No	Environmental Component	Project Activity	Impacts Identified	Impact Assessment after Mitigation
1	Topography	Site Clearance	Minor changes in landscape.	Insignificant
		Construction Activities	Changes in landscape.	Insignificant
		Operation activities	Changes in land use. The available free land is utilized.	Insignificant
2	Air Quality	Site clearance	Excavation and levelling activities are limited hence, fugitive emissions would be restricted.	Insignificant
		Construction activities	Local increase in Particulate Matter	Insignificant
		Transportation	Vehicular and fugitive emissions	Insignificant
3	Noise	Construction activities	Temporary local increase in noise	Insignificant
		Operation activities	Continuous noise but confined to within the site	Insignificant
		Transportation	Increase in noise levels due to vehicular traffic	Insignificant
4	Water Resources	Construction activities	The ground water will be used only during the construction activities, if required.	Insignificant
		Operation activities	Water to be drawn from sea	Insignificant
5	Water Pollution	Construction activities	Small volume of wastewater from the construction and sanitation	Insignificant
		Operation activities	Effluent generated in the plant	Insignificant as there will be zero discharge
6	Ecology	Site Clearance	There will not be major disturbance to flora fauna	Insignificant

		Construction activities	There will not be major disturbance	Insignificant
		Operation activities	There will not be major disturbance to flora fauna	Insignificant
7	Soil Characteristics	Construction activities	Filling material is required for 499 acres of land at the project site	Significant
		Operation activities	No changes in this phase	Insignificant
8	Land Use	Construction activities	There will be change in land use for industrial purpose.	Significant
		Operation activities	The project will be coming up in vacant and agricultural land	Insignificant
9	Socio-economics	Construction activities	Creation of additional jobs/ businesses	Significant
		Operation activities	Rise in per capita income due to increased opportunities	Significant
10	Civic Amenities	Construction activities	Built up of temporary structures for workers and non-workers	Moderately insignificant
		Operation activities	Availability of permanent structures for workers, non-workers	Moderately insignificant
11	Occupational Health	Construction activities	Dusty conditions during summer with vehicular movement	Insignificant
		Operation activities	Process specific activities, heat and emission protective control measures followed	Insignificant
12	Vibrations	Construction activities	Heavy equipment usage will be temporary	Insignificant
		Operation activities	Continuous usage of machinery	Insignificant
13	Solid/ Hazardous waste	Construction activities	General construction waste will be disposed off in designated sites	Insignificant
		Operation activities	Fly ash will be sold out to cement industry/ brick industry. Par will be stored in specified area	Insignificant

Environmental Monitoring Program

Chapter – 5
Environmental Monitoring Program

5.0 Pollution Monitoring and Surveillance Systems

For thermal power stations, the Indian Emission Regulations stipulate the limits for particulate matter emissions and minimum stack height will be maintained for keeping the sulphur dioxide levels in the ambient within the air quality standards.

The characteristics of the effluent from the plant would be maintained so as to meet the requirements of the State Pollution Control Board and the minimum National Standards for thermal Power Plants stipulated by the Central Board for Prevention and Control of Water Pollution.

5.1 Air Quality monitoring programme

The purpose of air quality monitoring is acquisition of data for comparison against prescribed standards, thereby ensuring that the quality of air is maintained within the permissible levels.

It is proposed to monitor the following parameters from the stack emission:

- Suspended Particulate matter
- Particulate matter (PM_{10} & $PM_{2.5}$)
- Sulphur dioxide (SO_2)
- Oxides of Nitrogen (NO_x)

It is proposed to monitor particulate emission qualitatively and quantitatively in the stack and with the aid of a continuous particulate stack monitoring system. The stack monitoring data would be utilized to keep a continuous check on the performance of ESPs.

Further it is proposed to monitor and record the weather parameters such as temperature (maximum & minimum), Relative humidity, wind direction, wind speed, rainfall etc. on daily basis, for this purpose, it is proposed to install Weather Monitoring Station with necessary gadgets.

5.2 Water quality monitoring programme

The monitoring schedule and parameters to be analysed in the effluent generated from various sources is presented in the following table:

Table -5.1
Effluent Quality in Plant

Source of Effluent	Frequency of analysis	Parameters for Examination
Ash dyke area	Weekly	pH, suspended solids, oil and grease, chromium, zinc, iron, manganese, nickel
Effluent quality in Guard Pond & Neutralization pit	Weekly	pH, suspended solids, oil and grease, copper, iron

5.3 Post Project Environmental Monitoring

Environmental monitoring will be conducted on regular basis to assess the pollution level in the plant as well in the surrounding area. Therefore, regular monitoring program of the environmental parameters is essential to take into account the changes in the environment. The objectives of monitoring are;

- To verify the result of the impact assessment study in particular with regards to new developments;
- To follow the trend of parameters which have been identified as critical;
- To check or assess the efficacy of the controlling measures;
- To ensure that new parameters, other than those identified in the impact assessment study, do not become critical through the commissioning of new installations or through the modification in the operation of existing facilities;
- To check assumptions made with regard to the development and to detect deviations in order to initiate necessary measures; and
- To establish a database for future Impact Assessment Studies for expansion projects.

The attributes, which merit regular monitoring, are specified below:

- Air quality;
- Water and wastewater quality;
- Noise levels;
- Soil quality;
- Ecological preservation and afforestation; and
- Socio Economic aspects and community development

The post project monitoring will be carried out at the industry level is discussed below:

5.4 Monitoring and Reporting Procedure

Regular monitoring of important and crucial environmental parameters has an immense importance to assess the status of environment during plant operation. With the knowledge of baseline conditions, the monitoring programme can serve as an indicator for any deterioration in environmental conditions due to operation of the plant and suitable mitigation steps could be taken in time to safeguard the environment. Monitoring is as important as that of control of pollution since the efficiency of control measures can only be determined by monitoring. The following routine monitoring programme would therefore be implemented. A comprehensive monitoring program will be implemented is given in the Table – 5.2

Table – 5.2

Post Project Monitoring

Source	Location	Parameters to be monitored	Frequency	Responsibility
Meteorology	At the project site	Wind speed, direction, temperature, relative humidity rainfall	Hourly	TANGEDCO

Source	Location	Parameters to be monitored	Frequency	Responsibility
Ambient Air Quality	Within plant and surrounding 10km radial zone.	PM_{10}, $PM_{2.5}$ SO_2, NO_x	Monthly	TANGEDCO
Water Quality	Within the plant and surrounding 10km radial zone Surface Water As well as Ground Water	As per IS: 10500	Monthly	TANGEDCO
	Within the plant and surrounding 10km radial zone.	Noise levels	Monthly	TANGEDCO
Soil quality	Within the plant and 10 km radial zone	Soil parameters	Monthly	TANGEDCO
Boilers	Individual Units	Particulate matter, SO_2, NO_x	Monthly	TANGEDCO
Wastewater	Inlet and outlet of ETP	pH, TDS, COD, SS and others	Monthly	TANGEDCO
	Ash dyke	pH, SS, Oil & Grease, Chromium, Zinc,	Weekly	

Source	Location	Parameters to be monitored	Frequency	Responsibility
		Ni, Hg, Pb etc.		
	Steam–Generator Blow down	pH, SS, Oil, Grease, Cu, Iron	Weekly	
	Cooling Tower	Phosphates	Weekly	

5.5 Environmental Laboratory Equipment

The plant will have an in-use environmental laboratory for the outline monitoring of air, water, soil and noise. For all non-routine analysis, the plant may utilize the services of external laboratories and facilities. The laboratory equipment required for monitoring and analysis are listed below.

Table–5.3
List of E t P d for E tal Laborat

Name of the Equipment	Nos.
Automatic Weather Station, which can record wind speed, wind direction temperature, relative humidity, rainfall, Solar radiation Sunshine	1
a) Online Automatic gaseous stack monitoring kit for SO_2, NO_x, O_2, Flue gas volume, Temperature etc. b) On line dust monitor	1
Fine Particulate Samplers for $PM_{2.5}$ & PM_{10}	5
Portable Flue Gas Analyser	1
Bomb Calorimeter for analyzing sulphur content, calorific value etc.	1
Atomic Absorption Spectrophotometer	1
Mercury analyzer	1
Portable Noise level meter (Dosimeter)	2

Portable Waste Water Analysis Kit	1
BOD Incubator	1
COD Digester	2
Electronic Balance	1
Calorimeter	1
Conductivity Meter	2
Different micron sieves (set)	1 set
Dissolved Oxygen Meter – Brief case size	2
Electronic colony counter	1
Flask Shaker	1
Hot Air Oven	2
Laboratory Water Distillation and demineralisation (DM) unit	2

5.6 Environmental Management Group

A separate environmental management group will be established to implement the management plan. The group will be headed by a Superintending Engineer. The group will ensure the suitability, adequacy and effectiveness of the Environment Management Program. The management review process will ensure that the necessary information is collected to allow management to carry out its evaluation. This review will be documented.

Functions of Environmental Management Group (EMG) at Site will be:

- Obtaining consent order from State Pollution Control Board.
- Environmental monitoring.
- Analysis of environmental data, reports, preparations and transmission of report to statutory authorities, Corporate Centre etc.
- 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.

5.7 Expenditure and Environmental Measures

Table – 5.4
Budget for Environmental M...

S.No.	Particulars	Capital Cost (Rs. in Crores)	Recurring Cost (Rs. in Crores)
1	Air i) ESPs ii) Dust Suppression system for coal handling	 120.00 3.00	 12.50 0.50
2	RCC bi-flue chimney	100.00	--
3	Cooling towers	50.00	9.00
4	Bottom ash and fly ash collection, storage and disposal system	150.00	7.50
5	ETP & STP	30.00	5.50
6	Occupational Health & Safety	10.00	5.00
7	Greenbelt development	5.00	2.50
8	Pollution monitoring instrument/ equipment & Laboratory	10.00	0.50
	Total	**478.00**	**48.00**

Additional Studies
(Risk Assessment& DMP)

Chapter – 6
Additional Studies
(Risk Assessment & Disaster Management Plan)

6.0 Risk Assessment

6.1 Introduction

The word 'disaster' is synonymous with 'emergency' as defined by the Ministry of Environment and Forests (MoEF). An emergency occurring in the proposed power plant is one that may affect several sections within it and/ or may cause serious injuries, loss of lives, extensive damage to environment or property or serious disruption outside the plant. It will require the best use of internal resources and the use of outside resources to handle it effectively. It may happen usually as the result of a malfunction of the normal operating procedures.

It is imperative to conduct risk analysis for all the projects where hazardous materials, fuels are handled. The risk assessment has been carried out as a few hazardous materials will be handled in 2X800 MW Super Critical Coal Based Thermal Power Plant at Uppur, Valamavoor and Thiruppalaikudi, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu.

The following have been addressed as part of the risk analysis.

- **Introduction**
- **Hazard Identification and Risk Analysis**
- **Risk Reducing Measures**

The Introduction deals with the objective and methodology of carrying out the risk analysis.

Hazard Identification and Risk Analysis: discusses about the various types of hazards associated with the operation of the Plant due to process, storage & handling, human errors, electric failures and natural calamities. It also presents the calculated frequencies of occurrence of different accident scenarios for the identified potential hazard occurrence in the proposed power plant and the details of consequence modelling/ analysis for the identified potential accidents/disaster scenarios in the plant.

Risk Reducing Measures based on the calculated frequencies and consequences.

6.2 Objective

The principal objective of the study is to identify the potential hazards from the proposed facility and estimate the effects of the hazards to people and property within the plant premises.

The consequences resulting due to accidental release of toxic & flammable liquids and leakage of fuels, will provide data for developing strategies to prevent accidents right from design to operational phase. This will also generate information for formulating a meaningful Disaster Management Plan (DMP).

A risk analysis is defined as an assessment of the likelihood of a release of HAZMAT (hazardous materials) and the consequences that may result, based on information gathered during the hazard identification and vulnerability analyses. Risk analysis requires evaluation of existing base and local community plans, response capabilities, and previous incidents.

In order to determine the risk factor at each facility on the base, the following information was evaluated:

- Procedures for storing, handling, shipping, and transferring of HAZMAT;
- Facility information including: physical features and location of storm and sanitary sewer systems;
- Site measures for managing and controlling HAZMAT releases; and,
- Base emergency response and preparedness programs.

6.3 Methodology

The Risk Analysis Study carried out under the following task heads:

- **System Study**

  The system description covers the plant description, storage & handling of fuels / chemicals, etc.

- **Hazard Identification**

  The hazards associated with the proposed Power Plant have been discussed in terms of material hazards due to fuel oil storage.

- **Frequency of Hazard Occurrence**

  Based on the available international statistics and in-house risk database, the frequencies of occurrence for the different accident scenarios were determined. The frequencies derived from the historical database have been checked with the possible hazard scenario identified during hazard identification.

- **Consequence Analysis**

  Based on the identified hazards, accident scenarios and the frequency of occurrence, consequence calculations were done for spreading distances (zone of influence) or risk distance for Pool fires.

- **Risk Reducing Measures**

  Necessary risk reducing measures have been suggested based on the consequence scenarios.

6.4 Hazard Identification and Risk Analysis (HIRA)

The main hazard potentials in the proposed 2x800 super critical coal based thermal power plant at uppur is categorized as below:

- **Material hazards:** Light Diesel Oil (LDO) and Heavy Fuel Oil (HFO) as an auxiliary fuel for start-up and flame stabilization, and coal as the major fuel used in the proposed thermal power plant.

- **Process hazards:** due to loss of containment during handling of hazardous materials or processes resulting in fire, explosion, etc

- **Mechanical hazards:** due to "mechanical" operations such as welding, maintenance, falling objects etc. - basically those NOT connected to hazardous materials.

- **Electrical hazards:** electrocution, high voltage levels, short circuit, etc.

Out of these, the material and process hazards are the one with a much wider damage potential as compared to the mechanical and electrical hazards, which are by and large

limited to very small local pockets.

6.4.1 Material Hazards

Light Diesel Oil (LDO) and Heavy Fuel Oil (HFO) are used as auxiliary fuel, which are inflammable. Coal is the major fuel used in the proposed power plant. In addition to that HSD will be stored in 300 m^3 tank which will be used for DG set.

Table –6.1

Tank	No. of tanks	Capacity m^3
Light Diesel Oil (LDO)	1	500
Heavy Fuel Oil (HFO)	2	2000
High Speed Diesel (HSD)	1	300

Some of the important properties indicating the hazardous nature of LDO, HFO and HSD are given below.

Table –6.2
Properties of Fuels

Chemical	Flash point °C	Auto Ignition °C	Flammability		Boiling point °C	TLV ppm	NFPA		
			LFL%	UFL%			Nf	Nh	Nr
Light Diesel Oil (LDO)	54.4	256	0.4	6.0	182-371	300	2	0	0
Heavy Fuel Oil (HFO)	66	407.2	1.0	5.0	150	300	2	2	0
High Speed Diesel (HSD)	32	225	0.6	6.0	315–376	800	2	1	0

* NFPA: National Fire Protection Association

6.4.2 Process Hazards

No process hazards are assessed.

6.4.3 Hazard Intensity Classification

The hazard intensities of the chemicals that are to be handled in the proposed power plant (as per NFPA codes) are presented below.

Table -6.3

Health Hazard	Fire Hazard	Reactivity Hazard
4 Materials which on very short exposure could cause death or major injury, even with prompt medical attention.	4 Materials which will rapidly vaporize at atmospheric pressure and normal temperature, or which are readily dispersed in air and which will burn readily.	4 Materials which are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3 Materials which on short exposure could cause death or major injury even though prompt medical treatment is given.	3 Liquids and solids that can be ignited under almost all temperature conditions.	3 Materials which in themselves are capable of detonation or explosive reaction but require a strong initiating source or which must be heated under confinement before initiation or which react explosively with water.
2 Materials which on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment is given.	2 Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	2 Materials which are normally unstable and readily undergo violent chemical change but do not detonate. Also materials which may react violently with water or which may form explosive mixtures with water.
1 Materials which on exposure would cause irritation but only minor residual injury, even if no treatment is given.	1 Materials that must be preheated before ignition can occur.	1 Materials which are normally stable, but which can become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently.
0 Materials which on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.	0 Materials that will not burn.	0 Materials which are normally stable, even under fire exposure conditions, and which are not reactive with water.

Physiological Effects of Threshold Thermal Doses

Table – 6.4
Degree of Hazards

Threshold Dose (KJ/m^2)	Effect
375	3rd degree burn
250	2nd degree burn
125	1st degree burn
65	Threshold of pain, no reddening or blistering of skin caused

Note:

1st degree burn- Involves only epidermis. Example sunburn, blisters may occur.

2nd degree burn- Involves whole of epidermis over the area of burn plus some portion of dermis area.

3rd degree burn- Involves whole of epidermis and dermis. Sub-cutaneous tissues may also be affected.

Table –6.5
Damage Due to Incident Radiation Intensit

Incident Radiation Intensity (KW/m2)	Type of Damage
37.5	Minimum energy required igniting wood at infinite long exposure (non-piloted).
32.0	Maximum flux level for thermally protected tanks
12.5	Minimum energy required for piloted ignition of wood, melting plastic tubing etc.
8.0	Maximum heat flux for un-insulated tanks.
4.5	Sufficient to cause pain to personnel if unable to reach cover within 20 seconds. However blistering of skin (1^{st} degree burns) is likely.
1.6	Will cause no discomfort to long exposure.
0.7	Equivalent to solar radiation.

6.5 Consequence Analysis

To estimate the damage caused by the release of fuels and flammable liquids the following parameters were calculated:

- Release Rate of the fuels and flammable liquids in case of pipeline, tank, pump and tanker failure.

Based on the methodology discussed above a set of catastrophic scenarios was generated to carry out Risk Analysis calculations, as listed below:

- Catastrophic release from Light Diesel Oil (LDO) tank – Pool Fire
- Catastrophic release from Heavy Fuel Oil (HFO) tank – Pool Fire
- Catastrophic release from High Speed Diesel (HSD) – Pool Fire

Possible hazards associated with a flash fire include thermal radiation, smoke, and explosion.

Pool Fire

When a non-boiling liquid spills, it spreads into a pool. The size of the pool depends on the availability of the bund and obstacles. If there are no obstacles or bund, it can spreadinto a thin film on flat land/floor. In general, a cylindrical flame approximates the flame geometry. Radiation levels at various distances are calculated taking into account atmospheric transmission coefficient, geometric view factor and the radiation intensity in terms of surface heat flux of the flame. Depending upon the conditions, there are several ways in which these can occur, ultimately causing damage due to heat radiation.

Effects of Pool Fire

Pool fire may result when bulk storage tanks of fuel will leak/burst, and the material released is ignited. If the tanks are provided with dike walls to contain the leak and avoid spreading of flammable material, the pool fire will be confined to the dike area only. However, the effects of radiation may be felt to larger area depending upon the size of the pool and quantity of material involved.

Thermal radiation due to pool fire may cause various degrees of burns on human bodies. Moreover, their effects on objects like piping, equipment are severe depending upon the radiant heat intensity.

Consequences in respect of containment failure related to fuel tank, is a modeled assuming relevant atmospheric condition, using certain mathematical models presented in Scenarios.

Table-6.6
Heat Radiation Hazards Due To Storage

Heat Radiation Intensity kW/m^2	Distance in Metres		
	HFO	LDO	HSD
32.0	9	12	10
25	10	13	11
12.5	14	19	16
9.5	16	22	18
4.5	23	32	26

The risk contours are shown for HFO & LDO in Figure 6.1

6.5.1 Conclusions and Principal Remedial measures

Thermal radiation hazards due to storage of Light Diesel Oil (LDO), Heavy Fuel Oil (HFO) and High Speed Diesel (HSD) as Fuels

Risk Analysis for the proposed thermal power plant was carried out with the objective to identify the potential hazards from storage facilities. Certain important conclusions and remedial measures arising out of the study are mentioned below. The relevant sections should be referred for detailed discussion of items of interest.

- The thermal radiation contours corresponding to 32 kW/m^2 radiation intensity due to HFO, LDO and HSD storage tanks fire at power plant is confined to within the premises. Hence, for such a scenario, the effect of lower thermal radiation levels on general public outside the plant premises is insignificant.

- The higher intensity of radiation contours is confined to within the plant premises only.

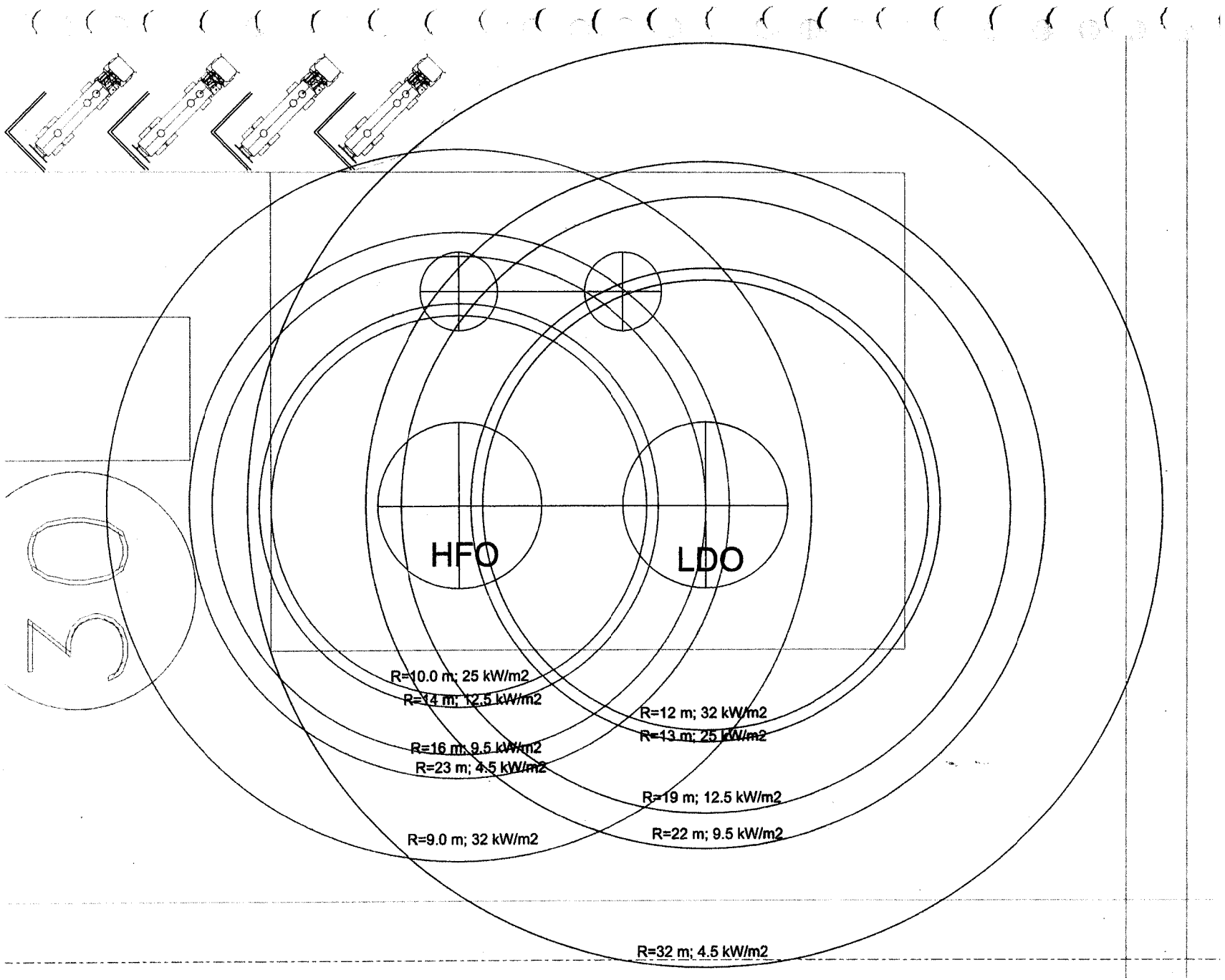


Figure - 6. Risk Contours

- Adjacent tanks will be thermally protected by firewater and foam system similar to the existing tanks.

- The firewater cooling system and Foam facilities are provided with Foam system as per OISD [Oil Industry Safety Directorate] for fuel storage tanks.

- Adjacent tanks will be thermally protected by firewater and foam system for fuel tanks.

- The storage tanks will be provided with fixed foam conveying system with foam pourers and all around firefighting facilities with hydrants and foam cum water monitors as per OISD norms. This enables tank cooling in case of fire. It is therefore, important that cooling of the adjoining fuel storage tanks is done, promptly, in case of tank fire on any of the fuel storage tanks. It is also important to cool the storage tank on fire so that tank shell does not give away. It is opined that the above provisions for safety are adequate.

Furthermore, the following additional measures for safety are taken.

These measures include inspecting all other piping and appurtenances for damage and corrosion to prevent the unexpected leakage of Light Diesel Oil (LDO), Heavy Fuel Oil (HFO) and High Speed Diesel (HSD) establishing an Emergency Plan, Employee Emergency Plans and Fire Prevention Plans."

Remedial measures:

- Store in tightly closed containers in a cool, well-ventilated area away from WATER, HEAT, COMBUSTIBLES (such as WOOD, PAPER and OIL) and LIGHT.
- Store away from incompatible materials such as flammable materials, oxidizing materials, reducing materials, strong bases.
- Use corrosion-resistant structural materials and lighting and ventilation systems in the storage area.
- Wood and other organic/combustible materials will not be used on floors, structural materials and ventilation systems in the storage area.

- Use airtight containers, kept well sealed, securely labelled and protected from damage
- Use suitable, approved storage cabinets, tanks, rooms and buildings.
- Suitable storage will include glass bottles and containers.
- Storage tanks will be above ground and surrounded with dikes capable of holding entire contents.
- Limit quantity of material in storage. Restrict access to storage area.
- Post warning signs when appropriate. Keep storage area separate from populated work areas. Inspect periodically for deficiencies such as damage or leaks.
- Have appropriate fire extinguishers available in and near the storage area.

The following measures are adopted for reducing the risk involved in pipeline systems.

Preventive Maintenance:

Routine inspection and preventive maintenance of equipment / facilities at the unit.

Instruments:

All the instruments like pressure, temperature transmitters/gauges and alarms switches and safety interlocks will be tested for their intended application as per the preventive maintenance schedule. Similarly, the emergency shutdown system will be tested as per the preventive maintenance schedule.

6.6 Risk Mitigation Measures

The materials handled at the proposed installation are inflammable and reactive substances and based on the consequence analysis; the following measures are adopted as risk mitigation measures.

- The storage area, process area as well as road tankers loading/unloading areas where there is maximum possibility of presence of flammable hydrocarbons in large quantities, it will be ensured that combustible materials are not placed here such as oil filled cloth, wooden supports, oil buckets etc. to reduce the probability of secondary fires in case of release.

- Hydrocarbon, smoke and fire detectors will be suitably located and linked to fire fighting system to reduce the response time and ensure safe dispersal of vapours before ignition can occur.

- Tank fires result in little damage at ground levels. Damage at tank height is such as to damage adjacent tanks. Hence tank cooling provisions, particularly upper sections of the tank will be ensured to prevent explosion. Foam for arresting roof fires will be started immediately.

- Pool fires resulting from tanker/pump/pipeline leakage are dangerous since the liquid pool becomes unconfined. Training in fire fighting, escape action, operation of emergency switches etc. will be provided.

- Pump loading line failures have also a possibility of causing major damage. Strict inspection, maintenance and operation procedures are established for preventing escalation of such incidents.

- Emergency procedures will be well rehearsed and state of readiness will be achieved.

6.6.1 Possibilities, Nature and Effects of Emergency

Leaving aside earthquake, cyclone, flood, arson and sabotage, the possible emergencies that can arise in the plant due to storage and handling of the above materials are:

- Explosion in boilers, turbo generators, and transformers.
- Heavy leakage and subsequent fire in the fuel oil handling area and storage tanks
- Large fires involving the coal stockyard and coal handling areas
- Accidental release of huge ash slurry
- Chlorine leakage in the water treatment plant
- Accidental fire due to some other reasons

6.7 Disaster Management Plan

This DMP has been designed based on the range, scales and effects of "Major Generic Hazards" described in the Risk Assessment Report just mentioned and on their typical behaviours predicted therein. The DMP addresses the range of thermal and mechanical impacts of these major hazards so that potential harm to people onsite and off-site, plant and environment can be reduced to a practicable minimum. The scenarios of loss of containment are credible worst cases to which this DMP is linked.

The project is in its formative stage and detail engineering is yet to be done, so the elements of the DMP are based on concepts.

6.7.1 Capabilities of DMP

The emergency plan envisaged will be designed to intercept full range of hazards specific 'to power plant such as fire, explosion, major spill etc. In particular, the DMP will be designed and conducted to mitigate those losses of containment situations, which have potentials to escalate into major perils.

Another measure of the DMP's capability will be to combat small and large fire due to ignition of flammable materials, either from storage or from process streams and evacuate people from the affected areas speedily to safe locations to prevent irreversible injury.

Emergency medical aid to those who might be affected by incident heat radiation flux, shock wave overpressures and toxic exposure will be inherent in the basic capabilities.

The most important capability of this DMP will be the required speed of response to intercept a developing emergency in good time so that disasters such as explosion, major fire etc. are never allowed to happen.

6.7.2 Disaster Control Philosophy

The emergency control philosophy of the plant is in line with its normal operational controls. The emergency control room will be the plant's Central Control Room, which will employ Distributed Control System (DCS). All emergency operations, which may involve shutdown of the plant, will be controlled from the Central Control Room by the same operator(s) using dedicated "Shut-Down Consoles". The consoles will send commands to initiate the shutdown procedure. Plant shutdown system will be performed by DCS.

The principal strategy of DMP of the plant is "Prevention" of identified major hazards. The "Identification" of the hazards will employ one or more of the techniques [e.g. Hazard and Operability Study (HAZOP), accident consequence analysis etc.]. Since these hazards can occur only in the event of loss of containment one of the key objectives of technology selection, project engineering, construction, commissioning and operation is "Total and Consistent Quality Assurance". The Project Authority will be committed to this strategy right from the conceptual stage of the plant so that the objective of prevention can have ample opportunities to mature and be realized in practice

The DMP or Emergency Preparedness Plan (EPP) will consist of:

- On-site Emergency Plan
- Off-site Emergency Plan

Disaster Management Plan preparation under the headlines of On-site Emergency Plan and Off-site Emergency Plan is in consonance with the guidelines laid by the Ministry of Environment and Forests (MOEF), Govt of India.

"Occupier" of the facility is responsible for the development of the On-site Emergency Plan as per the guidelines given by the Government; The Off-site Emergency Plan will be developed by the Government (District Authorities).

6.8 On-Site Emergency Plan

6.8.1 Objectives

The objective of the On-site Emergency Plan should be to make maximum use of the combined resources of the plant and the outside service to

- Effect the rescue and treatment of casualties
- Safeguard other personnel in the premises
- Minimise damage to property and environment
- Initially contain and ultimately bring the incident under control
- Identify any dead
- Provide for the needs of relatives
- Provide authoritative information to the news media
- Secure the safe rehabilitation of affected areas
- Preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of emergency

6.8.2 Action Plans

The Action Plan consists of:

- Identification of Key Personnel
- Defining responsibilities of Key Personnel
- Designating Emergency Control Centers and Assembly Points
- Declaration of Emergency
- Sending All Clear Signal
- Defining action's to be taken by non-key personnel during emergency

6.8.3 Key Personnel

The actions necessary in an emergency will clearly depend upon the surrounding circumstances. Nevertheless, it is imperative that the required actions are initiated and directed by nominated people, each having specified responsibilities as part of co-ordinated plan. Such nominated personnel are known as Key Personnel.

The Key Personnel are:

- Site Controller (SC)
- Incidental Controller (IC)
- Liaison and Communication Officer (LCO)
- Fire and Security Officer (FSO)
- Team Leaders (TL)

Site Controller (SC)

In the emergency situation, decisions have to be taken which may affect the whole or a substantial part of the plant and even places outside. Many of these decisions will be taken in collaboration with the other officers at the plant and the staff. It is essential that the authority to make decision be invested in one individual. In this plan, he is referred to as the 'Site Controller'. The Plant Manager (however called) or his nominated deputy will assume responsibility as SC.

Incident Controller (IC)

In the emergency situation, someone has to direct the operations in the plant area and co-ordinate the actions of outside emergency services at the scene of incident. The one who will shoulder this responsibility is known as 'Incident Controller' in this plan.

A Senior Operations Officer or an officer of similar rank of the unit may be nominated to act as the IC.

Liaison and Communication Officer (LCO)

Operations Officer or any other officer of deputy rank will work as LCO and will be stationed at the main entrance during emergency to handle Police, Press and other enquiries. He will maintain communication with the IC

Fire and Safety officer (FSO)

The Fire and Safety Officer will be responsible for fire fighting. On hearing the fire alarm he shall contact the fire station immediately and advise the security staff in the plant and cancel the alarm. He will also announce on PAS (public Address System) or convey through telephones or messengers to the SC, IC and LCO about the incident zone. He will open the gates nearest to the incident and stand by to direct

the emergency services. He will also be responsible for isolation of equipment from the affected zone.

Team Leaders (TL)

A number of special activities may have to be carried out by specified personnel to control as well as minimize the damage and loss. For this purpose designated teams would be available. Each team will be headed by a Team Leader (TL).

Following teams are suggested:

- Repair Team
- Fire Fighting Team
- Communication Team
- Security Team
- Safety Team
- Medical Team

6.8.4 Responsibilities of Key Personnel

Site Controller (SC)

- On getting information about emergency, proceed to Main Control Centre
- Call in outside emergency services
- Take control of areas outside the plant, which are affected
- Maintain continuous communication, review situation and assess possible course of events
- Direct evacuation of nearby settlements, if necessary
- Ensure that casualties are getting enough help
- Arrange for additional medical help and inform relatives
- Liaison with Fire and Police Services and Provide advice on possible
- effects on outside areas
- Arrange for chronological recording of the emergency
- Where emergency is prolonged, arrange for relieving personnel, their catering needs etc.
- Inform higher officials in head office
- Ensure preservation of evidence

- Direct rehabilitation work on termination of emergency

Incident Controller (IC)

- On getting emergency information, proceed to Main Control Centre
- Activate emergency procedure such as calling in various teams
- Direct all operations within plant with following priorities:

a) Control and contain emergency

b) Secure safety of personnel

c) Minimise damage to plant, property and the environment

d) Minimise loss of material

Direct rescue and repair activities
Guide fire-fighting teams
Arrange to search affected area and rescue trapped persons
Arrange to evacuate non-essential personnel to safe area/assembly point
Set up communications network and establish communication with SC
Arrange for additional help/equipment to key personnel of various teams
Consider need for preserving all records, information for subsequent enquiries

Liaison and Communications Officer

- To ensure that casualties receive adequate attention, arrange additional help if required and inform relatives

- To control traffic movements into the plant and ensure that alternative transport is available when need arises

- When emergency is prolonged, arrange for the relief of personnel and organize refreshments/catering facility

- Advise the Site Controller of the situation, recommending (if necessary) evacuation of staff from assembly points

- Recruit suitable staff to act as runners between the Incident Controller and himself if the telephone and other system of communication fail. -Maintain contact with congregation points

- Maintain prior agreed inventory in the Control Room

- Maintain a log of the incident on tape

- In case of a prolonged emergency involving risk to outside areas by windblown materials - contact local meteorological office to receive early notification of changes in weather conditions

Fire and Safety Officer

- Announce over the PAS in which zone the incident has occurred and on the advice of the Shift Officer informs the staff to evacuate the assembly

- Inform the Shift Officer In-charge, if there is any large escape of fumes.

- Call out in the following order:

1) Incident Controller or his nominated deputy

2) Maintenance Officer

3) Personnel and Administrative Officer

4) Departmental Head in whose area the incident occurred

5) Team Leaders (TL)

6.8.5 Responsibilities of Teams

- Repair Team

They will identify source of leak and arrest it, take steps to keep rest of the plant in safe condition, arrange safe shutdown of operations if necessary, attend to all repair jobs which are needed from emergency point of view, take steps to contain or reduce the intensity of emergency, arrange for additional equipment and give temporary connections as needed.

- Fire Fighting Team

They will rush to the incident spot and start fighting the fire, maintain adequate water pressure in the fire hydrant system, arrange first aid fire extinguishers where needed and guide and direct outside fire fighting agencies.

- Communication Team

They will maintain the communication network inside the terminal, attend urgent repairs in the communication system, and arrange messengers for conveying urgent messages when needed so, help SC, IC, LCO and FSO in their communication activities.

- Security Team

They will man all gates, with minimum delay permit the entry of authorized personnel and outside agencies, vehicles etc. who have come to help, bar entry of unauthorized persons, allow the ambulance etc. to go through the gates without normal checks.

- Safety Team

They will rescue the casualties on priority basis, transport casualties to first aid post, safe places, or medical centres, account the personnel, search for missing

personnel and pass information to the kith and kin of fatal or serious casualties, arrange required safety equipment, report of status to their leader, record of accidents, collect and preserve evidences in connection with accident cases, arrange for transport of casualties, arrange for transport of materials, attend to vehicle breakdowns, arrange petrol and diesel supply and withdraw and transport materials from stores.

- Medical Team

They will arrange for first aid, arrange for stretchers, arrange for immediate medical attention, arrange for sending the casualties to various hospitals and nursing homes and arrange for medicines.

6.8.6 Emergency Control Centre

The Emergency Control Centre will be the focal point in case of an emergency from where the operations to handle the emergency are directed and co-ordinated. It will control site activities.

Emergency management measures in this case will be carried out from single control Centre designated as Main Control Centre (MCC)

MCC is the place from which messages to outside agencies will be sent and mutual aids and other helps for the management of emergency will be arranged. It will be located in the safe area. It will be equipped with every facility for external and internal communication, with relevant data, personal protective equipments to assist hose manning the centre to enable them to co-ordinate emergency control activities. CC will be attended by SC.

Proposed Location: Office of the DGM (Maintenance) located in Administrative Building

Following facilities would be available in the MCC:

- P&T phones, mobile phones, intercoms, and wireless
- Fax and telex
- Emergency manuals
- Blown up area maps
- Internal telephone directories
- District telephone directories
- Emergency lights
- Wind direction and speed indicator
- Requisite sets of personal protective equipment such as gloves, gumboots and aprons
- MCC will be furnished with call out

MCC will be furnished with call out list of key persons, fire, safety, first aid, medical, security, police and district administrative authorities. MCC will also contain safety

data pertaining to all hazardous materials likely to cause emergency and well-defined procedures of fire fighting, rescue operations, first aid etc.

6.8.7 Assembly Point

In an emergency, it will certainly be necessary to evacuate personnel from affected areas and as precautionary measure, to further evacuate non-essential workers, in the first instance, from areas likely to be affected, should the emergency escalate. The evacuation will be effected on getting necessary message from I.e. On evacuation; employees would be directed to a predetermined safe place called Assembly Point.

Proposed Location: Area opposite to service building will be the Assembly Point where all non-key personnel would assemble on getting direction over Public-Address System.

Outdoor assembly points, predetermined and pre-marked, will also be provided to accommodate evacuees from affected plant area(s). Roll call of personnel collected at these assembly points, indoor and outdoor will be carried out by roll call crew of safety team to account for any missing person(s) and to initiate search and rescue operations if necessary.

6.8.8 Declaration of Emergency

An emergency may arise in the terminal due to major leakage of oil or major outbreak of fire. In case of major leak or major outbreak of fire the state of emergency has to be declared by the concerned by sounding Emergency Siren.

Upon manual or sensor detection of a major loss of containment of volatile hazardous substance, the DMP is activated by raising an audible and visual alarm through a network of geographically dispersed gas/vapour and heat detectors and also "break-glass" type fire alarm call points with telephone handsets to inform the Central Control Room.

A separate siren audible to a distance of 5 km range will be available for this purpose. The alarm is coded such that the nature of emergency can be distinguished as a leakage or major fire.

The Control Centre and Assembly point have been located at an area of the minimum risk or vulnerability in the premises concerned, taking into account the wind direction, areas which might be affected by fire/explosion, leakage etc.

After cessation of emergency, FSO will communicate to IC. After verification of status, IC will communicate with SC and then announce the "All Clear" by instructing the Time Office to sound the "All Clear Signal".

Alarms would be followed by an announcement over Public Address System (PAS). In case of failure of alarm system, communication would be' by telephone operator who will make announcement in the complex through PAS. Walkie-talkie system is very useful for communication during emergency with predetermined codes of communication. If everything fails, a messenger could be used for sending the information.

Two 5 km, range variable pitch electric sirens (one in service and the other standby) will generate the main alarm for the entire site as well as for the district fire brigade. The alarm is coded such that the nature of emergency can be distinguished as a leakage or major fire. Fire and Gas alarm matrices are provided at the Central Control room, security gate, on-site fire station and main administrative office corridor to indicate location of the site of emergency and its nature.

6.8.9 Mutual Aid

Procedure

All factories may not be equipped with an exhaustive stock of equipment/materials required during an emergency. Further, there may be a need to augment supplies if an emergency is prolonged.

It would be ideal to pool all resources available in the and nearby outside agencies especially factories during an emergency, for which a formal Mutual Aid scheme should be made among industries in the region.

6.8.10 Essential Elements

Essential elements of this scheme are given below:

- Mutual aid must be a written document, signed by Location In-charge of all the industries concerned
- It should specify available quantity of materials/ equipment that can be spared (not that which is in stock)
- Mode of requisition during an emergency.

- It should authorize the shift-in-charge to quickly deploy available material/equipment without waiting for formalities like gate pass etc.
- It should spell out mode of payment/replacement of material given during an emergency
- It should specify key personnel who are authorized to requisition materials from other industries or who can send materials to other industries
- It should state clearly mode of receipt of materials at the affected unit without waiting for quantity/quality verification etc.
- Revision number and validity of agreement should be mentioned
- This may be updated from time to time based on experience gained

6.8.11 Emergency Management Training

The Key Personnel would undergo special courses on disaster management. This may preferably be in-plant training. The Managers, Senior Officers and Staff would undergo a course on the use of personal protective equipment.

The Key Personnel belonging to various Teams would undergo special courses as per their expected nature of work at the time of emergency.

The plant management should conduct special courses to outside agencies like district fire services to make them familiar with the plant layout and other aspects, which will be helpful to them during an emergency.

6.8.12 Mock Drills

It is imperative that the procedures laid in this Plan are put to the test by conducting Mock Drills. To avoid any lethality, the emergency response time would be clocked below 2 minutes during the mock drill.

1st Step: Test the effectiveness of communication system

2nd Step: Test the speed of mobilisation of the plant emergency teams

3rd Step: Test the effectiveness of search, rescue and treatment of casualties

4th Step: Test emergency isolation and shut down and remedial measures taken on the system

5th Step: Conduct a full rehearsal of all the actions to be taken during an emergency

The Disaster Management Plan would be periodically revised based on experiences gained from the mock drills.

6.9 Proposed Communication System

The instrument and control system will take care of the following operating philosophy of the plant:

- The project will be provided with a control system located in a central control room.
- The shift engineer will operate the plant from his console panel.
- All operations will be represented in a graphic panel on the console and every operation will be depicted as operating sequences.
- All operating parameters will be displayed in digital format.
- Alarms will be provided for all parameters, when they exceed set values.
- High-High/Low-Low alarms and trip functions will be provided to trip
- Pumps/compressors to bring the entire system to a safe shutdown.

6.10 Proposed Fire Fighting System

Elaborate fire fighting system will be available for fighting fires in any corner of the plant. A comprehensive fire detection and protection system is envisaged for the complete power station.

- Fire water storage tanks of adequate capacity.

- Fire water pump house containing combination of diesel and electrically driven pumps.

- Hydrant system complete with suitable size piping, valves, instrumentation, hoses, nozzles, hose boxes/stations, monitors etc.

- Foam injection system for fuel oil/storage tanks consisting of foam concentrate tanks, foam pumps, in-line inductors, valves, piping and instrumentation etc.

- Automatic high velocity water spray system consisting of detectors, deluge valves projectors, valves, piping and instrumentation.

- Automatic medium velocity water spray system consisting of QB

- Detectors/smoke detectors, linear heat sensing cable detectors, deluge valves, isolation valves, nozzles, piping, instrumentation etc.

- Suitable "Halon Substitutes" such as INERGEN or FM: 200 or AGGONITE for protection of control room, equipment room, computer room and other electric and electronic equipment rooms.

- Computerized analogue, addressable, early warning type fire detection and alarm system consisting various types of fire detection such as ionisation type smoke detection system, photo electric type smoke detection system, linear heat sensing cable detector, quartzoid bulb (QB) heat detection system, infrared heat detectors and spot type electrical heat detectors.

- Portable and mobile extinguishers, such as pressurized water type, carbondioxide type, foam type, dry chemical powder (DCP) type located at strategic locations throughout the plant.

- Fire tenders/engines of water type, DCP type/foam type, trailer pump with fire jeep etc. provided in the fire station.

- Complete instrumentation and control system for the entire fire detection and protection system for safe operation of the complete system.

6.11 Other Safety Measures

Considering that fire and explosion is the most likely hazard in such installations, the plant is being provided with systems to guard against such hazards. Salient among these are:

- A proper layout to prevent and minimize the effects of any hazardous situation
- Design of storage vessels and all components to codes and standards to withstand the rigorous duty
- Provision of operating systems to conduct the process through well-established safe operating procedures
- A control system, which monitors all plant parameters and give alarms
- Control system, which has trip provisions to prevent hazard conditions escalating
- A gas detection system which will provide early warning of any leaks
- Provision of a fire protection system to control fire
- Provision of flame-proof lighting system in the fire prone areas

6.12 Proposed First Aid And Medical Facilities

The First Aid Medical Centre has been proposed. It will be fully equipped with emergency facilities. It will be open round the clock. A Medical Officer with Compounder will always be available in the centre. Emergency cars will be available in all the shifts. Adequate number of first aid boxes will be kept at strategic locations.

Required stock of first aid medicines will be maintained. Trained first aiders will be available in all departments.

Facilities to be kept in the Medical Room along with others will include: Oxygen Cylinders, Injection Corarnine, Glucose Saline, LV. Sets, Syringes, Injection Needles, Stretchers and medicines.

6.13 Proposed Emergency Power Supply

Strategic areas will be provided with emergency lights fed through station battery system. Portable emergency lamps will be also available at required points. A Diesel Driven Generator of adequate capacity will be available to keep the operations running in case of power failure. Diesel Engine operated fire pumps will be available.

6.14 Off Site Emergency Plan

Objective

If the effects of the accident or disaster inside the plant are felt outside its premises, it calls for an off-site emergency plan, which should be prepared and documented in advance in consultation with the District Authorities.

Key Personnel

The ultimate responsibility for the management of the off-site emergencies rests on the Collector / District Magistrate / Deputy Commissioner. He will be assisted by representatives from all concerned organisations, departments and services at the District level. This core group of officers would be called the District Crisis Management Group (CMG). The members of the group will include:

- Collector/District Magistrate Deputy Commissioner
- Commissioner of Police
- Municipal Commissioner, if municipalities are involved
- Deputy Director, Health
- Pollution Control Board Representative

An Operation Response Group (ORG) will then have to be constituted to implement the directives of the CMG.

The various government departments, some or all of which will be concerned, depending on the nature of the emergency, could include:

- Police
- Health & Family Welfare
- Medical
- Revenue
- Fire Service
- Transport
- Electricity
- Animal Husbandry
- Agriculture
- Civil Defence
- PWD
- Civil Supplies
- Panchayats

The SC and IC, of the on-site emergency team, will also be responsible for communications with the CMG during the off-site emergency.

Education to Public

People living within the influence zone should be educated on the emergency in a suitable manner. This can be achieved only through the Local and District Authorities. However, the Project Authority will extend necessary information to the Authorities.

6.15 Natural Disaster

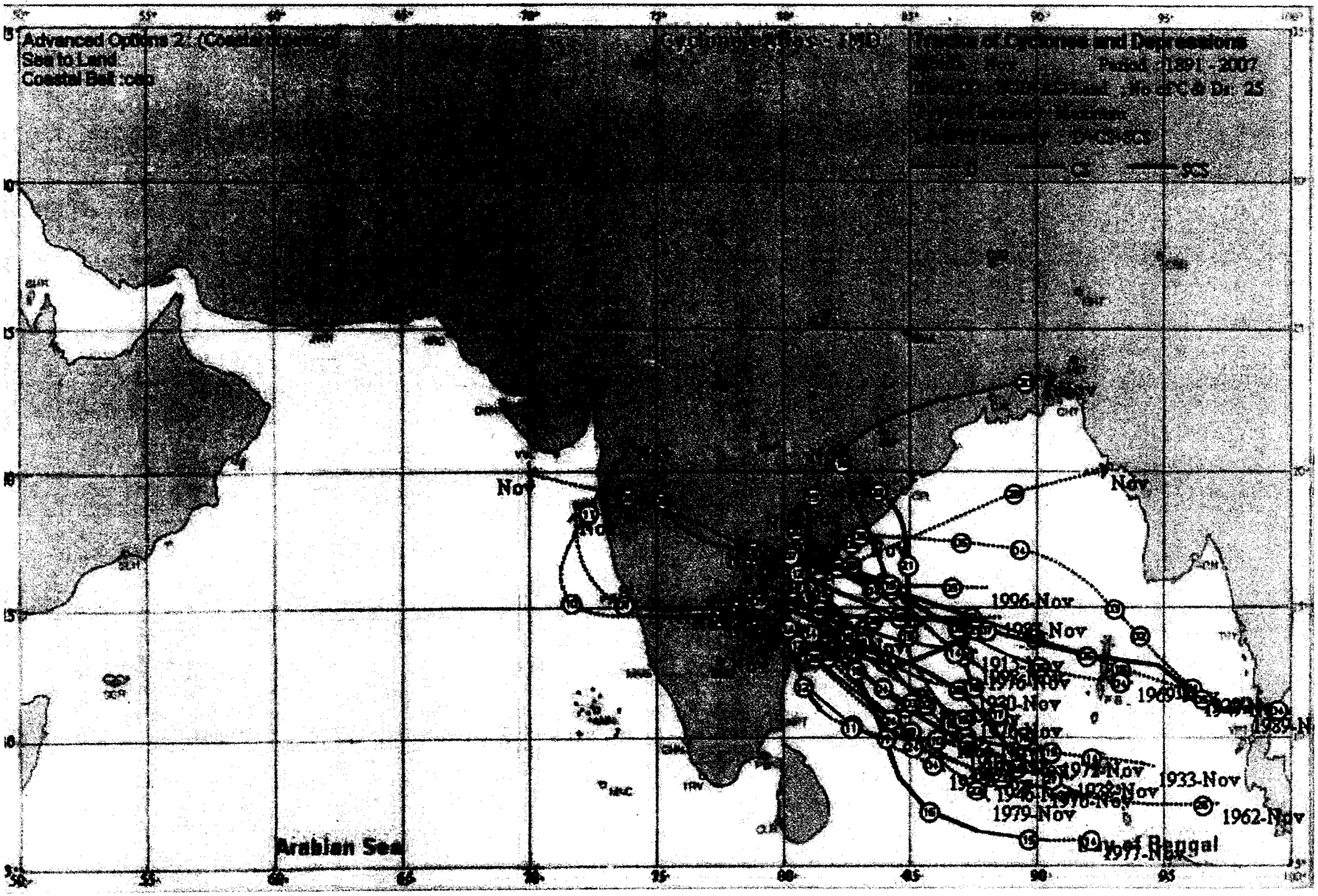
A scientific study conducted by the Geological Survey of India indicated that the southern part of erstwhile Dhanushkodi Township facing Gulf of Mannar sank by almost 5 meters during 1948-49 due to vertical tectonic movement of land parallel to the coastline.

The 1964 cyclone was started with a formation of a depression with its centre at 5°N 93°E in the South Andaman Sea on 17 December 1964.

In Dec 2004, Indian Ocean tsunami that struck South India, the sea around Dhanushkodi receded about 500 metres from the coastline.

The proposed project site is 1.0 km away from the shoreline and far beyond 100 km from the disasters occurred in the past. The power plant will be established at an elevation of 5.0 m above mean sea level and thick green belt will be developed along the periphery of the project site. Hence, the proposed power plant may not have significant impacts due to natural disasters like tsunami, cyclones. The cyclone atlas is provided in **Figure – 6.2**.

Figure – 6.2


Arabian Sea
Nov
1996-Nov
1976-Nov
1930-Nov
1933-Nov
1962-Nov
1979-Nov
1977-Nov

Project Benefits

Chapter – 7
Project Benefits

7.0 Benefits

TANGEDCO (TNEB) has proposed to install coal based power plant of capacity 2 x 800 MW super critical coal based thermal power plant at Uppur, Valamavoor and Thiruppalaikudi, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu.

The power generated in the power plant would be available at 400 kV level in the station switchyard bus and would be fed to Tamil Nadu Transmission Corporation Limited (TANTRANSCO) 400 kV A Karaikudi substation, which is about 40 km NW of the proposed site and 400 kVA Chekkanurani substation which is about 90 km West of the proposed site.

The proposed project development will give rise to various social and economic development measures in the study area.

7.1 Improvement in Physical Infrastructure

The proposed project is expected to yield a positive impact on the socio-economic environment. It helps in sustainable development of this area including further development of physical Infrastructural facilities. The following physical infrastructure facilities will improve due to proposed project.

- Road Transport facilities
- Educational facilities
- Water supply and sanitation

7.2 Improvement in Social Infrastructure

The proposed project will lead to indirect employment opportunity. 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. This will enhance their income and lead to overall economic growth of the area.

The following changes in socio-economic status are expected to take place with this project.

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

is going to have positive impact on consumption behavior by way of raising average consumption and income through multiplier effect. The project is going to bring about changes in the pattern of demand from food to non-food items and sufficient income is generated.

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

7.3 Places of Historical Importance

There is no historical or archaeological monument within 10 km of the area. Industrial development and consequent economic development should lead to improvement of environment through better living and greater social awareness.. On the other hand, the proposed project is likely to have several benefits like improvement in indirect employment generation and economic growth of the area, by way of improved infrastructure facilities and better socio-economic conditions.

7.4 Other Tangible Benefits

The proposed project is likely to have other tangible benefits as given below.

- Indirect employment opportunities to local people in contractual works like housing construction, transportations, sanitation, for supply of goods and services to the project and other community services
- Additional housing demand for rental accommodation will increase
- Market and business establishment facilities will also increase
- Cultural, recreation and aesthetic facilities will also improve
- Improvement in communication, transport, education, community development and medical facilities

7.5 Fishermen Welfare Fund:

"An endowment of **Fishermen Welfare Fund** should be created out of CSR grants not only to enhance their quality of life 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."

Following Fishermen Welfare Schemes are already in force:

- National Fishermen Savings cum Relief Scheme
- Tamilnadu Marine Fisherwomen Savings cum Relief Scheme
- Relief Assistance to Marine Fishermen Families during lean months (Rs.4000/family)
- Relief Assistance to Marine Fishermen Families during fishing ban season (Rs.2000/family)
- Fishermen Group Accident Insurance Scheme (premium paid by State Govt.)
- Fishermen/fisherwomen group Janatha Personal Accident Insurance Scheme
- Subsidy for purchase of out board motor to traditional fishermen
- Supply of sales tax exempted diesel to motorized fishing crafts (1500 liters per month)
- Daily relief Assistance to Families of Missing fishermen (Rs.250/day)
- Relief to families of deceased fishermen subject to attack by Srilankan Navy
- Seamless communication network
- Tamil Nadu Fishermen Welfare Board (Board formed on 29.6.2007)

However, in view of the directions of EAC/MOEF, it is considered that a lump sum amount of Rs.200.00 lakhs may be earmarked for Fishermen Welfare Fund.

Environmental Management Plan

Chapter – 8
Environmental Management Plan

8.0 Introduction

The Environment Management Plan describes both generic good practice measures and site-specific measures so as to mitigate potential impacts associated with the proposed activities. The Environmental Management Plan (EMP) of the proposed power plant with respect to noise, air quality, water quality, solid waste, ecology, landscape socio-economic measure are summarized below

The EMP provides a delivery mechanism to address potential adverse impacts and to introduce standards of good practice to be adopted for all project works. For each stage of the program, the EMP lists all the requirements to ensure effective mitigation of every potential environmental attribute and socio-economic impacts. For each impact type during construction and operation the following information is presented:

- A comprehensive listing of the mitigation measures (actions) that are needed to implement.
- The parameters that will be monitored to ensure effective implementation of the action;
- The timing for implementation of the action to ensure that the objectives of mitigation are fully met.

8.1 Environmental Management Plan during Construction Phase

8.1.1 Air Environment

The construction of proposed power plant would result in increase of dust concentrations due to fugitive dust. Frequent water sprinkling in the vicinity of the construction sites would be undertaken and will be continued after the completion of plant construction, as there is scope for heavy truck mobility. It will be ensured that both petrol and diesel powered vehicles are properly maintained to comply with exhaust emission requirements.

8.1.2 Noise Environment

There will be marginal increase in noise levels during construction phase, which is temporary and intermittent.

8.1.3 Water Environment

During construction, provision for infra-structural services including water supply, sewage, drainage facilities and electrification will be made.

8.1.4 Land Environment

Any hazardous material required for constructional activity will be stored as per safety norms. Further construction site will be provided with suitable toilet and treatment facilities for maintaining hygienic conditions.

8.1.5 Socio-economic Environment

Any construction activity will benefit the local population in a number of ways. The company management will give preference to local eligible people through both direct and indirect employment. It will provide ample opportunity to the locals to up-lift their living standards by organizing events that propagate mutual benefits to all, such as health camps, awareness campaigns, donations to poorer sections of society and down-trodden.

8.1.6 Safety and Health

Adequate space will be provided for construction of temporary sheds for construction workers mobilized by the contractors. The project will take care of supply of potable water for the construction workers. The safety department will supervise the safe working of the contractor and their employees. Work spots will be maintained clean, provided with optimum lighting and enough ventilation to eliminate dust/fumes. A comprehensive Occupational Health and Safety management plan is put in place to address any sort of eventuality.

8.2 Environmental Management Plan during Operations Phase

8.2.1 Air Environment

Air pollution is inevitable from power production. The major pollutants emerged due to power plant operations are suspended particulate matter, fine particulate matter (PM_{10}& $PM_{2.5}$), Sulphur dioxide and Oxides of Nitrogen.

Stack Emissions Management

The following measures will be adopted for the control of emissions in the proposed power plant units.

- Suitably designed ESP with efficiency of 99.95% will be placed downstream of the stacks which will separate out the incoming dust in flue gas and limit the dust concentration at its designed outlet concentration of less than 50 mg/Nm^3.
- For the effective dispersion of the pollutants stack height has been fixed 275 m based on the CPCB requirements.

- The dust generated from coal handling plant will be insignificant because of handling of fine coal in closed circuit. For further suppression of dust adequate water spray system is being provided;
- Complete combustion takes place in the bed itself. Hence formation of carbon monoxide is not traced
- A well-designed burner system, will limit the temperature to a reasonably low value of NO_x.
- All vehicles and their exhausts would be well maintained and regularly tested for emission concentration;
- Adequate thickness of insulating material with proper fastening will be provided to control the thermal pollution;
- Provision of regular preventive maintenance of pollution control equipment; and
- Stack emissions will be regularly monitored by external agencies on periodic basis.

Fugitive Emission Management

The following measures are being adopted:

- Dust suppression system by water sprinkler at dump hopper of coal
- Regular dust suppression with water sprinkler on the haul roads;
- Control of fugitive emissions from the ash pond through maintaining a permanent blanket of water cover over the deposited ash
- Green belt development and afforestation in the plant and surroundings of ash disposal area.
- Dust suppression/extraction system at coal handling plant to control fugitive emission

Tree plantation will be done in 275 acres of land and avenue plantation will be done on both sides of the internal road and near the main office building as well as at the parking area. In addition to that green belt will be developed outer area of the proposed plant.

Stack Gas Monitoring

The emissions from the stack will be monitored continuously through online stack measuring devices for exit concentration of sulphur dioxide, oxides of nitrogen and particulate matter pollutant levels if found exceeding the limit, necessary control measures will be taken to control within standards. Sampling ports would be provided in the stacks according to CPCB guidelines.

Ambient Air Quality Monitoring

The concentration of Suspended Particulate Matter (SPM), PM_{10}, $PM_{2.5}$, SO_2, and NO_x in the ambient air within the project boundaries (adjoining villages) would be monitored as per the direction of the state pollution control board.

Meteorological Observations

The dry bulb temperature, wet bulb temperature, wind speed, wind direction, cloud cover, rainfall and solar radiation will be recorded daily.

8.2.2 Noise Environment

Some of the design features provided to ensure low noise levels are given below:

- All rotating items will be well lubricated and provided with enclosures as far as possible to reduce noise transmission. Extensive vibration monitoring system will be provided to check and reduce vibrations. Vibration isolators will be provided to reduce vibration and noise wherever possible;
- The noise generating items such as fans, blowers, compressors, pumps, motors etc. are so specified as to limit their speeds and reduce noise levels. Static and dynamic balancing of equipment will be insisted upon and will be verified during inspection and installation; For DG sets, acoustic enclosures will be provided.
- Provision of silencers will be made wherever possible;

- The insulation will be provided for prevention of loss of heat and personnel safety will also act as noise reducers;
- Layouts of equipment foundations and structures will be designed keeping in view the requirement of noise abatement;
- Central control room(s) will be provided for operation and supervision of plant and equipment will be air-conditioned, insulated and free from plant noise. Necessary enclosures will also be provided on the working platforms/areas to provide local protection in high noise level areas;
- Proper lubrication and housekeeping to avoid excessive noise generation;
- In case where the operation of the equipment warrants the presence of operators in close proximity to equipment, the operators will be provided with necessary safety and protection equipment such as ear plugs, ear muffs etc.;
- By provision of green belt in and around the plant premises;
- Occupational Health and Safety Administration System for evaluation of exposure of noise pollution on the associated staff and comparing it with permissible exposure and subsequently taking corrective actions will be developed;

By these measures, it is anticipated that noise levels in the plant will be maintained within the permissible limits at the boundary of the plant premises. Plantations on the periphery of the plant would further attenuate noise levels.

8.2.3 Solid Waste Management

The main solid waste from the power plant will be ash (Fly ash and Bottom ash). The average coal consumption rate from the power plant along with ash generation are provided in the following table.

Table – 8.1
Details of Ash Generation

Description	2x800 MW TPP	
	100% Imported Coal	Blended Coal (70% imported coal & 30% indigenous coal)
Coal consumption	4.64 MTPA	5.57 MPTA
Total Ash	0.464 MTPA (10%)	1.8938 MTPA
Fly Ash (@80%)	0.3712 MTPA	1.515 MTPA
Bottom Ash (@20%)	0.0928 MTPA	0.3788 MTPA

It is proposed to utilize 100% of the fly ash for which ash utilization plan is ready. During emergency the ash will be disposed off safely in ash pond area. Bottom ash and unutilized fly ash will be disposed off in the ash pond. To control fugitive dust emission from the ash pond area water layer will be maintained above the ash pond.

STATUTORY PROVISIONS

Ministry of Environment & Forests (MoEF), Govt. of India vide its notification No. S.O. 763 (E) dated 14th September 1999 duly amended vide notification No. S.O. 979 (E) dated 27th August 2003 and notification No. S.O. 2804 (E) dated 3rd November 2009 has made it mandatory.

- **Within 100Km radius of a Thermal Power Plant**
  - To use Fly Ash based Building products such as cement or concrete, fly ash bricks, blocks, tiles etc. in all construction projects
  - To use Fly Ash in Road or Flyover Embankment construction
  - To use Fly Ash in Reclamation of low lying areas
- **Within 50Km of a Thermal Power Plant (By Road)**
  - To use Fly Ash in back filling of underground and open cast mines
- **Financial institutions to include a clause in their loan documents for compliance of this notification**

New coal/lignite based thermal Power Stations and/or expansion units commissioned after notification are required to achieve the target of fly ash utilization as given in below table:

Table – 8.2

S. No.	Percentage Utilization of Fly Ash	Target Date
1	At least 50% of fly ash generation	One year from the date of Commissioning
2	At least 70% of fly ash generation	Two years from the date of Commissioning
3	At least 90% of fly ash generation	Three years from the date of Commissioning
4	100% of fly ash generation	Four years from the date of commissioning

The unutilized fly ash in relation the target during a year, if any, shall be utilized within next two years in addition to the targets stipulated for these years and the balance unutilized fly ash accumulated during first four years (the difference between the generation and utilization target) shall be utilized progressively over next five years in addition to 100% utilization of current generation of fly ash.

Fly Ash Utilization

The fly ash can be used for the manufacture of cement and bricks. It can also be utilized in mass concrete construction in dams and other hydraulic structures. Fly ash can also be sintered to produce sintered fly ash, which is an important lightweight aggregate for making structural concrete. It can also be used for a number of other purposes such as:

i. In making bricks
ii. As fine aggregate in mortar and concrete block
iii. As a filler in rubber, paint, bituminous concrete and bituminous products
iv. As a raw material for glass manufacturing
v. In soil stabilization
vi. In sand blasting in place of sand, for cleaning turbine blades
vii. As a filler layer under road pavements

The Sludge generated in sludge thickener will be 28.8 tonnes/day and sludge from STP will be 7.5 tonnes per day. The dried STP sludge will be utilized as manure for green belt development and the ETP sludge will be utilized for land filling in low lying areas within the plant premises. The wastewater management scheme is shown in **Figure – 8.1**.

The details of the solid waste generated from proposed power plant are given in the following Table.

Table- 8.3
Details of Solid Waste M t

S.No.	Particulars	Solid waste in TPD		Mode of Disposal
		100% imported coal	Blended Coal	
1	Fly ash	1406.1	5738.8	Used in cement plant and for manufacturing other construction materials like paver blocks, hollow / solid blocks, mosaic tiles, bricks etc.
2	Bottom ash	351.52	1434.70	Bottom ash would be pumped in wet form to the proposed ash pond. However, utilization of bottom ash for road works etc., will be encouraged.
3	Sludge Thickener	28.8	28.8	Landfill in low lying areas
4	STP Sludge	7.5	7.5	Manure within plant premises.
Total		**1793.92**	**7209.8**	

Bottom Ash Utilization

Bottom ash can be used in road construction, as a foundation material, as a noise barrier, as a capping layer on landfill sites and as an aggregate in asphalt & concrete.

a. Road Construction

Bottom ash can be used in road construction as fill material, mainly in large motorway embankments.

b. Foundation Material

Bottom ash is a popular foundation & fill material in all works involving large areas of asphalt pavement and where there will be no impact of direct contact with the groundwater. It is used as a fill material in vehicular parking areas or large storage hangars.

c. Noise Barriers

Bottom ash can be used as a raw material in the construction of noise barriers with a natural appearance along motorways.

d. Aggregate

The use of bottom ash as an aggregate in asphalt and concrete is sieved, separated into coarse and fine fractions, coated with bitumen and added to asphalt instead of stone chippings.

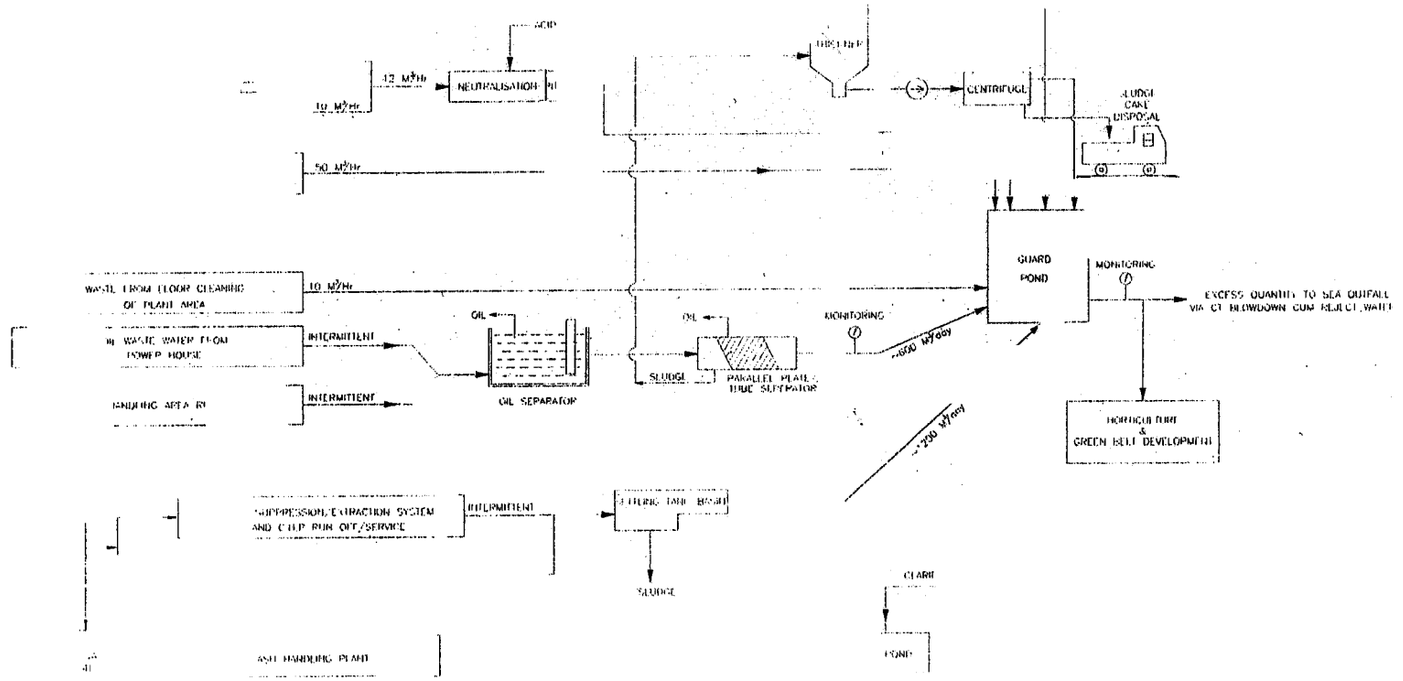
8.2.4 Water and Wastewater Management

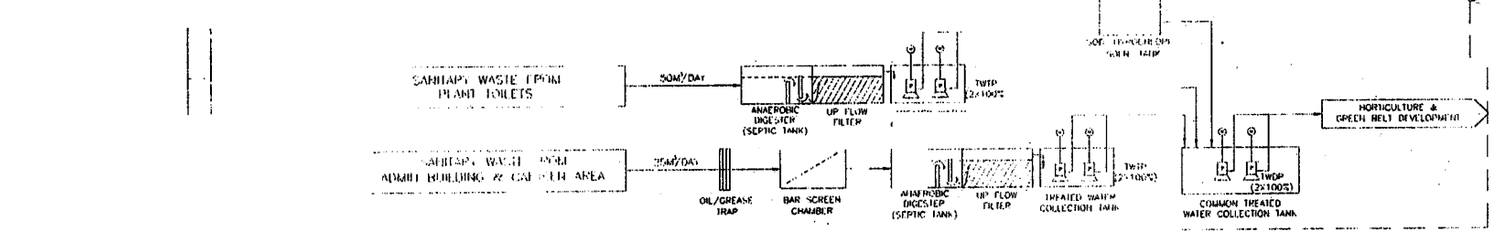
Continuous efforts would be made to reduce the water consumption and thereby to reduce the wastewater generation. Flow meters would be installed for all major water inlet and the flow rates would be continuously monitored. Periodic water audits would be conducted to explore the possibilities for minimization of water consumption.

Waste water Management

The total water requirement for the proposed thermal power plant is 15376 m^3/hr against which sea water outfall is 10508 m^3/hr. The wastewater generated would be 3574 m^3/day and used for green belt development.

Figure-8.





NOTES:-

1. ALL FLOW RATE ARE IN

RSN	DS	DS	RM	FINAL SUBMISSION
RSN	DS	DS	RM	FIRST SUBMISSION
APPROVED	REVIEWED	CHECKED	DRAWN	DESCRIPTION

		FLOW DIAGRAM FOR WASTE WATER MANAGEMENT SCHEME
RO	16.04.13	2x800MW UPPUR THERMAL POWER PROJECT
PO	26.08.12	TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED
REV.	DATE	

RPOSE

DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS

JOB NO. 1204

DWG. NO. 1204-010-DWG-

RO

Final Disposal of the wastewater

The treated wastewater will be used for horticulture and green belt development within the plant. The cooling water system blow-down would be drawn from cold cooling water system and discharged back to the sea, at distance of about 6.5 km off the coast, with suitable diffuser and discharge structure at an appropriate location based on The intake and outfall studies were done by Department of Ocean Engineering, IIT Madras, Chennai, Tamil Nadu.

Monitoring of Wastewater Treatment

The treated wastewater would be monitored regularly for the flow rate and quality to identify any deviations in performance of Effluent and sewage treatment plants. If the effluent does not meet the standards it will be sent to Sedimentation tank again for further treatment. The treated effluent meeting statutory norms will be discharged to sea.

8.3 Storm Water Management

Based on the rainfall intensity of the proposed area, storm water drainage system will be designed and connected to the storm water networks. Storm water drainage system consists of well-designed network of open surface drains and rainwater harvesting pits along the drains so that all the storm water is efficiently drained off without any water logging.

8.4 Rain Water harvesting System

The rain (storm) water from the building roofs, non process area and grade level surfaces will be directed through the rain water harvesting structures and excess water will be directed through open drains to the storm drainage system. The storm water from the storm drainage system will be discharged outside the plant boundary. All drains will be lined and will be arranged to provide the shortest possible drainage path for efficient drainage.

Rainwater Harvesting System (RWHS) designs and construction details are given below.

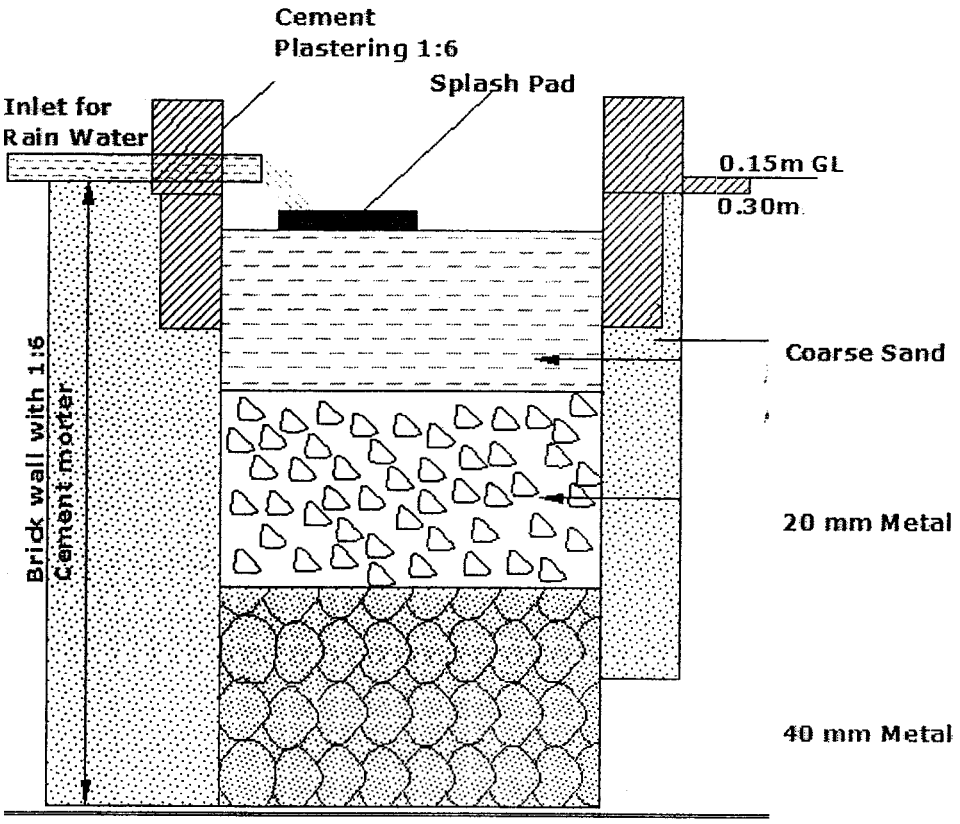


Figure 8.2: Rainwater Harvesting Structure

The plant may have an in-house environmental laboratory for the routine monitoring of air, water, soil and noise. For all non-routine analysis, the plant may utilize the services of external laboratories and facilities.

Surface Area Rainwater Harvesting

The unit is proposed rain water harvesting by way of surface run-off.

Surface area = 3346753 m^2

Annual rainfall = 827 mm

Considering Runoff co-efficient as 0.6

Total water recharged by harvesting = (Area X Annual Rainfall X Runoff coefficient for surface) = 3346753 m^2 x0.827 m x 0.6

Total water recharged by harvesting = 1660659 m^3

Roof top Rainwater Harvesting

Rainwater Harvesting scheme is proposed and will be sought for suitable place within the premises. The unit is proposed to rain water harvesting by way of capturing run-off from rooftops.

The basic concept of harvesting rainwater is simple. Rainwater is mostly collected from the roofs of buildings. It flows by gravity through gutters and downspouts into a storage tank.

Roof top area = 343983 m^2

Annual rainfall = 827 mm

Considering Runoff co-efficient as 0.85

Total water recharged by harvesting = (Area X Annual Rainfall X Runoff coefficient for roof top) = 343983 m^2 x 0.827 m x 0.85

Total water recharged by harvesting = 241803 m^3

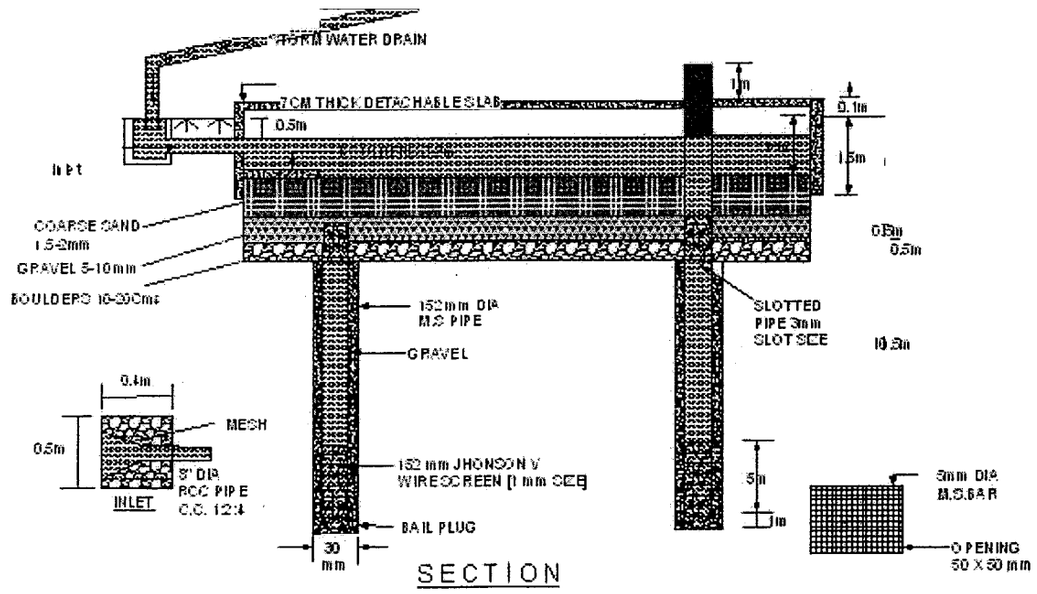


Figure 8.3: Rooftop Rain Water Recharge

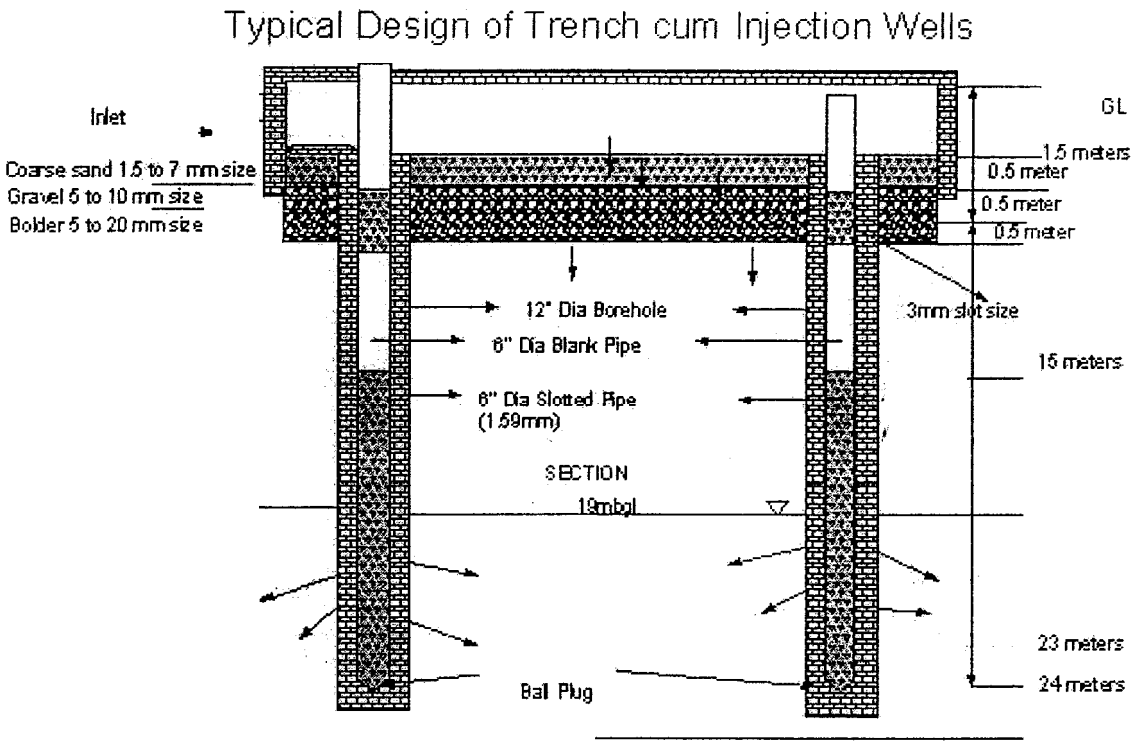


Figure 8.4: Design of Trench cum Injection Wells

The recharging pit i.e., the bottom basin of the recharging pit will be of size 15mx15mx4.5m deep. The bottom basin will consist of many nos of 100 mm dia PVC perforated pipes installed upto the sand strata depth from the basin bed level. The perforated pipes will be wrapped with coir, so that the water is filtered while passing to the ground. Hand rails will be provided to the recharging pit at the top bench with hard footpath for safety purpose.

Schemes for regeneration and preservation of village ponds

The total runoff water 1902462 m^3 can be recharged through rain water harvesting scheme and the recharge water shall be diverted to the village tanks/ponds at the vicinity of the project site by lying of pipelines.

It is proposed to desilt and deepen the nearby tanks so that the water received from the water shed is stored in the tanks.

Further it is proposed to connect both Naganendhal big tank and valamvur tank so that the excess water can be diverted and connected to the Peyar river in the southern side of the plant boundary.

8.5 Housekeeping

Salient features of housekeeping will be adopted are as follows:

- Mechanized cleaning of roads and floor area inside the plant premises by using road sweeper and mobile vacuum cleaner on regular basis;
- Training on regular basis to all workers and staff about the importance of cleanliness;
- Careful garbage transportation to dumping site and disinfection of transport vehicles body;
- Decorative plantation and gardening to improve aesthetics of the plant; and
- Construction of suitably designed drains all along the roads and boundary of the plant premises.

8.6 Occupational Health & Safety

During operation stage, dust causes the main health hazard. Other health hazards are due to gas cutting, welding, noise and high temperature and micro ambient conditions especially near the boiler and platforms, which may lead to adverse effects (Heat cramps, heat exhaustion and heat stress reaction) leading to local and systemic disorders.

Table – 8.4
Health Evaluation schedule:
Frequency of Periodical Examination of Occu ational Health

Occupation	Type of evaluation	Frequency
	Pre-placement	
Coal Handling Area	Chest X-ray, spirometry and vision testing	Every 5 years to age <30; Every 4 years to age 31-40; and every 2 years to age 41-50;
Boiler Area & Turbo Generator Area	Chest X-ray, spirometry and vision testing	Every 5 years to age <30; Every 4 years to age 31-40; and every 2 years to age 41-50;
Noise prone areas	Audiomet	Annually
Main Control Room	Far & Near Vision; Colour Vision; and Hearing tests	Every 5 years to age <30; Every 4 years to age 31-40; And every 2 years to age 41-50;
Ash Handling Area	Chest X-ray, spirometry, Vision; and Hearing tests	Every 5 years to age <30; Every 4 years to age 31-40; And very 2 years to age 41-50;

The precautionary measures, which will be followed to reduce the risk due to dust on the workers, engaged in and around the material handling areas:

- Adequate arrangements are made for preventing the generation of dust by providing the chutes at transfer points to reduce the falling height of material,

preventing spillage of material by maintaining the handling equipment, isolating the high dust generating areas by enclosing them in appropriate housing and appropriately de-dusting through high efficiency bag filters;

- Massive afforestation will be undertaken in the plant. The tree cover acts as a sink for both gaseous as well as particulate matter.
- Due care will be taken to maintain continuous water supply in the water spraying system and all efforts would be made to suppress the dust generated by coal handling system by water spraying at appropriate points;
- Almost all material handling systems are automatic. The workers engaged in material handling system will be provided with personal protective equipment like dust masks, respirators, helmets, face shields etc;
- All workers engaged in material handling system will be regularly examined for lung diseases such as PFT (Pulmonary Function Test) tests;
- Any worker found to develop symptoms of dust related diseases will be changed over to other jobs in cleaner areas and provided with proper medical care; and
- Thermal insulation will be provided wherever necessary to minimize heat radiation from the equipment, piping, etc. to ensure protection of workers. Insulation will be done by adequate cleats, wire nets, jackets etc. to avoid loosening. Insulation thickness is so selected that the covering jacket surface temperature does not exceed the surrounding ambient temperature by more than 15°C. The effect of thermal pollution of air will be negligible considering the atmosphere as the ultimate heat sink

8.7 Design of Green Belt

Green belt of around 50–100 m width or as notified by SPCB in consent letter will be provided throughout the periphery of the proposed project site.

8.7.1 Green Belt and Afforestation Plan

Green belt development in an industry is one of the most effective environmental pollution control measures. Trees play vital role in keeping the ground level concentrations in control within the plant premises and also in preventing the horizontal dispersion of the pollutants to the surrounding areas. They are very effective in trapping the pollution causing agents viz. dust and gaseous pollutants. They are also considered to be excellent indicators of

excessive ground level concentrations. The green belt is being proposed for the following objectives.

Green belt will be developed in 275 acres in project area and along periphery of the site. In addition to that thick green belt will be developed along the Tsunami protection bund. Apart from the bulk plantation around the boundaries, roadside avenue plantations will also be taken up. Based on the agro-climatic conditions of the region, location of the proposed power plant, physico-bio-chemical properties of the soil strata, nature of the pollutants and their rate of dispersion, it is suggested to develop greenbelt around the plant. The year wise green belt plan is shown in the Table – 8.5.

Table – 8.5
Green Belt Plan

Year wise	Area in Acres	No of Saplings
1st Year	100	101215
2nd Year	65	65789
3rd Year	40	40486
4th Year	36	36437
5th Year	34	34413
Total	**275**	**278340**

Such green areas would not only improve the floral status as well as the look of the area, but also serve the dual purpose of arrest of any fugitive dust from unpaved or open areas and also help to abate the noise effects through dampening effects and replenish the oxygen and ameliorating the surrounding temperature.

Table-8.6
Suggested Plant Species for Road Side Plantation

S. No.	***Scientific Name***	**Vernacular name**
1	Bauhimapururea	Kachnar
2	*Leucaenaleucocephala*	Subabool
3	*Delonixregia*	Gulmohar
4	*Cassia fistula*	Amaltas
5	*Pongamiapinnata*	Karanj
6	*Samaniasaman*	Rain tree

Table - 8.7
Plant Species Suggested for Green Belt Development suggested by CPCB

S.no	Botanical name of the plant	Size of the grown up tree	Type and suitable site, where the plants are to be plotted
1	Acacia auriculaeformis	Medium	Semi-evergreen fragrant white flowers suitable in green belts and on road sides
2	Adina corodifolia	Large	Deciduous, a light demander, suitable on open areas and near flares
3	Aeglemarmelos	Medium	Deciduous, good for green belts near temples.
4	Anogeissuslatifolia	Medium	Deciduous, Suitable for green belts
5	Artabotryshexapetaius	Small	Evergreen shrub with fragrant flowers good for gardens and inside boundary wall and long canals
6	Averrhoacarambola	Small	Semi evergreen, good in narrow green belts along the ash pond
7	Azadirachtaindica	Large	Evergreen, suitable in green belts along the boundary and outside office & sensitive buildings like hospitals.
8	Bauhinia variegate	Medium	Deciduous, good in green belts in garden and as a second row avenue tree
9	Borassusflabellifer	Large	A tall deciduous palm can be used as wind break when of different age.
10	Boswelliaserrata	Medium	Deciduous suitable on green belt on willow soils
11	Bureraserrata	Medium	Evergreen, suitable on willow soils as a green belt or avenue tree
12	Buteamonosperma	Medium	Deciduous for green belt and as a second row avenue tree
13	Caesalpiniapulcherrima	Small	A large shrub, suitable for gardens outside offices and along channels
14	Callistemon lanceolatus	Medium	Deciduous for some time, ornamental plant in garden

S.no	Botanical name of the plant	Size of the grown up tree	Type and suitable site, where the plants are to be plotted
15	Carevaaroborea	Large	Deciduous, good in green belts
16	CarrisaCarandas	Small	Semi evergreen large bushy shrub good as a hedge to protect against noise.
17	Carhotaurents	Large	A lofty palm, good as a wind break
18	Cassia fistula	Medium	Deciduous, good ornamental tree in green belts.
19	C.siamea	Large	Evergreen, good as an avenue tree.
20	Casuarinaequisetifolia	Medium	Evergreen suitable for covering low lying area and in green belts and along ponds.
21	Cedrelatoona	Large	Deciduous, good in open spaces, in green belts and along ponds.
22	Ficusbengalensi	Large	Deciduous, widely spaced avenue tree (15 m apart)
23	Ficusreligiosa	Large	Deciduous, widely spaced avenue tree also as a single tree in isolated sites.
24	Maducaindica	Medium	Deciduous, good in green belts.
25	Peltophoruminerme	Medium	Semi evergreen, suitable on road sides, in gardens and outside office buildings.
26	Saracaindica	Medium	Evergreen tree good on road sides within campus
27	Tamarindusindica	Large	Evergreen tree good along boundary and road sides.
28	Terminaliacatappa	Large	Deciduous tree
29	Terminaliaarjuna	Large	Evergreen tree for road sides and in green belts
30	Zanthoxyium	Medium	Deciduous in green belts

8.8 Measures to Improve Socio-Economic Conditions

For the benefit of the community in the vicinity of the project, the project authorities will be taken several measures to develop various amenities in an effort to improve standard of living.

The project cost is Rs.9600 crores and 0.4% will be provided budget for CSR activities. Rs.38.00 crores as capital cost and 3.00 crore as annual recurring cost will be earmarked for the activities to be taken up under CSR in consultation with Local bodies and Revenue department/Government of Tamil Nadu.

The following needs for the community are;

- Renovation of schools, PHCs, Anganwadis
- Toilet facilities
- Community halls
- Infrastructure facilities
- Auction halls for fishermen, fish net mending shed, fish drying platform, berth for boat anchoring purpose for fishermen
- Youth training development programmes
- Protection wall for about 500m in Morepannai village shore
- Regular health camps
- Desilting of village tanks
- Laying roads, street lights

Table – 8.8
Corporate Social Responsibility (CSR) Budget

S. No.	Particulars	Amount (Rs. In Lakhs)
1.	Drinking water supply	1034.00
2.	Augmentation of School Facilities	300.00
3.	Augmentation of Anganwadi Facilities	80.00
4.	Augmentation of PHC Facilities	125.00
5.	Toilet facilities	200.00
6.	Community halls	150.00
7.	Auction halls, net mending sheds, fish drying platforms,	120.00
8.	Sea wall in Morepannai village	100.00
9.	Youth training programmes	100.00
10.	Library, playground, gym	200.00
11.	Roads, street lights	500.00
12.	De-silting of Tanks in the study area	600.00
13.	Women Empowerment Group	60.00
14.	Fishermen Welfare fund	200.00
	Total	**3769.00 ~ 3800.00**

8.9 Landscaping

The various services / utility areas within the plant will be suitably graded to different elevations. Natural features of the plant site will be retained as far as possible to integrate with the buildings to form pleasant environment. Areas in front of various buildings and the entrance of power plant will be landscaped with ground cover, plants, trees based on factors like climate, adaptability, etc. The green belt will consist of native perennial green and fast growing trees. Trees will also be planted around the coal stock Pile area and ash disposal area to minimize the dust pollution. Adequate afforestation will be carried out as per the guidelines of MoEF.

8.10 Fire Fighting & Protection System

Safety Policy and Regulations

Keeping in view of the safety requirement during construction, operation and maintenance phase, the project has formulated safety policy with the following regulations:

- To allocate sufficient resources to maintain safe and healthy conditions at work place.
- To take, steps to ensure that all known safety factors are taken into account in the design, construction, operation and maintenance of plants, machinery and equipment.
- To ensure that adequate safety instructions are given to all employees.
- To provide wherever necessary, protective equipment, safety appliances and clothing and to ensure their proper use.
- To inform employees about materials, equipment or processes review for making necessary changes from the point of view of safety in the light of experience and up to date knowledge.
- To provide appropriate instruction, training and supervision in health and safety, first aid and to ensure that adequate publicity is given to these matters.
- To ensure proper implementation of fire prevention and an appropriate fire-fighting service together with training facilities for personnel involved in this service.
- To ensure that professional advice is made available wherever potentially hazardous situations exists or might arise.

- To organize collection, analysis and presentation of data on accident, sickness and incident involving personal injury to health with a view to taking corrective, remedial and preventive action.
- To promote through the established machinery, joint consultation in health and safety matters, to ensure effective participation by all employees.
- To publish/notify regulations, instructions and notices, in the common language of employees.
- To prepare safety rules for each type of occupation/process involved in a project.
- To ensure regular safety inspection by a competent person at suitable intervals of all buildings, equipment, work places and operations

Fire Protection System

- The plant has proposed adequate number of wall/column mounted type portable fire extinguishers in various strategic areas of the plant including the control room, administration building, stores, pump house etc. These portable fire extinguishers are basically of carbon dioxide and dry powder type.
- Fire hydrants at suitable locations for TG building, boiler area, fuel handling & storage area.
- Medium velocity water spray system for the cable gallery
- Necessary electric driven, Jockey pumps with piping valves & instrumentation for safe operation

Summary and Conclusions

Chapter – 9
Summary & Conclusion

TANGEDCO is proposed to install coal based power plant of capacity 2 x 800 MW super critical imported coal based Thermal Power station at Uppur, Valamavoor and Thiruppalaikudi, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu.

9.0 Salient Features of the Project

- The proposed power plant capacity is 2x800 MW super critical imported coal based Thermal Power Plant.
- The identified plot has an area of 912 acres at Uppur, Valamavoor and Thiruppalaikudi, in Thiruvadanai Taluk, Ramanathapuram District of Tamil Nadu. .
- The total project cost is Rs..9600 Crores for establishing 2x800 MW Supercritical Thermal Power Plant.
- The imported coal of 14939 TPD is required for the proposed project 2x800 MW Power Plant which, will be supplied by MMTC Ltd.

9.1 Water requirement:

- The total plant water requirement will be 15376 m^3/hr and the sea water is sourced from Palk Bay. The water is used in different process of the thermal power plant, the main uses are Make-up water for condenser cooling; Cooling of electrical and mechanical auxiliary equipment such as, generators, transformers, compressors, and other heat exchangers; Make-up water for power cycle (boiler make-up); water requirement for ash disposal; Water for miscellaneous services such as Firefighting, General services viz. air conditioning, ventilation, service water, dust suppression, potable water for plant and township, etc.

9.2 Power Evacuation

- Power generated in the Power Plant would be available at 400 kV level in the station switchyard bus and would be fed to Tamil Nadu Transmission Corporation Limited (TANTRANSCO) 400KVA Karaikudi substation which is about 40KMs North West of the proposed site and 400KVA Chekkanurani substation which is about 90KMs west of the proposed site.
- **Steam Generator:** the general deposition of furnace, PA, ID and FD fans, air preheaters etc., has been taken as per standard layouts for Power plants of such size. The flue

ducts from the ESPs will be connected to the chimneys. ESP control room has been located on one side of the ESP.

- Dust extraction system at coal transfer points, coalbunkers will be provided. Ventilation system for tunnels & bunkers will be provided.
- In coal handling and storage areas suitable dust control/ collection equipment will be provided to ensure a clean and healthy environment. Due care will be taken in ash disposal area where wetting of dry ash is envisaged.
- All liquid effluents will be suitably treated and consumed for internal use like landscaping and green belt. The effluent will be neutralized by the addition of either acid or alkali to achieve the required pH.
- The ash disposal system will have provision for lean slurry disposal for bottom ash and high concentration slurry disposal for fly ash. The ash dump yard is located at a distance of about 600m away from the main power block.
- All equipment vulnerable to explosion or fire will be designed to relevant IS codes & statutory regulations. Suitable fire protection system comprising hydrants and spray systems will be provided for fire protection.
- There will be an environment cell and qualified chief chemist in charge of analytical measurements and qualified engineers for pollution control.
- The total employees required during plant operation for 2x800 MW station are 324 nos.

9.3 Conclusion

Based on the EIA study it is observed that the proposed project will not only generate the revenue for Tamil Nadu State and nation but also help to improve the power supply. The project will lead to direct and indirect employment generation in the area. Generation of thick green belt within the plant premises will improve the aesthetic of the area.

Hence, it can be summarized that the proposed plant will have a positive impact on the socio-economic of the area and lead to sustainable development of the region as the management will follow the management plans as described.

None of the areas are deemed to be critical, based on the findings of the EIA study. TANGEDCO will adopt such necessary and appropriate pollution control and mitigatory measures, environmental monitoring and management system and safety assurance measures throughout the life cycle of the plant. With this commitment, the project should not pose any intolerable impact to the environment.

Disclosure of Consultan Engaged

Chapter – 10
Disclosure of Consultants engaged

Name of the Consultants:

M/s Bhagavathi Ana Labs Limited

8-2-248/5/A/42, Venkateswara Hills Colony

Road No. 3, Banjara Hills

Hyderabad – 500 034.

Telephone – 040 - 23356908, 23348689

Fax – 040 – 23356909

Email: environ@bhagavathianalabs.com

Website: http://www.bhagavathianalabs.com

Bhagavathi Ana Labs Limited is a professional services company providing Environmental Consultancy, Environmental Engineering, Analytical and Quality testing, Water Resource studies, Technical Training and Enviro-legal services. Since inception in 1984, the company has completed number of projects spread all over India. The company has qualified and experienced staff of more than 100 people operating across seven offices in India. The Professionals and Technicians include Environmental Engineers, Environmental Scientists, Environmental Planners, Chemists, Mining Engineers, Geologists, Hydro-geologists, Economic and Social Science specialists etc. Bhagavathi Ana Labs Pvt Limited is an ISO 9001-2000 Company and is accredited by:

Ministry of Environment and Forests (MoEF), Govt. of India, New Delhi

National Accreditation Board for Education & Training (NABET)

Registered EIA Consultants Organisation, Quality Council of India, Reg No: EIA 81 005

National Accreditation Board for Testing and Calibration Laboratories (NABL) as per ISO/IEC 17025:2005

- Bureau of Indian Standards (BIS), New Delhi

National Accreditation Board for Education & Training

Quality Council of India

CERTIFICATE OF ACCREDITATION

M/s Bhagavathi Ana Labs Limited

 # 8-2-248/5/A/42, Venkateshwara Hills, Road No. 3, Banjara Hills, Hyderabad - 500034

are hereby accorded accreditation under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations (Rev. 06, 2010) for the following scope/s:

Sl.	Name of the Sector*	Category
1.	Mining of minerals	A
2.	River Valley, Hydel etc.	A
3.	Thermal Power Plants	A
4.	Coal washeries	A
5.	Mineral beneficiation	A
6.	Metallurgical industries– both primary and secondary	A
7.	Cement plants	A

**Details are given in Annexure IA*

Sl.	Name of the Sector*	Category
8.	Asbestos milling etc.	A
9.	Chemical fertilizers	A
10.	Industrial estates/ SEZs etc.	A
11.	Ports, Harbours, jetties, etc.	A
12.	Highways, railways etc.	A
13.	Common Effluent Treatment Plants	B
14.	Building and large construction etc.	B

Accreditation to the above Sectors is subject to the EIA reports being prepared by the experts (EIA Coordinators & Functional Area Experts) mentioned in Annexure IB and compliance to the Terms and Conditions mentioned in Annexure IC.

Certificate No: NABET/EIA/1013/001

Valid up to: May 30, 2013#

May 31, 2010
New Delhi

Director

Subject to
- Continual compliance to NABET Scheme and meeting the norms during yearly surveillance assessment
- Updated status of accreditation should be verified from QCI website (www@qcin.org).

National Accreditation Board
for Education and Training

NABET

NABET/EIA/RA008/015

April 28, 2014

The Chief Executive Officer
M/s Bhagavathi Ana Labs Private Limited
8-2-248/5/A/42, Venkateshwara Hills,
Road No 3, Banjara Hills, Hyderabad – 500 034
(Kind Attention: **Ms Bhagavathi Hari Babu**)

Dear Sir,

Sub: Re-Accreditation

This has reference to your application to QCI-NABET for re-accreditation (RA) as EIA Consultant Organization and the assessment carried for same in your organization from November 20-23, 2013.

We are pleased to inform you that based on the document and office assessments during RA, the Accreditation Committee has approved renewal of accreditation w.e.f. November 23, 2013 for a period of three years. The accreditation given to your organization is subject to coverage of balance Functional areas and specific response to NCs/Obs./Alerts issued (Refer Annexure III) with the following details:

1. Annexure I - Scope of accreditation
2. Annexure II - List of experts with approved sectors/ functional areas
3. Annexure III - Non-Conformances/ Observations/ Alerts (NCs/ Obs./ Alerts)
4. Annexure IV - Observations on Quality Management System (QMS)
5. Annexure V - Terms and conditions of accreditation
6. Annexure VI - Result of assessment
7. Annexure VII - Guidelines for addressing Major Non-Conformances/ Observations/ Alerts
8. Annexure VIII - Format to be followed for mentioning the names of the experts involved in EIA reports prepared by Bhagavathi Ana Labs Private Limited.

Result of RA including Non-Conformances/ Observations/ Alerts (NCs/ Obs./ Alerts) applicable to your organization as per RA are also posted on QCI website vide minutes of the Accreditation Committee meetings dated December 13, 2013 & January 31, 2014. You are requested to take necessary actions to close the NCs/ Obs. as per guidelines and timeframe mentioned in Annexure VII of this letter.

You are required to make all payments to NABET as applicable, within one month from the date of invoice sent to you. Continuation of this accreditation of your organization is subject to the clearance of all dues by your organization, satisfactory compliance to Annexure III and V.

With best regards,

Yours sincerely,

(Vipin Sahni)
C.E.O.

Scope of Accreditation

Annexure I

NAME OF THE CONSULTANT ORGANIZATION: M/s Bhagavathi Ana Labs Private Limited
8-2-248/5/A/42, Venkateshwara Hills,
Road No 3, Banjara Hills, Hyderabad – 500 034

Sector number				
	As per MoEF Notification	As per NABET Scheme	Name of Sector	Category A/B
1.			Mining of minerals including Opencast/ underground mining	A
2.			Offshore and Onshore oil and gas exploration, development & production	A
3.			River Valley, Hydel, Drainage and Irrigation projects	A
4.			Thermal Power Plants	A
5.			Coal washeries	A
6.			Mineral beneficiation including pelletisation	A
7.			Metallurgical industries (ferrous & non ferrous) – both primary and secondary	A
8.			Cement plants	A
9.			Petroleum refining industry	A
10.			Coke oven plants	A
11.			Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediates excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)	A
12.			Oil & gas transportation pipeline (crude and refinery/ petrochemical products), passing through national parks/ sanctuaries/coral reefs /ecologically sensitive areas including LNG terminal	A
13.		31	Industrial estates/ parks/ complexes/ areas, export processing zones (EPZs), special economic zones (SEZs), Biotech parks, Leather complexes	A
14.		33	Ports, harbours, jetties, marine terminals, break waters and dredging	A
15.		38	Building and large construction projec ing shopping malls, multiplexes, commercial complexes, housing estates, hospitals, institutions	B

Total = 15 Sectors

Individual EIA Coordinators approved for different sectors are mentioned in Annexure II

(Vipin Sahni)
C.E.O.