



KU THERMAL POWER PRIVATE LIMITED

Regd off: 8-2-277/a/3/1,2,3, first floor,
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Banjara hills, hyderabad – 500034
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Ref: KU/RFEIA/2015

Date; 5-10-2015

**To,
The Director,
Government of India,
Ministry of Environment & Forests
Indira Paryavaran Bhawan, Jorbagh Road
New Delhi - 110 003.**

Respected Sir ,

**Sub: Setting up of 2x 660 MW Coal Based Thermal Power Plant at
Ottapidaram & Sillanattam villages, Ottapidaram Taluk,
Thoothukudi District in Tamil Nadu. — KU Thermal Power Private
Limited - Reg**

**Ref; File No ; J-13012/115/2011- IA.II (T),
Minutes of 34 th Reconstituted EAC meeting dated 28th April
2015**

Our proposal was considered in the 34th EAC meet on 28th April 2015 for EC appraisal.

Vide minutes of MOEF, the Committee advised us to collect fresh data in the period May to July 2015 and submit the revised Final EIA report along with clarifications referred in the minutes. The committee also informed that “All the discrepancies in the EIA/EMP report shall be rectified and the revised EIA/EMP incorporating the above shall be submitted along with the revised Form-1”. The Ministry also advised the proponent to advertise in English and local newspapers about the fresh baseline data and the Revised EIA report.

As per the instructions of EAC, MOEF, we have collected Fresh baseline data during May - July 2015, Revised the Final EIA Report incorporating Fresh baseline data of May - July 2015 and addressing replies to the clarifications raised by MoEF&CC. Public notices was published in the newspapers (local and English) about the Revised EIA/EMP with revised AAQ data on 19-09-2015. The hard copies of Revised Final EIA Reports are made available at the following locations and soft copy was also placed on the website of KUTPPL for public information for comments of the public giving a time period of minimum 15 days after the public notice.

- District Collector Office, Thoothukudi
- Village Panchyat – Sillanatham and Ottipidaram
- District Industries, Thoothukudi
- Tamil Nadu Pollution Control Board, Thoothukudi

We have not received any objection or suggestion from the Public/any whatsoever during the 15 days notice period.

We are herewith submitting the Revised Final EIA report along with Revised Form – 1 for Ministry's consideration

We request the Ministry to consider our project for appraisal for issue of Environmental Clearance.

Thanking You
Yours Faithfully

For KU Thermal Power Private Ltd.

CH. Rama Krishna 5/10/2015

CH. Rama Krishna
Vice President

REVISED FORM -1

**Proposed Supercritical Coal Based Thermal Power Plant
of
1320 MW (2x660 MW)**

**At
Ottapidaram & Sillanatham Villages Ottapidaram Taluk,
Thoothukkudi District
Tamil Nadu**

By



**KU Thermal Power Private Limited
Hyderabad.**

Prepared By



B.S. ENVI-TECH (P) LTD

Secunderabad – 500 017

NABET Accreditation No : NABET/EIA/1316/RA002

FORM 1**(As Per New Notification of Mo.E.F dated 1-12-2009 vide SO 3067 (E))**

BASIC INFORMATION		
S. No	Item	Details
1	Name of the Project/s	KU THERMAL POWER PRIVATE LIMITED 1320 MW (2x660 MW) Supercritical Coal Based Thermal Power Plant
2	S. No. in the schedule	1 (d)
3	Proposed capacity/ area/ length/ tonnage to be handled/ command area/ lease area/ number of wells to be drilled	2 x 660 MW (Unit 1 & 2)
4	New/ expansion/ modernization	New
5	Existing capacity/ Area etc.	Not Applicable
6	Category of Project i.e 'A' or 'B'	A
7	Does it attract the general condition? If yes please specify.	No
8	Does it attract the specific condition? If yes please specify.	No
9	Location	
	Plot/ Survey/ Khasra No	Exhibit -1
	Village	Ottapidaram & Sillanatham Villages
	Taluk	Ottapidaram Taluk,
	District	Thoothukkudi District
	State	Tamil Nadu
10	Nearest railway station/ airport along with distance in Kms.	Tattaparai RS – 6.7 km – SE
11	Nearest town, city, district head quarters along with distance in kms.	Thoothukkudi - 10.2 km – SE
12	Village panchayaths, Zilla parishad, Municipal Corporation, Local body (Complete postal addresses with telephone nos to be given)	Ottapidaram & Sillanatham Villages Ottapidaram Taluk, Thoothukkudi District, Tamil Nadu
13	Name of the applicant	KU THERMAL POWER PRIVATE LIMITED
14	Registered address	KU THERMAL POWER PRIVATE LTD Block C, Ground floor, Stemwood Apts NO.14 Factory Road, Adj to Safdarjung Hospital New Delhi – 110 029

15	Address for correspondence	KU THERMAL POWER PRIVATE LTD Block C, Ground floor, Stemwood Apts NO.14 Factory Road, Adj to Safdarjung Hospital New Delhi
	Name	Mr. Ch.Ramakrishna
	Designation (Owner /Partner/ CEO)	Vice President – Project Development
	Address	KU Thermal Power Private Ltd Block C, Ground floor, Stemwood Apts NO.14 Factory Road, Adj to Safdarjung Hospital, New Delhi
	Pin code	110 029
	E- mail	rkcherukuri@kuinfra.com
	Telephone no.	+91-11-43793600
	Fax no.	+91-11-43793650
16	Details of Alternative sites examined, if any location of these sites should be shown on a topo sheet.	Three sites were assessed (Enclosed as Exhibit – 2)
17	Interlinked projects	None
18	Whether separate application of interlinked project has been submitted?	Not Applicable
19	If yes, date of submission	Not Applicable
20	If no, reason	Not Applicable
21	Whether the proposal involves approval/clearance under: if yes, details of the same and their status to be given. (a) The Forest (Conservation)Act, 1980 (b) The Wild Life (Protection)Act, 1972 (c) The CRZ Notification, 1991	No No Yes
22	Whether there is any Government Order/ Policy relevant/ relating to the site?	None
23	Forest land involved (hectares)	None
24	Whether there is any litigation pending against the project and/or land in which the project is propose to be set up? (a) Name of the court (b) Case No (c) Orders/ directions of the court, if any and its relevance with the proposed project.	As on date, no case is pending against the project.

(I) ACTIVITY			
1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)			
S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	Yes	<p>Total land requirement for the project is about 800 acres as per CEA. Project area is optimized as per EAC, MoEF&CC advise to 750 acres from the originally proposed area of 800 acres. The land falls under the jurisdiction of Ottapidaram & Sillanattam villages of Thoothukudi district of Tamil Nadu and is private patta land. The land belongs to various private parties. 725 acres has been acquired by KUTPPL with mutual consent of land owners.</p> <p>The land will be put to use as per the following landuse table</p> <ul style="list-style-type: none"> • Main Plant -125.00 • Water Storage-25.00 • Railway Corridor-120.00 • Coal storage-75.00 • Ash Pond -100.00 • Other BOP Facilities-115.00 • Township-30.00 • Sub Total -590.00 • Greenbelt-160.00 • Total -750.00
1.2	Clearance of existing land, vegetation and buildings?	No	Most of the land is barren, without any habitation.

			and maintenance spares , Storage tanks for storing liquid fuel.
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	Yes	Ash pond will store part of the ash generated from the plant.
1.16	Facilities for long term housing of operational workers?	Yes	Residential colony is proposed within project area for the operating personnel with all facilities.
1.17	New road, rail or sea traffic during construction or operation?	Yes	Coal received at Thoothukudi Port will be transported to the project site by rail through proposed railway siding.
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	Yes	-do-
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	No	No changes in the existing traffic route.
1.20	New or diverted transmission lines or pipelines?	Yes	Pipeline will be laid from South Ganga Water Technologies Private Limited (SGWTPL) located at 10.7 Km for getting desalinated water
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?	No	No perennial nallas are existing within the project site. No alteration of the surface drainage pattern of the area is proposed.
1.22	Stream crossings?	No	No perennial nallas are existing within the project site.
1.23	Abstraction or transfers of water from ground or surface waters?	No	Nil
1.24	Changes in water bodies or the land surface affecting drainage or run- off?	Yes	Suitable drainage facility for the power plant area, merging with the natural drains in the area, will be provided.
1.25	Transport of personnel or materials for construction, operation or decommissioning?	Yes	Transport of personnel and material is required during construction and operation.
1.26	Long-term dismantling or	No	No dismantling/

	decommissioning or restoration works?		decommissioning of existing structure.
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	No	Not applicable.
1.28	Influx of people to an area in either temporarily or permanently?	Yes	During Construction nearly 2000 people and During Operation nearly 125 people directly and 400 people indirectly will get employment opportunity . Additional employment due to support services like security, horticulture development, and township will be in the range of 50 people.
1.29	Introduction of alien species?	No	Not applicable
	Loss of native species or genetic diversity?	No	No loss of genetic species. Existing genetic diversity will not be disturbed.
1.31	Any other actions?	Yes	Green Belt will be developed with in and around the periphery of the plant.

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

S.No.	Information/checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)	Yes	750 Acres will be used for establishing power plant and related facilities.
2.2	Water (expected source & competing users) unit: KLD	Yes	About 260 m ³ /hr desalinated water supplied from South Ganga Water Technologies Private Limited will be used.
2.3	Minerals (MT)	No	Not applicable
2.4	Construction material – stone, aggregates, sand / soil (expected source – MT)	Yes	No major cut and fill are involved About 4.4 Lakh m ³ of RCC

			is estimated to be consumed. The proportionate construction material will be procured from 100-km radial area.
2.5	Forests and timber (source – MT)	No	Not applicable
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	Yes	Power required for the project during construction stage will be taken from state Electricity board. Coal required during operational phase will be imported/indigenous
2.7	Any other natural resources (use appropriate standard units)	Yes	6.05 MTPA of blend coal (domestic : imported 70:30) /4.62 Million Tons Imported Coal from Indonesia will be consumed per annum.

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	Nil	No hazardous material will be used.
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	No	No change is anticipated.
3.3	Affect the welfare of people e.g. by changing living conditions?	Yes	Creating employment opportunities and improving the living standards of local population
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	Nil	No vulnerable group of people will be affected. Pollution control measures will be undertaken as per the norms.
3.5	Any other causes	Nil	Nil

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities / rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	No	Not applicable.
4.2	Municipal waste (domestic and or commercial wastes)	Yes	About 13.4 m ³ /hr of sewage from the Plant areas is estimated to be generated which will be sent to and treated in the Sewage treatment plant located at the colony. The treated waste water will be used for green belt development.
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	Yes	Waste lubricating oils to be disposed of as per pollution control board guidelines to licensed reclaiming units
4.4	Other industrial process wastes	No	Nil
4.5	Surplus product	No	Nil
4.6	Sewage sludge or other sludge from effluent treatment	Yes	Sludge from clarifier to be utilized for green belt and for filling up low lying areas
4.7	Construction or demolition wastes	Yes	Construction wastes/ debris will be disposed in a suitable manner.
4.8	Redundant machinery or equipment	No	Nil
4.9	Contaminated soils or other materials	No	Nil
4.10	Agricultural wastes	No	Nil
4.11	Other solid wastes	Yes	The peak generation of ash due to use of coal in the proposed 1320 MW power plant is estimated to be about 1.876 MTPA (at 85 % PLF).

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
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5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	Yes	Steps will be taken at the design stage itself to limit PM, NO _x and SO _x emissions from the chimney as per CPCB and MoEF standards, by providing suitable control equipment
5.2	Emissions from production processes	No	Not applicable.
5.3	Emissions from materials handling including storage or transport	No	As the coal will be transported through closed conveyor, negligible coal dust is envisaged.
5.4	Emissions from construction activities including plant and equipment	Yes	Exhaust gases from diesel generator sets used during construction - negligible
5.5	Dust or odours from handling of materials including construction materials, sewage and waste	Yes	Negligible
5.6	Emissions from incineration of waste	No	Negligible
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	Nil
5.8	Emissions from any other sources	No	Not envisaged.

6. Generation of Noise and Vibration, and Emissions of Light and Heat:			
S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	Yes	Noise levels of operating machinery limited as per CPCB/ MoEF stipulations. Operating personnel provided with safety appliances like ear muffs, masks, etc.
6.2	From industrial or similar processes	No	Not envisaged.
6.3	From construction or demolition	Yes	Noise levels will be limited as per CPCB/MoEF stipulations. Personnel will be provided with safety appliances like ear muffs, masks, etc.
6.4	From blasting or piling	No	Noise during piling is envisaged but Negligible

6.5	From construction or operational traffic	Yes	Noise levels limited as per CPCB/MoEF stipulations
6.6	From lighting or cooling systems	No	Not envisaged.
6.7	From any other sources	No	Not envisaged.

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	No	Not envisaged
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	No	The plant will be operated on zero discharge concept hence no discharge.
7.3	By deposition of pollutants emitted to air into the land or into water	No	Not envisaged as coal will be transported in closed conveyor within plant site and dust suppression system is proposed for unloading and loading areas.
7.4	From any other sources	No	Not envisaged.
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	No	Not expected as suitable environmental control measures will be undertaken.

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/ rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	No	Not envisaged as suitable control measures will be undertaken.
8.2	From any other causes	No	Not envisaged.
8.3	Could the project be affected by natural disasters causing	Yes	Designs take into account the seismic factors as per BIS

	environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?		requirements, and measures / steps to cope with such events will be adopted by the construction and operating staff. Adequate training will be imparted to the personnel.
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9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality			
S. No	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
9.1	<p>Lead to development of supporting facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.:</p> <ul style="list-style-type: none"> • Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) • housing development • extractive industries • supply industries • other 	<p>Yes</p> <p>Yes</p>	<p>The Company has budgeted an amount of Rs 20.25 crores for implementation of the CSR activities. Recurring budget of Rs 1.5 crore/year is earmarked to sustain the CSR activities post commissioning of the plant. (Enclosed as Exhibit-3)</p>
9.2	Lead to after-use of the site, which could have an impact on the environment	No	No such impact envisaged.
9.3	Set a precedent for later developments	No	Not anticipated.
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	Yes	Given in EIA Report

(II) ENVIRONMENTAL SENSITIVITY			
S.No	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
1	Areas protected under international conventions, national or local legislation for their ecological,	Nil	None within 15 km

	landscape, cultural or other related value		
2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests.	Malattar river Kallar river Korampallam river Bay of Bengal	12.3 km- NNE 13.2 km- ENE 14.0 km- SSE 11.0 km - E
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	Chalikulam RF Islands of Gulf of Mannar	5.5 km - WNW ➤ Kosavari Tivu - 15.0 km - ESE ➤ Van Tivu (Church Island) - 14.3 km - ESE
4	Inland, coastal, marine or underground waters	Bay of Bengal	11.0 km - E
5	State, National boundaries	State boundary	Tamil Nadu - Kerala - 90.0 km - W
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	National Highway (NH-45B) connecting Madurai - Thoothukudi	3.1 km in Eastern direction.
7	Defense installations	Nil	No Defence installations.
8	Densely populated or built-up area	Thoothukudi	10.2 km
9	Areas occupied by sensitive man-made land uses. (<i>hospitals, schools, places of worship, community facilities</i>)	Thoothukudi	10.2 km
10	Areas containing important, high quality or scarce resources (<i>ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals</i>)	Malattar river Kallar river Korampallam river	12.3 km- NNE 13.2 km- ENE 14.0 km- SSE
11	Areas already subjected to pollution or environmental damage. (<i>those where existing legal environmental standards are exceeded</i>)	No	Nil
12	Areas susceptible to natural hazard which could cause	No	Nil

	the project to present environmental problems (<i>earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions</i>)		
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"I hereby give under taking that the data and information given in the application and enclosures are true to the best of my knowledge and belief and I am aware that if any part of the data and information submitted is found to be false or misleading at any stage, the project will be rejected and clearance give, if any to the project will be revoked at our risk and cost.

Date: 05-10-2015

Place: Hyderabad


Signature of the Applicant (Project proponent/ Authorized signatory)	
Name	Mr. Ch.Ramakrishna
Designation	Vice President - Project Development
Address	KU THERMAL POWER PRIVATE LTD Block C, Ground floor, Stemwood Apts NO.14 Factory Road, Adj to Safdarjung Hospital New Delhi

EXHIBIT - 1**SURVET NUMBERS**

S.NO	SILLANANTHAM		EXTENT IN HECT	EXTENT IN ACRE
	SURVEY NO	SUB DIV		
1	1	1	0.80.0	1.97
	1	3	0.04.5	0.11
	1	5	4.29.0	10.6
2	2	1	6.88.0	16.99
3	3	7	0.18.5	0.46
4	4	4A	0.86.0	2.12
	4	4B	2.13.0	5.26
5	5	2A	0.58.0	1.43
	5	2B	0.65.0	1.61
	5	2C	1.24.0	3.06
6	7	2	0.34.0	0.84
7	8	1	1.94.5	4.8
	8	3	0.31.5	0.78
	8	4	0.66.5	1.63
	8	5	0.50.5	1.25
8	10	1A	0.64.5	1.59
	10	2	0.19.0	0.47
	10	3	0.01.5	0.04
	10	5	0.06.0	0.15
	10	6	0.25.0	0.62
	10	7	0.35.0	0.86
9	11	1	0.37.0	0.91
	11	2	0.67.0	1.66
	11	3	0.57.5	1.42
	11	4A	0.63.0	1.56
	11	4B	1.22.0	3.01
	11	6	0.60.5	1.49
10	12	1	0.37.0	0.91
	12	2	3.44.5	8.51
	12	4	0.66.0	1.63
	12	5	0.01.0	0.02
11	13	1	0.58.5	1.44
	13	2	0.98.0	2.42
12	15	1	0.57.0	1.41
	15	2A	0.25.0	0.62
	15	2B	0.25.0	0.62
	15	3A	0.80.8	2
	15	3B	0.72.5	1.79

	15	5	0.52.5	1.3
	15	6	0.15.0	0.37
	15	8	0.30.0	0.74
13	36	1	0.33.0	0.82
	36	2	0.54.5	1.35
	36	4B	0.24.0	0.59
	36	5	0.41.5	1.03
	36	6	0.50.0	1.23
	36	7	0.68.5	1.69
14	37	1	1.30.5	3.22
	37	2	0.33.0	0.82
	37	6	0.52.5	1.3
	37	7A	1.06.0	2.62
	37	7B	0.60.0	1.48
15	39	1A	0.42.0	1.04
	39	1B	0.42.0	1.04
	39	2	0.94.0	2.32
	39	3	0.39.5	0.98
	39	4	0.41.5	1.03
	39	5	0.80.5	1.99
16	40	1	0.69.5	1.72
	40	2	0.67.0	1.65
	40	5	0.71.5	1.77
17	41	1A	0.45.5	1.12
	41	1B1	0.40.5	1
	41	1B2	0.42.0	1.04
	41	2	0.70.0	1.72
	41	3	0.60.75	1.5
18	42	1	0.60.0	1.48
	42	2	0.56.68	1.4
19	49	1	0.37.5	0.93
	49	2A	0.39.0	0.96
	49	2B	0.26.0	0.64
	49	4	0.60.0	1.48
	49	5A	0.33.0	0.82
	49	5B	0.33.5	0.83
20	50	1	1.37.5	3.4
	50	2	0.66.5	1.64
	50	3	0.71.0	1.75
				6.79
21	51	1	1.36.0	3.36
	51	2	1.28.5	3.17
22	53	1	1.21.5	3
	53	2	0.54.0	1.33

	53	4A	0.16.5	0.41
	53	6	0.19.0	0.47
	53	7	0.19.5	0.48
23	55	1	0.30.5	0.75
	55	2A	0.13.0	0.32
	55	2B	0.14.5	0.36
	55	3A	0.26.0	0.64
	55	3B	0.39.0	0.96
	55	5	0.19.7	0.49
	SAMINANTHAM			
1	198	1	0.36.5	0.9
		2	1.91.0	2.94
2	199	3	0.60.0	1.48
	OTTAPIDARAM			
	150	1B1	0.41.0	1.01
	150	5B	1.33.0	3.29
26	151	2	0.88.5	2.19
	151	3	0.56.5	1.4
	151	5	0.54.5	1.35
	151	6	0.32.5	0.8
	151	8	0.38.0	0.94
	151	9	0.83.5	2.06
	151	10	0.84.5	2.09
	151	13	0.67.0	1.65
	151	14	0.84.5	2.09
27	152	3A2	0.17.5	0.43
	152	4A	0.58.5	1.44
	152	4B	0.61.0	1.51
	152	4C	0.58.0	1.43
	152	5A	0.03.0	0.07
	152	5B	0.86.5	2.14
	152	5C	0.90.0	2.22
	152	6A	0.50.0	1.23
	152	7	1.73.0	4.27
	152	9	0.10.0	0.25
	152	152/10	0.01.0	0.02
28	153	1C	0.73.0	1.8
	153	1D	0.10.5	0.26
	153	1E	0.88.0	2.17
	153	3A	0.66.5	1.64
	153	3B	1.05.0	2.59
	153	3C	0.01.0	0.02
29	154	1A	0.40.0	0.98
	154	1B	0.39.0	0.96

	154	3	1.41.5	3.48
	154	4B	0.46.0	1.14
	154	4C	0.47.0	1.16
	154	5A	0.94.0	2.32
	154	5B	0.41.0	1.01
	154	5C	0.44.0	1.09
	154	6	0.03.0	0.07
30	156	6A	0.01.0	0.02
	156	6B	0.02.0	0.05
	156	6C	0.01.0	0.02
	157	3A	1.13.00	2.79
31	158	1	2.76.5	6.83
	158	2	3.39.0	8.37
	158	3B	1.71.0	4.22
32	159	1A	0.74.5	1.84
	159	1B	1.55.5	3.84
	159	2	1.06.0	2.62
	159	3A	0.52.0	1.28
	159	3B	0.52.0	1.28
	159	4A	0.79.5	1.96
	159	4B	0.79.5	1.96
	159	5	1.05.0	2.59
33	160	1A	0.38.0	0.94
	160	1B1	0.20.5	0.51
	160	1B2	0.36.0	0.89
	160	2A	0.41.0	1.01
	160	2B	0.42.0	1.04
	160	2C	0.77.0	1.9
	160	2D	0.69.5	1.72
	160	2E	0.69.0	1.7
34	161	1	0.62.5	1.54
	161	2	0.63.0	1.56
	161	3	2.33.5	5.77
	161	4	1.41.0	3.48
	161	5	0.48.0	1.19
	161	6A	0.90.0	2.22
	161	6B	0.81.0	2
	161	7	0.48.5	1.2
	161	8	0.48.5	1.12
	161	9	1.59.0	3.93
	161	10A	0.39.5	0.98
	161	10B	0.25.0	0.62
	161	10C	0.22.0	0.54
	161	10D	0.22.0	0.54

	161	10E	0.22.0	0.54
	161	10F	0.22.0	0.54
	161	12	0.03.5	0.09
	161	13A	0.10.0	0.24
	161	13B	0.72.0	1.78
35	163	2A	0.47.0	1.16
	163	2B	0.45.0	1.11
	163	3A	0.37.5	0.93
	163	3B	1.29.5	3.2
	163	6	0.30.5	0.75
	163	7	0.04.0	0.1
	163	8A	1.25.0	3.09
	163	8B	0.64.5	1.59
	163	8C	0.63.5	1.57
	163	9	0.99.5	2.46
	163	10	0.73.5	1.82
	163	11	0.29.5	0.73
36	164	1B1A	1.77.0	4.37
	164	1B1B	1.89.0	4.67
	164	1B2A	0.21.5	0.53
	164	1B2B	1.68.0	4.15
37	165	1B1	0.08.0	0.2
	165	1B2	0.26.0	0.64
	165	1C	0.20.0	0.49
	165	1D	0.07.5	0.19
	165	3B	0.28.0	0.69
	165	3C	0.47.0	1.16
	165	3D	0.58.0	1.43
	165	3E	2.38.0	5.88
38	166	5	0.20.0	0.49
	166	6A	0.29.0	0.72
	166	6B	1.40.5	3.47
	166	7	0.93.0	2.3
39	167	1	0.61.0	1.51
	167	3	1.20.0	2.96
	167	4	2.55.0	6.3
	167	5B	0.04.5	0.11
	167	5C	0.02.5	0.06
40	168	1B	1.69.5	4.19
	168	1C	0.80.5	1.99
	168	1D	0.77.5	1.91
	168	2B	1.37.5	3.4
	168	2C	1.21.0	2.99
	168	2D	1.34.0	3.31

41	169	3A	0.50.0	1.23
	169	3B	0.09.0	0.22
	169	4A	0.59.0	1.46
	169	5A	0.62.5	1.54
	169	5B	0.73.0	1.8
	169	5C	1.12.0	2.77
	169	6A	1.19.5	2.95
	169	6B	0.70.0	1.72
	169	6C	0.36.5	0.9
	169	6D	0.93.5	2.31
	169	8	0.03.0	0.07
	169	9	0.22.5	0.56
	169	10	0.48.0	1.19
42	170	1	0.92.5	2.28
	170	3	0.43.5	1.07
	170	4	0.50.0	1.23
	170	6	0.11.0	0.27
	170	7A	0.23.5	0.58
	170	7B	0.29.5	0.72
	170	7C	0.28.0	0.69
	170	8A	0.55.5	1.37
	170	8B	0.60.0	1.48
	170	11A	0.18.0	0.44
43	171	1A	1.68.0	4.15
	171	1C	0.30.5	0.75
	171	1D	0.77.5	1.91
44	172	1A	1.58.0	3.9
	172	1B	1.72.5	4.26
	172	1C	3.11.0	7.68
	172	2B	0.02.0	0.05
	172	2C	0.04.0	0.1
	172	2D	0.02.5	0.06
45	179	1	1.81.5	4.48
46	180	1A	0.51.0	1.26
	180	1B	0.52.5	1.3
	180	1C	1.05.5	2.61
	180	1D	1.00.5	2.48
	180	1E	0.92.0	2.27
	180	2A	1.02.0	2.52
	180	2B	1.03.0	2.54
	180	2C	1.23.0	3.04
47	181	1	1.02.0	2.52
	181	3	0.07.5	0.19

		4	0.56.5	1.4
	181	5A	0.95.5	2.36
	181	5B	1.87.5	4.63
		6	1.90.0	4.69
	181	7	0.03.5	0.09
	181	8	0.07.5	0.19
		9	0.01.0	0.02
48	182	2	0.31.0	0.77
	182	3B	0.02.5	0.06
	182	3C	0.29.0	0.72
	182	3D	0.53.5	1.32
	182	4A	0.50.0	1.23
	182	4B	0.32.0	0.79
	182	4C	0.22.5	0.56
	182	4D	0.22.5	0.56
	182	4E	0.31.5	0.78
	182	5A	0.05.5	0.14
	182	5B	1.56.0	3.85
	182	6	0.41.5	1.03
49	183	1	0.49.5	1.22
	183	2	0.33.0	0.82
	183	3A	0.01.0	0.02
	183	3B	0.84.0	2.07
	183	5	0.86.0	2.12
	183	6	0.39.5	0.98
	183	7	0.20.0	0.49
	183	8	0.03.0	0.07
	183	9	1.03.0	2.54
	183	10A	0.06.0	0.15
	183	10B	0.22.0	0.54
	183	10C	0.22.5	0.56
	183	10D	0.22.5	0.56
	183	10E	0.23.0	0.57
	183	10F	0.23.5	0.58
	183	11	0.13.0	0.32
	183	12	0.75.5	1.86
	183	13	0.58.5	1.44
	183	14	0.29.0	0.72
50	184	1A	0.72.5	1.79
	184	1B	0.75.5	1.79
	184	1C	0.10.5	0.26
	184	2	0.06.0	0.15
	184	4	0.13.5	0.33
	184	5A1	0.91.5	2.26

	184	5A2	1.30.0	3.21
	184	5A3	0.24.5	0.61
	184	5A4	1.71.5	4.22
	184	5B	0.62.0	1.53
	184	7A	0.25.0	0.62
	184	7B	0.03.0	0.07
				17.15
51	185	1	0.43.5	1.07
	185	2	0.60.0	1.48
	185	3	0.96.5	2.38
	185	4	1.07.0	2.64
	185	6	0.03.0	0.07
	185	7	0.96.5	2.38
	185	8A	0.06.0	0.15
	185	8B	0.01.0	0.02
	185	9	0.31.0	0.77
	185	10	0.29.0	0.72
	185	11	0.35.5	0.88
	185	12	0.61.5	1.52
	185	13	0.47.0	1.16
	185	14	0.20.0	0.49
	185	15	0.05.5	0.12
	185	16	0.41.0	1.01
52	186	1	0.79.5	1.96
	186	2	0.93.0	2.3
	186	3	0.88.0	2.17
	186	4	0.92.5	2.28
	186	5	0.76.5	1.89
	186	6	1.40.0	3.45
	186	8	0.26.5	0.65
53	187	1	1.16.5	2.88
	187	2A	1.13.5	2.8
	187	2B	1.90.5	4.71
	187	4	0.06.5	0.16
	187	5	0.33.0	0.82
	187	6A	0.83.0	2.05
	187	6B	0.56.5	1.4
	187	7	0.17.0	0.42
54	188	1A	1.02.5	2.53
	188	1B	0.78.0	1.93
	188	3	0.13.0	0.32
	188	4	0.69.5	1.72
	188	5	0.73.5	1.82
	188	6A	0.54.5	1.35

	188	6B	0.59.5	1.47
	188	6C	0.55.5	1.37
	188	6D	0.62.0	1.53
	188	6E	0.61.5	1.52
	188	6F	0.52.0	1.28
	188	7A	0.13.5	0.33
	188	7B	0.01.0	0.02
55	189	1A	1.65.0	4.08
	189	1B	1.60.0	2.47
	189	2	1.01.5	2.49
	189	3	0.09.5	0.23
	189	4	0.04.0	0.1
56	190	2	1.07.0	2.64
	190	4	0.06.5	0.16
	190	5A	1.03.5	2.56
	190	5B	0.52.0	1.28
	190	5C	0.60.0	1.48
	190	5D	3.57.0	8.82
	190	6B	0.29.5	0.73
	190	7A	0.37.5	0.93
	190	7B	0.08.0	0.2
57	191	1	2.10.5	5.19
	191	2	1.00.5	2.48
	191	3	0.08.5	0.21
58	192	1A	1.37.0	3.38
	192	1B	1.35.0	3.33
	192	1C	0.58.5	1.44
	192	1D	0.57.5	1.42
	192	1E	0.55.0	1.36
	192	1F	1.48.5	3.67
	192	1G	0.12.5	0.31
	192	2A	0.15.5	0.38
	192	2B	0.73.5	1.82
59	193	1	1.11.0	2.74
	193	2	1.16.5	2.88
60	194	1A	1.22.5	3.03
	194	4	1.39.0	3.43
	194	5	3.65.5	9.03
61	198	1	0.36.5	0.9
	198	2	1.91.0	4.72
62	199	1A	1.47.5	3.64
	199	6	0.02.0	0.05
63	200	1	0.97.0	2.4
	200	2	1.01.0	2.49

	200	3A1	0.17.0	0.42
	200	3A2	0.21.50	0.53
	200	3A3	0.20.0	0.49
	200	3B	0.20.5	0.51
	200	4	0.79.5	1.96
	200	5	3.19.0	7.88
64	201	1	0.26.5	0.65
	201	2	0.27.0	0.67
	201	3	0.49.5	1.22
	201	4	0.31.0	0.77
	201	5	0.90.0	2.22
	201	6A	0.22.5	0.56
	201	6B	0.20.0	0.49
	201	6D	0.19.5	0.48
	201	6E	0.21.5	0.53
	201	6F	0.19.0	0.47
	201	7	0.73.5	1.82
	201	8A	0.17.5	0.43
	201	8B	0.21.0	0.52
	201	8C	0.34.0	0.84
	201	9	1.50.5	3.72
	201	10	0.94.0	2.32
	201	11A	0.84.0	2.07
	201	11C	0.46.5	1.15
65	202	1	0.86.0	2.12
	202	2	0.41.0	1.01
	202	3	0.14.0	0.35
	202	4	1.79.5	4.43
	202	5	1.12.0	2.77
	202	6	1.27.5	3.15
	202	7	1.15.5	2.85
	202	8	1.26.0	3.11
	202	9	1.24.0	3.06
66	203	6	0.92.5	2.28
67	209	5	1.08.0	2.67
68	214	3B	0.43.0	1.06
	214	4	1.13.5	2.8
69	215	2	1.71.0	4.22
	215	3A	0.68.0	1.68
	215	4A	0.50.0	1.23
	215	4B	0.60.5	1.49
	215	5	0.55.0	1.36
70	216	1A	0.37.0	0.91
	216	1B	1.19.5	2.95

	216	2	0.60.5	1.49
	216	3	1.05.0	2.59
	216	4B	0.67.5	1.67
	216	5A	0.82.5	2.04
	216	5B	0.74.0	1.83
	216	6A	0.71.0	1.75
	216	6B	0.58.5	1.44
	TOTAL REGISTRATION - 737.16			
	CANCILATION - 21.16			
	TOTAL		716	

EXHIBIT - 2**DETAILS OF ALTERNATE SITE EVALUATED**

Three (3) probable locations were assessed for site selection:

Site-1: Veppalodai site, near veppalodai Village, Tuticorin district, Tamilnadu

Site-2: Kayalpattinam site, near Kayalpattinam village, Tuticorin District, TN

Site-3: Ottapidaram & Sillanattam village, Ottapidaram taluk, Tuticorin District, Tamilnadu

SITE SELECTION CRITERIA

S.NO	CRITERIA	SITE-1 (Veppalodai)	SITE-2 (Kayalpattinam)	SITE-3 (Ottapidaram & Sillanattam)
1	Nearest Town	Thoothukudi (19.0 km, S)	Thoothukudi (25 km, N)	Thoothukudi (10 km, SE)
2	Road Connectivity	SH-75 (2.3 KM, NW)	SH-17 (6.2 km, E)	NH-45B (3.0 km, E) SH-75 (2.8 km, N)
3	Rail Connectivity	Thoothukudi (19.1 km, S)	Kayalpattinam (2.0 km, S)	Tattaparai (6.7 km, SE)
4	Port	Thoothukudi (24.0 km, S)	Thoothukudi (25.0 km, N)	Thoothukudi (18.5 km, E)
5	Water Source	South Ganga Waters Technologies Private Ltd at Vellapatti (14.1 km, S)	South Ganga Waters Technologies Private Ltd at Vellapatti (31.0 km, N)	South Ganga Waters Technologies Private Ltd at Vellapatti (10.7 km, SE)
6	Coal Source (Domestic & Imported)	Indigenous coal fields and Imported coal from Indonesia	Indigenous coal fields and Imported coal from Indonesia	Indigenous coal fields and Imported coal from Indonesia
7	Protected areas as per Wildlife Protection Act, 1972 (National Parks, Wildlife Sanctuaries and Reserves)	Nil in 10 km radius	Nil in 10 km radius	Nil in 10 km radius
8	Reserved / Protected Forests (in 15 Km radius)	Nil	Nil	Nil
9	Religious, Archeological Monuments	Nil	Nearer to Srichendur	Nil
10	Defence Installations	Nil in 10 km	Nil in 10 km	Nil in 10 km

11	Land Profile	Barren land	Barren land	100% uncultivable waste land
12	Social Issues	Nil	Nil	Nil
13	Homestead oustees	Nil	Nil	Nil
14	Forest land	Nil	Nil	Nil

Source; Final EIA report of M/s Vimta Labs Ltd

SELECTION OF THE SITE

After evaluation of the above 3 sites, the site near Ottapidarm & Sillanattam villages in Ottapidaram taluk, Thoothukudi district has been identified for the development of the project due to the following advantages

- Site is a dry land with no irrigation facilities as per revenue records.
- Availability of required plain land
- Proximate to Thoothukudi Port
- Nearest national high way (NH-45B) is at about 3.0 km from the selected site
- Nearest railway Station (Tattaparai) is at about 6.7 km
- Desalinated water availability from South Ganga Waters Technology Private Ltd located at 10.7 km from the site
- No National Parks, Wildlife Sanctuaries in 10 km radius
- No human settlements, habitations or forests in the Project area
- Suitability for laying railway siding for transportation of coal from Thoothukudi port
- Power evacuation to nearby PGCIL substation

	self employment skills						
	7. Farmers Development Fund	15.00	15.00	15.00	15.00	15.00	75.00
	8. Setting up a model agricultural farm and providing seeds to the farmers	15.00	15.00	15.00	15.00	15.00	75.00
	9. Support/Aid for setting up of Household fruit processing small unit	8.00	8.00	8.00	8.00	8.00	40.00
	10. Fishermen Development Fund	25.00	25.00	25.00	25.00	25.00	125.00
	11. Financial help to the existing Self Help groups in all the villages	10.00	10.00	10.00	10.00	10.00	50.00
III	HEALTH						
	1. Conducting of medical camps	15.00	15.00	15.00	15.00	15.00	75.00
	2. Providing Ambulance with paramedical staff	15.00	15.00	5.00	5.00	5.00	45.00
	3. Financial aid for operation at Hospitals	25.00	25.00	25.00	25.00	25.00	125.00
	4. Providing medical care to T.B. Patients for the affected villages	10.00	10.00	10.00	10.00	10.00	50.00
IV	EDUCATION						0.00
	1. Provision of scholarships for class toppers	5.00	5.00	5.00	5.00	4.00	24.00
	2. Distribution of Books and Stationery	8.00	8.00	8.00	8.00	8.00	40.00
	3. Distribution of School Uniforms	5.00	5.00	5.00	5.00	5.00	25.00
	4. Cultural Activities	5.00	5.00	5.00	5.00	5.00	25.00
	5. Celebrations at Schools	5.00	5.00	5.00	5.00	5.00	25.00
	6. Providing Teaching Assistance/External Experts for Schools	5.00	5.00	5.00	5.00	5.00	25.00
V	SPORTS						
	1. Training and Encouraging Sports activities	4.00	4.00	4.00	4.00	4.00	20.00
	2. Sponsorship for best Sportsmen for further training	4.00	4.00	4.00	4.00	4.00	20.00
	Total	360.00	385.00	430.00	438.00	412.00	2025.00

Additionally an amount of Rs. 1.5 crores per year will be earmarked towards the recurring expenditure during the operation phase of the power plant in the area.

Due to file size limitation, for uploading on MoEF website, we are herewith uploading Revised Final EIA Report without Annexures

We will be submitting the hard copy to MoEF enclosing Annexures along with Acknowledgement

**REVISED FINAL
ENVIRONMENTAL IMPACT ASSESSMENT REPORT**

**Proposed Supercritical Coal Based Thermal
Power Plant
of
1320 MW (2x660 MW)**

**At
Ottapidaram & Sillanattam Villages
Ottapidaram Taluk, Thoothukudi District
Tamil Nadu**

By



**KU Thermal Power Private Limited
Hyderabad.**

Prepared By



B.S. ENVI-TECH (P) LTD

Secunderabad - 500 017

NABET Accreditation No : NABET/EIA/1316/RA002

September , 2015

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EXECUTIVE SUMMARY



EXECUTIVE SUMMARY

1.0 INTRODUCTION

M/s. KU THERMAL POWER PRIVATE LIMITED (KUTPPL) proposes to setup 2x660 MW (1320 MW) Coal Based Thermal Power Plant at Ottapidaram & Sillanattam villages, Ottapidaram Taluk, Thoothukudi District in Tamil Nadu State. This project is being setup as a part of the power generation augmentation program of Government of Tamil Nadu.

The proposed project of 1320 MW capacity is categorized as Category - A project as per Environmental Impact Assessment (EIA) Notification SO 1533, of 14-09-2006 which necessitates obtaining the Environmental Clearance from Ministry of Environment and Forests & Climate Change (MoEF&CC).

As per the requirement of EIA notification, KUTPPL had submitted the necessary application to MoEF&CC for approval of Terms of Reference (TOR). The Terms of Reference was approved by MoEF&CC for carrying out the EIA study vide letter No. J- 13012/115/2011-IA-II (T) dated 28-12-2011

The Draft EIA report was prepared by M/s. Vimta Labs, based on site specific baseline data collected during the period October to December 2011.

The project has been presented before MoEF&CC for validity extension of TOR for the proposed thermal power plant which was considered by the Expert Appraisal Committee meeting held during 5th – 6th December 2013 and the validity period of Terms of Reference extended for one year i.e. till 27-12 2014.. The TOR extension for the project has been extended for one more year i.e; till 27-12- 2015 vide letter no: J-13012/115/2011- IA.II (T), dated 15-1-2015.

The Public Hearing was conducted on 25 -7-2014 by Tamil Nadu State Pollution Control Board.

Final EIA report incorporating the details of the Public Consultation was prepared and submitted to Ministry in March 2015. The proposal was discussed in the Expert Appraisal Committee meet on 29th April

2015. During the discussions, the committee observed that the baseline data was collected in the period October to December 2011, which is monsoon season in Tamilnadu. The Committee, advised the proponent to collect fresh data in the period May to July 2015 and submit the revised Final EIA report along with few more clarifications. The committee informed the proponent that “All the discrepancies in the EIA/EMP report shall be rectified and the revised EIA/EMP incorporating the above shall be submitted along with the revised Form-1”. The Ministry also advised the proponent to advertise in local newspapers about the fresh baseline data and the Revised EIA report.

Accordingly, B S Envi-Tech (P) Ltd has been engaged by KUTPPL to collect fresh baseline data during May to July 2015 and submit the Revised Final EIA Report in compliance to the clarifications raised by MoEF&CC vide minutes of 34th meeting of the re-constituted Expert Appraisal Committee on Environmental Impact Assessment of Thermal Power & Coal Mining projects held on 29th - 30th April, 2015.

The Revised Final EIA Report incorporates fresh baseline data collected during May - July 2015 and replies to the clarifications raised by MoEF&CC.

As per EAC, MOEF minutes cited above, to make the Public Aware, public notices in the newspapers including local language informing the public about the revised EIA/EMP with revised AAQ data has been published on 19-09-2015. The Revised Final EIA Reports are made available at the following location for comments of the public giving a time period of minimum 15 days after the public notice.

- a. District Collector Office, Thoothukudi
- b. Village Panchyat – Sillanatham and Ottipidaram
- c. District Industries, Thoothukudi
- d. Tamil Nadu Pollution Control Board, Thoothukudi

The Revised EIA/EMP Report was also placed on the website of KUTPPL for public information.

The comments of the Public obtained along with response statement are enclosed as in the Revised EIA Report.

2.0 PLANT CAPACITY, COST AND IMPLEMENTATION SCHEDULE

PROJECT SCHEDULE

S.NO	Unit No.	Unit capacity	Year of commissioning	Project Cost Rs crores
1.	Unit #1	660 MW	Unit #1 :40 months from Notice to proceed (NTP) to Zero date	6600
2.	Unit #2	660 MW	Unit #2 : 44months from Zero date	
Total		1320 MW		

3.0 TECHNOLOGY SELECTION & IMPLEMENTATION

The proposed 1320 MW coal fired power plant will be a base load station comprising two (2) Pulverized Coal Fired Steam generating units operating with supercritical-steam-conditions (supercritical technology) and its Auxiliaries and two (2) Steam Turbine Generators & its Auxiliaries. The proposed units will employ supercritical steam conditions of 259 kg/cm² & 565 °C and will have higher efficiency resulting in reduced emission of green house gases.

4.0 PROJECT SITE AND ITS ENVIRONS

The site is located near Ottapidaram & Sillanattam Villages of Ottapidarm Taluk in Thoothukudi District of Tamilnadu with an average msl of about 31 m.

Study area is 10 km radius around the project boundary and is part of Survey of India Toposheet No. 58/L/1 (Scale: 1:50000).

Nearest railway line connecting Kovilpatti Jn. – Thoothukudi Melur RS of Southern Railway line is at a distance of 6.2 km in project Southern direction.

Thoothukudi is major town at a distance of 10.5 km in SE direction.

The National Highway (NH- 45B) connecting Madurai – Thoothukudi is located at about 3.1 km in Eastern direction, The nearest railway station is Tattaparai located at 6.7 km in SE direction.

Nearest Settlements from the project site are:

- Sillanatham – 0.2 km – SE
- Sivaminattam – 1.4 km - SW
- Lakshmipuram – 1.0 km – NW
- Subrahmanyapuram – 1.3 km – N
- Venkateswarapuram – 2.3 km - E

The Project site consists of two Solar Power Plants of 1 MW each.

The project site is at about 12.3 km, NNE from Malattar river, 13.2 km, ENE from Kallar river and 14.0 km, SSE from Korampallam river

The nearest airport is Thoothukudi at 18.5 km in SSW direction.

The Nearest Reserved / Protected Forest is Chalikulam RF located at a distance of 5.2 km in West North West direction. There are no wild life sanctuaries, national parks, elephant/tiger reserves within 10km radius of the study area.

The nearest Marine Sanctuaries (Islands of Gulf of Mannar) are beyond 10.0 km and they are:

- Kosavari Tivu – 15.0 km – ESE
- Van Tivu (Church Island) - 14.3 km - ESE

There are no ecological sensitive locations, archaeological monuments, places of tourist interests and defence installations within 10 km radius. The industries located within 10 km radius as per the information obtained from TNPCB are:

1. M/s. Sesa Sterlite Ltd, SIPCOT
2. M/s. Ind-Bharath Thermal Power Ltd, Saminathan.
3. M/s. V.V. Titanium Pigments Pvt Ltd, SIPCOT.
4. M/s. Sesa Sterlite Ltd (Power Plant), Meelavittan.
5. M/s. Ind-Bharath Power Gencom Ltd, Keelaarasadi.
6. M/s. Kalpaga Chemicals Ltd, Silanatham.

5.0 SITE SELECTION

KUTPPL has evaluated the following sites from techno-economic feasibility and environmental aspects:

- Site-1: Veppalodai site, near veppalodai Village, Tuticorin district, Tamilnadu
- Site-2: Kayalpattinam site, near Kayalpattinam village, Tuticorin District, TN
- Site-3: Ottapidaram & Sillanattam village, Ottapidaram taluk, Tuticorin District, Tamilnadu

After evaluation of the above 3 sites, the site near Ottapidaram & Sillanattam villages in Ottapidaram taluk, Thoothukudi district has been identified for the development of the due to the following reasons.

The Ottapidaram & Sillanattam has the following advantages:

- Site is a dry land with no irrigation facilities as per revenue records.
- Availability of required plain land
- Proximate to Thoothukudi Port
- Nearest national high way (NH-45B) is at about 3.0 km from the selected site
- Nearest railway Station (Tattapari) is at about 6.7 km
- Desalinated water availability from South Ganga Waters Technology Private Ltd located at 10.7 km from the site
- No National Parks, Wildlife Sanctuaries in 10 km radius
- No human settlements, habitations or forests in the Project area
- Suitability for laying railway siding for transportation of coal from Thoothukudi port
- No R&R issues involved in the project
- Power evacuation to nearby PGCIL substation

PHOTOGRAPHS OF APPROVED SITE



6.0 REQUIREMENT OF THE PROJECT

Water

The project is based on air cooled condensate system, due to which, the water consumption for the plant is very less. After taking other consumptive water needs into account, the total water requirement is estimated to be 260 m³/hr. COC considered for Auxiliary cooling is 5. This requirement will be obtained from Desalination plant of South Ganga Water Technologies Private Limited (SGWTPL).

SGWTPL is operating Desalination plant located at 10.7. The capacity of the plant is about 3MLD (presently). South Ganga obtained CRZ Environmental clearance up to 10MLD capacity. SGWTPL will supply

desalinated water to the proposed KUTPPL. The water requirement per day will be 6.24MLD.

Water supply agreement signed between KUTPPL & SGWTPL Ganga Waters Technologies Private Limited.

Coal

The proposed power plant will be operated as Independent Power Plant (IPP). The project will be implemented with super-critical technology.

The project will be using Imported coal or blended coal having ratio of 70 % Indigenous coal and 30 % Imported coal supported by the secondary fuel oil (LDO) for start-up and Heavy Oil for flame stabilization at low loads. The estimated coal requirement of the plant based on coal quality is given below

ANNUAL COAL REQUIREMENT

Fuel		2x660 MW (1320 MW)
Imported Coal (100%)	TPH	620.43
	TPD	14891
	MTPA	4.62@ 85 % PLF
or		
Blend Coal (70% indigenous coal and 30% imported coal)	TPH	812.51
	TPD	19500
	MTPA	6.05 @ 85 % PLF

MTPA – million tonnes per annum, TPH -Tonnes Per Hour, TPD-Tons per day

Source : KUTPPL

Coal transportation

The coal imported from Indonesia as well as the Indigenous coal will be shipped into Thoothukudi Port. Coal received at Thoothukudi Port will be transported to the project site by rail through proposed railway siding. Incase of any delay in rail siding, the Coal will be transported by road.

Power Evacuation

The power generated will be stepped up to 400kV and will be evacuated to the 400kV line bays to the grid. The nearest pooling

station(400/765kV) is at Ettayapuram which is at a distance of 40Km from site.

Manpower

The total manpower of power plant during operation period is estimated to be 450 persons. Preference will be given to local persons from neighboring villages.

Township

Township will be constructed for the employees of the power plant in 30 acres within the project site. The township will include the residential quarters for all the employees, guest house, recreation and health facilities. About 350 employees will be accommodated in township.

7.0 ENVIRONMENTAL IMPACT ASSESSMENT STUDY

Baseline Status

The baseline environmental quality represents the background scenario of various environmental components in the study area.

The Draft EIA report was prepared based on site specific baseline data collected during the period October to December 2011, by M/s Vimta Labs. During EAC, MoEF appraisal meeting, the committee observed that the baseline data was collected in the period October to December 2011, which is rainy season in Tamilnadu. The Committee, hence advised to collect fresh data during non-monsoon and submit the revised Final EIA report.

Fresh baseline data was collected during the period May to July, 2015 (study period) and presented in this chapter.

Meteorology

Predominant Wind direction during the period was from NE-ENE-E-ESE-SE sector accounting to about 79.02% of the total time. Wind speeds during this period were varying between 1-15 kmph. The winds of less than 1.7 kmph were treated as calm, about 1.63% of the time the winds were under calm condition.

Air Environment

Ambient air quality of the study area has been assessed through a network of 8 ambient air quality locations representing the downwind, cross wind and upwind impact scenario of the project site.

The Ambient Air Quality monitored in the study area was found to be well within the limits of NAAQ standards prescribed for Residential, Rural & Other Areas.

SUMMARY OF AAQ MONITORING ($\mu\text{g}/\text{m}^3$)

Station Code	Locations	98 TH PERCENTILE VALUES				
		PM ₁₀	Pm _{2.5}	SO ₂	NO _x	Ozone
A1	Project site	44.5	27.0	10.4	11.9	29
A2	Sillanattam	39.2	23.5	9.4	10.8	31
A3	Rajavinkovil	40.8	25.0	10.2	11.7	22
A4	Pudiyamputtur	43.0	24.6	9.6	10.5	27
A5	Ottapidaram	44.2	24.9	10.0	11.5	23
A6	Lakshmipuram	42.6	25.5	9.9	10.7	25
A7	Venkateshwarapuram	43.1	24.4	10.3	11.4	28
A8	Mel Arasadi	41.9	25.6	9.8	10.6	32

Note: CO at all locations was found < 1.0 ppm

Noise Environment

Eight monitoring locations were selected to assess the noise levels in the study area. Noise levels recorded in the day and night time were found to be less than 54 dB (A).

Water Environment

Seven water samples were collected within 10 km radius of the project site. The parameters thus analysed were compared with IS -10500. The water quality showed high TDS, Chlorides and hardness due to proximity of sea.

Soil Environment

Eight samples were collected to assess the soil quality in the 10 km study area of plant site which revealed low fertile quality

Biological Environment

From the study it has been observed that there are no endangered, endemic or threatened species.

8.0 PREDICTION OF IMPACTS

The proposed project will be constructed in two phases. The project may influence the environment in two distinct phases:

- a) During construction phase which is temporary and of short term
- b) During operation phase which may have long term effects

Impacts during Construction Phase

The construction of proposed power plant would result in increase of fugitive dust concentrations due to fugitive dust. Frequent water sprinkling in the vicinity of the construction sites would be undertaken to reduce the fugitive dust generation.

Noise levels generated during construction activity will be temporary in nature. Onsite workers working in noise prone areas would be provided with earmuffs and plugs.

During construction, provision for infrastructural services including water supply, sewage, drainage facilities and electrification will be made. KUTPPL will ensure proper sanitation facilities for the labor colony and the temporary staff quarters

The site development activities like site clearing, leveling, earth work excavation and infrastructural development like roads etc will lead to stagnation of water. Adequate arrangements will be made to ensure proper drainage of water.

The impact on soil will be minimum as the construction activity for the main plant and auxiliary units would be confined within the plant boundary.

A senior Environment and Safety Officer will be made in-charge of the Environment and Safety aspects during construction.

Proper Sanitation, dwelling and drinking Water facilities will be provided to the workforce at site.

Air Environment

The proposed operation of the power plant will result in emission of particulate matter, sulphur dioxide and oxides of nitrogen due to burning of coal in the boilers. Ground level concentrations of PM, SO₂ and NO_x were estimated due to emissions from proposed 1320 MW coal based power plant. The following table shows the incremental ground level concentrations :

INCREMENTAL GROUND LEVEL CONCENTRATION, µg/m³

		PM10	SO₂	NO_x
Scenario – A	1320 MW KUTPPL plant with operation on Imported coal	1.22	27.7	18.7
Scenario – B	1320 MW KUTPPL plant with operation on Blend coal	1.32	29.0	20.2

Predicted maximum incremental ground level concentrations are superimposed on the maximum baseline concentrations 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 below :

OVERALL SCENARIO WITHIN STUDY AREA (µg/m³)

	PARTICULATE MATTER (PM10)	SULPHUR DIOXIDE SO₂	OXIDES OF NITROGEN NO_x
Baseline Scenario (max)	44.5	10.4	11.9
Predicted Ground level Concentration (Max) (Worst Case : Scenario – B)	1.32	29.0	20.2
Overall Scenario (worst case)	45.82 (100)	39.4(80)	32.1(80)

Note: Value in parenthesis is NAAQ standard for Industrial, Rural and Residential Areas

ESTIMATION OF CUMULATIVE GROUND LEVEL

Information on operating and proposed industries within 10 km radius of the study area was collected. The industries which are presently operating are

- a) Ind Bharath Thermal Power plant – 2 X 150 MW - 0.1 km – W
- b) Ind Bharath 3x63 MW Power station- 5.3 km – ESE
- c) Sterlite Copper Smelter - Sterlite Industries – 6.0km – SSE
- d) Sterlite Thermal Power Plant – 160 MW power plant
- e) Coastal Energen - Thermal Power Plant - 1 X 600 MW – 7.8 km – ENE

The emissions from the above industries are reflecting in the baseline monitoring studies carried out during the period May-July, 2015

The industries which are proposed/under implementation and yet to be commissioned within 10 km are:

- a) Ind Bharath Thermal Power plant – 1 X 150 MW - 0.1 km – W
- b) Coastal Energen - Thermal Power Plant –1 X 600 MW 7.8 km – ENE
- c) Coastal Energen - Thermal Power Plant –2 X 800 MW 7.8 km – ENE

Ground level concentrations of PM10 SO₂ and NO_x were estimated to project the incremental increase of concentrations above baseline concentrations due to emissions from the power plant. The following table shows the summary of the same

INCREMENTAL GROUND LEVEL CONCENTRATION, µg/m³

	SOURCES CONSIDERED	PM	SO ₂	NO _x
Scenario - C	a. 1320 MW KUTPPL with Imported Coal b. Ind Bharath Thermal Power plant – 1 X 150 MW - 0.1 km - W c. Coastal Energen - Thermal Power Plant –1 X 600 MW 7.8 km – ENE d. Coastal Energen - Thermal Power Plant –2 X 800 MW 7.8 km – ENE	2.01	45.8	28.2
Scenario - D	a. 1320 MW KUTPPL with Blend Coal b. Ind Bharath Thermal Power plant – 1 X 150 MW - 0.1 km - W c. Coastal Energen - Thermal Power Plant –1 X 600 MW 7.8 km – ENE d. Coastal Energen - Thermal Power Plant –2 X 800 MW 7.8 km – ENE	2.12	47.3 6	31.4

Noise Environment

During operation, the major noise generating sources are:

Source	Noise level (dB (A))
Steam turbines	90
Compressors	90
Coal crushers	85
Ash Slurry pumps	90
Boiler feed water pumps	90-102

All high noise making equipment will be provided with acoustic enclosures.

Noise level at the plant boundary, calculated from the above equation, is expected to be less than 55 dB (A) without considering any attenuation factors. The insulated source boundary walls and development of greenbelt along the periphery of the power plant will further reduce the noise levels.

Water Environment

The Air cooled condenser is envisaged for the project to limit water usage. Makeup water requirement for the auxiliaries cooling and other makeup requirements (for auxiliary cooling, makeup water, service water etc) are estimated to be about 260 m³/h(6.24MLD).

Land Environment

The main solid waste generated from the power plant is ash. Maximum ash generation from power plant is from blend coal. Steam generating units are the main sources of the solid waste where coal is burnt. The following table shows the ash generation from the power plant.

ASH GENERATION (MTPA)

	100% Imported coal	Blend coal (70% Indian & 30% imported)
Coal consumption at full load (100%)	620.43 TPH	812.83 TPH
Ash content considered for design	5.52%	31.06%
Ash generated per hour in Tonnes	34.25	252.43
Ash generated per year in Million Tonnes @85%PLF	0.255	1.876
Fly Ash Generation (80% of total ash)	0.204	1.50
Bottom ash (20% of total ash)	0.051	0.376

9.0 ENVIRONMENTAL MANAGEMENT PLAN

AIR POLLUTION CONTROL MANAGEMENT

The power plant is a coal based power plant where imported coal or blended coal would be used as fuel. Particulate Matter, SO₂ and NO_x are the major pollutants emitted due to combustion of coal containing Sulphur content of 0.50 % (max) .

The bottom ash generated in the form of clinker will be collected in the hoppers. The plant will have facility to offer bottom ash to users. Unused bottom ash will be disposed to ash pond.

In order to minimize fly ash emission to atmosphere, high efficiency Electrostatic Precipitators (ESP) (2 nos) will be installed. The Pollution control system will be designed to limit the particulate emission to less than 50 mg/Nm³. Therefore the impact due to particulate emission due to combustion of coal leading to rise of suspended particulate concentration in the ambient air will be minimal. The fly ash collected in the hoppers will be removed through dry collection system.

One bi-flue stack of 275 m height will be provided as per CPCB guidelines.

Dust extraction system of coal crusher and other equipment will be provided with Bag filters to minimise fugitive dust emission from Coal Handling Plant.

Combustion of coal will result in NO_x emission of about 650 mg/Nm³ from the stack of the proposed power plant. This will lead to increase of ambient NO_x level. Predicted NO_x level due to emission from the proposed power plant super imposed on the baseline concentrations showed the ground level concentrations to be well within the limits of NAAQ standards.

Low NO_x burners will be provided for the steam generators to minimize the emission of Nitrogen oxides from boilers.

FUGITIVE DUST CONTROL

For control of fugitive dust, water spray arrangement will be provided to spray water all-round the coal stockpiles to suppress the dust and to wet the coal while compacting to minimize the dust nuisance. A closed conveyor system will be implemented to minimize the dust nuisance. All transfer points will be provided with bag filters.

NOISE CONTROL

All equipment in the power plant would be designed for noise levels not exceeding 90 dB(A). Proper encasement of noise generating sources will be done to control the noise levels. The proposed greenbelt development will further reduce the noise levels.

All operations and maintenance personal working near noise prone areas would be provided with earmuffs & earplugs.

A thick greenbelt in an area of 160 acres will be developed all around the plant with a width of 50 m (min), which acts as noise barrier.

WATER QUALITY MANAGEMENT

The total wastewater generation from the plant is 43.4 m³/hr. Detail of wastewater generation from various areas is given below:

WASTEWATER GENERATION (m³/hr)

		Waste Water
Cooling Water - auxiliary cooling tower blowdown		20
Service / Plant Utilities		10
Domestic	Plant	6.4
	Township	8
Total		43.4

Plant service water (floor wash in oily area) will be treated for oil and grease removal and will be routed along with CT blowdown to Central monitoring Basin (CMB)

All the wastewater water streams except domestic wastewater will be routed to Central Monitoring Basin. Water from this is being fully utilized for greenbelt and horticulture development.

Treated wastewater from the CMB totaling to 28 m³/hr will be recycled back to for use in coal handling plant for dust suppression and for greenbelt development Domestic waste water will be treated in Sewage Treatment plant and it will be used for greenbelt development.

LAND ACQUISITION

Power Plant will be located in an area of about 750 acres Private Land. About 725 acres of private patta land had been procured

ASH MANAGEMENT

The area estimated for ash disposal is about 100 acres, to store ash generated from the 1320 MW power plant. The Fly ash generated would be utilized in dry form. An action plan for utilization of flyash to achieve 100 % utilization within four years will be drawn.

Maximum flyash generation from the plant is 6320 t/day. KUTPPL has tiedup with the following for offtake of flyash generated from the plant for the following quantities.

1. My Home Industries Limited – 0.35 MTPA as on today and 0.7 MTPA by 2018.
2. The Ramco Cements Limited – 0.50 MTPA.

KUTPPL is exploring the possibility of exporting Flyash.

The Fly ash, which cannot be utilised, would be disposed off to the ash dump area in slurry form. Ash pond will be provided with suitable lining to prevent leaching.

10.0 COMMUNITY DEVELOPMENT

An amount of Rs. 20.25 crores will be earmarked for the implementation of the community development plan in the area as part of corporate social responsibility plan by KUTPPL.

Additionally an amount of Rs. 1.5 crores per year will be earmarked towards the recurring expenditure during the operation phase of the power plant and also take up the implementation of the community development plan in the buffer zone of the study area.

11.0 BUDGET FOR IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT PLAN.

A budget of Rs 418 Crores is earmarked for implementing the Environmental Management Plan

Recurring cost for EMP is Rs 20.9 Crores

12.0 POST PROJECT MONITORING PLAN

KUTPPL will establish a full-fledged Laboratory equipped/hire services of recognized laboratory for monitoring all the environmental parameters as per CPCB /MOEF guidelines.

13.0 PUBLIC HEARING

Revised detailed response and Action plan with budgetary provisions for issues raised in PH are enclosed as **Annexure – 7 B**

14.0 CONCLUSION

The project will help meet the growth of demand for electricity in Tamil Nadu state and Southern India. It will strengthen the regional power

supply system and stimulate industrial development, and improve living standards of the people.

The Super Critical Technology adopted and the implementation ensures that the impacts due to the proposed power plant are amenable to technological control and effective environmental management.

The air emissions, noise generated, and wastewater quality will be regulated to meet environmental quality standards prescribed by CPCB for thermal power plants.

The Company will undertake various socio economic development activities in the project and surrounding areas as per the community development plan. The positive economic output will improve the overall quality of life of the people living in the area.

CHAPTER - 1

INTRODUCTION



CHAPTER -1: INTRODUCTION

1.1 PURPOSE OF THE REPORT

M/s. KU THERMAL POWER PRIVATE LIMITED (KUTPPL) proposes to setup 2x660 MW (1320 MW) Coal Based Thermal Power Plant at Ottapidaram & Sillanattam villages, Ottapidaram Taluk, Thoothukudi District in Tamil Nadu State. This project is being setup as a part of the power generation augmentation program of Government of TamilNadu.

The proposed project of 1320 MW capacity is categorized as Category - A project as per Environmental Impact Assessment (EIA) Notification SO 1533, of 14-09-2006 which necessitates obtaining the Environmental Clearance from Ministry of Environment and Forests & Climate Change (MoEF&CC).

As per the requirement of EIA notification, KUTPPL had submitted the necessary application to MoEF&CC for approval of Terms of Reference (TOR). The Terms of Reference was approved by MoEF&CC for carrying out the EIA study vide letter No. J- 13012/115/2011-IA-II (T) dated 28-12-2011 (enclosed as **Annexure – 1 A**).

The Data format for Draft EIA report was prepared by M/s. Vimta Labs, based on site specific baseline data collected during the period October to December 2011.

The project has been presented before MoEF&CC for extension of TOR validity for the proposed thermal power plant which was considered by the Expert Appraisal Committee meeting held during 5th – 6th December 2013 and the validity period of Terms of Reference was extended for one year i.e. till 27-12 2014.. The TOR validity for the project has been extended for one more year i.e; till 27-12- 2015 vide letter no: J- 13012/115/2011- IA.II (T), dated 15-1-2015. The copy of the TOR letter and extension of TOR validity for the proposed project are given in **Annexure-1 (B & C)**.

The Public Hearing was conducted on 25 -7-2014 by Tamil Nadu State Pollution Control Board.



Final EIA report incorporating the details of the Public Consultation was prepared and submitted to Ministry in March 2015. The proposal was discussed in the Expert Appraisal Committee meet on 29th April 2015. During the discussions, the committee observed that the baseline data was collected in the period October to December 2011, which is monsoon season in Tamilnadu. The Committee, advised the proponent to collect fresh data in the period May to July 2015 and submit the revised Final EIA report along with few more clarifications. The committee informed the proponent that “All the discrepancies in the EIA/EMP report shall be rectified and the revised EIA/EMP incorporating the above shall be submitted along with the revised Form-1”. The Ministry also advised the proponent to advertise in English and local newspapers about the fresh baseline data and the Revised EIA report.

Accordingly, B S Envi-Tech (P) Ltd has been engaged by KUTPPL to collect fresh baseline data during May to July 2015 and submit the Revised Final EIA Report in compliance to the clarifications raised by MoEF&CC vide minutes of 34th meeting of the re-constituted Expert Appraisal Committee on Environmental Impact Assessment of Thermal Power & Coal Mining projects held on 29th - 30th April, 2015. Minutes of meeting of MoEF &CC along with replies to the clarifications raised are enclosed as **Annexure-1D & Annexure-1D (contd.)**

The subject report is Revised Final EIA Report incorporating fresh baseline data collected during May - July 2015 and replies to the clarifications raised by MoEF&CC (**Chapter 13**). Compliance of the Terms of Reference is enclosed as **Annexure - 1E**.

As per EAC, MOEF minutes cited above, to make the Public Aware, public notices in the newspapers including local language informing the public about the revised EIA/EMP with revised AAQ data has been published on 19-09-2015. Copy of the Advertisements given in the Newspapers are enclosed as **Annexure -1F**. The Revised Final EIA Reports are made available at the following location for comments of the public giving a time period of minimum 15 days after the public notice.



- a. District Collector Office, Thoothukudi
- b. Village Panchyat – Sillanatham and Ottipidaram
- c. District Industries, Thoothukudi
- d. Tamil Nadu Pollution Control Board, Thoothukudi

The Revised EIA/EMP Report was also placed on the website of KUTPPL for public information.

The comments of the Public obtained along with response statement are enclosed as **Annexure – 1G**.

1.2 KU THERMAL POWER PRIVATE LIMITED (KUTPPL)

KUTPPL ventured into developing the proposed project with 2 X 660 MW units at Ottapidaram & Sillanattam villages, Thoothukudi district in Tamilnadu and the project report has been prepared taking into consideration of requirement of land, water and other basic infrastructure accordingly.

The proposed power plant will be operated as Independent Power Plant (IPP) and will be based on 100 % Imported Coal/Blend Coal (70 % Indigenous Coal and 30 % Imported coal).

1.3 PRESENT PROPOSAL

KUTPPL proposes to implement the 1320 MW power project as given below:

PROJECT SCHEDULE

S.No	Unit No.	Unit Capacity	Tentative time schedule	Project Cost (Rs Crores)
1.	Unit#1	660 MW	Unit#1 :40 months from Notice to proceed (NTP) to Zero date	6600
2.	Unit #2	660 MW	Unit #2 : 44 months from Zero date	

Salient features of the proposed project are given in **Table - 1.1**



TABLE - 1.1
SALIENT FEATURES OF THE PROPOSED PROJECT

			Details
Capacity (MW)			1320(2X660)
Cost of the Project (Rs. in Crores)			6600
Steam Generators Capacity (TPH)			2200(at BMCR) & 2100 (at TMCR)
Steam Turbine Capacity, (MW)			660 (2 nos)
Land (Acres)			750
Fuel			Imported Coal (100%, Indonesia) or Blended coal (Indigenous 70%: Imported 30%)
Fuel Consumption	Imported Coal	t/day	14891
		Million TPA (@85 % PLF)	4.62
	Or		
	Blend Coal (70% indigenous coal and 30% imported coal)	t/day	19500
Million TPA (@85 % PLF)		6.05	
Fuel Supply			Indigenous Imported Coal – Indonesia
Height of Chimney (m)			One bi flue stack of 275-m height
Source of Water			South Ganga Water Technologies Private Limited, Tuticorin
Water Requirement (m ³ /hr)			260 m ³ /hr (Desalinated Water) .
Type of cooling			Air Cooling Condensate System
Ash Pond (acres)			100

1.3.1 PROJECT COST

The Capital cost of the project is about Rs. 6600 crores for 2 X 660 MW, which includes about Rs. 418 crores for Environmental Management Plan. The project completion schedule is tentatively considered as 44 months from Zero Date.

1.4 LOCATION OF THE PROJCT SITE

The site is located near Ottapidaram & Sillanattam Villages of Ottapidarm Taluk in Thoothukudi District of Tamilnadu with an average msl of about 31 m. **Fig - 1.1** shows the location map of the site.

The coordinates of the Project Site are given below:

PROJECT SITE

- A) 8°52'26.04"N, 78° 3'56.55"E
- B) 8°52'40.21"N, 78° 3'55.62"E
- C) 8°52'35.10"N, 78° 3'32.57"E
- D) 8°53'13.79"N, 78° 3'25.19"E
- E) 8°53'25.82"N, 78° 3'52.62"E
- F) 8°53'48.33"N, 78° 3'50.12"E
- G) 8°53'57.91"N, 78° 4'30.88"E
- H) 8°53'27.97"N, 78° 4'24.89"E
- I) 8°52'43.91"N, 78° 4'11.65"E
- J) 8°52'40.91"N, 78° 4'03.86"E
- K) 8°52'25.79"N, 78° 4'05.11"E

Ash pond is proposed within the project site. Coordinates of the ash pond are given below:

ASH POND

- L) 8°53'19.13"N, 78° 4'13.57"E
- M) 8°53'25.94"N, 78° 3'57.03"E
- N) 8°53'41.44"N, 78° 4'6.91"E
- O) 8°53'32.15"N, 78° 4'20.48"E



Map showing coordinates of the project site and ash pond is shown in **Fig - 1.2**.

Study area is 10 km radius around the project boundary and is part of Survey of India Toposheet No. 58/L/1 (Scale: 1:50000).

Nearest railway line connecting Kovilpatti Jn. – Thoothukudi Melur RS of Southern Railway line is at a distance of 6.2 km in Southern direction.

Key Map showing the location of various features around the project site is shown in **Fig - 1.3**. Photographs of the project site are shown in **Fig - 1.4**. Thoothukudi is a major town at a distance of 10.5 km in SE direction.

The National Highway (NH- 45B) connecting Madurai – Thoothukudi is located at about 3.1 km in Eastern direction, The nearest railway station is Tattaparai located at 6.7 km in SE direction.

Nearest Settlements from the project site are:

- Sillanatham – 0.2 km – SE
- Sivaminattam – 1.4 km - SW
- Lakshmipuram – 1.0 km – NW
- Subrahmanyapuram – 1.3 km – N
- Venkateswarapuram – 2.3 km - E

Fig - 1.5 shows the 10 km radius of the project site. The salient features of the project site are given in **Table - 1.2**.

The Project site consists of two Solar Power Plants of 1 MW each.

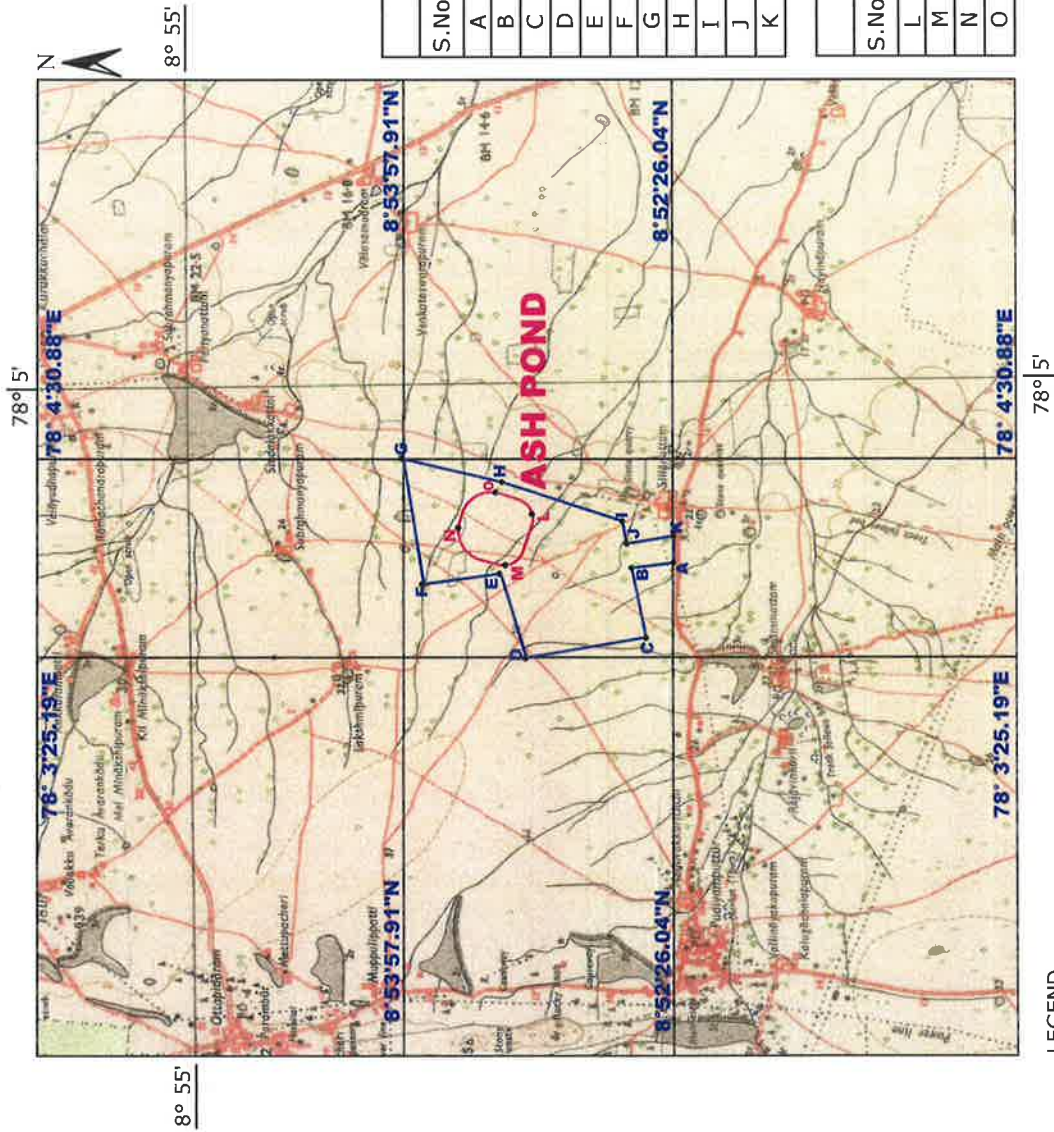
The project site is at about 12.3 km, NNE from Malattar river, 13.2 km, ENE from Kallar river and 14.0 km, SSE from Korampallam river

The nearest airport is Thoothukudi at a distance of 17.5 km in SSE direction.

The Nearest Reserved / Protected Forest are Chalikulam RF located at a distance of 5.2 km in West North West direction. There are no wild life




FIG - 1.2
MAP SHOWING CO-ORDINATES OF THE PROJECT SITE AND ASH POND



PROJECT SITE CO-ORDINATES		
S.No.	LATITUDE "N"	LONGITUDE "E"
A	8°52'26.04"N	78° 3'56.55"E
B	8°52'40.21"N	78° 3'55.62"E
C	8°52'35.10"N	78° 3'32.57"E
D	8°53'13.79"N	78° 3'25.19"E
E	8°53'25.82"N	78° 3'52.62"E
F	8°53'48.33"N	78° 3'50.12"E
G	8°53'57.91"N	78° 4'30.88"E
H	8°53'27.97"N	78° 4'24.89"E
I	8°52'43.91"N	78° 4'11.65"E
J	8°52'40.91"N	78° 4'3.86"E
K	8°52'25.79"N	78° 4'5.11"E

ASH POND CO-ORDINATES		
S.No.	LATITUDE "N"	LONGITUDE "E"
L	8°53'19.13"N	78° 4'13.57"E
M	8°53'25.94"N	78° 3'57.03"E
N	8°53'41.44"N	78° 4'6.91"E
O	8°53'32.15"N	78° 4'20.48"E

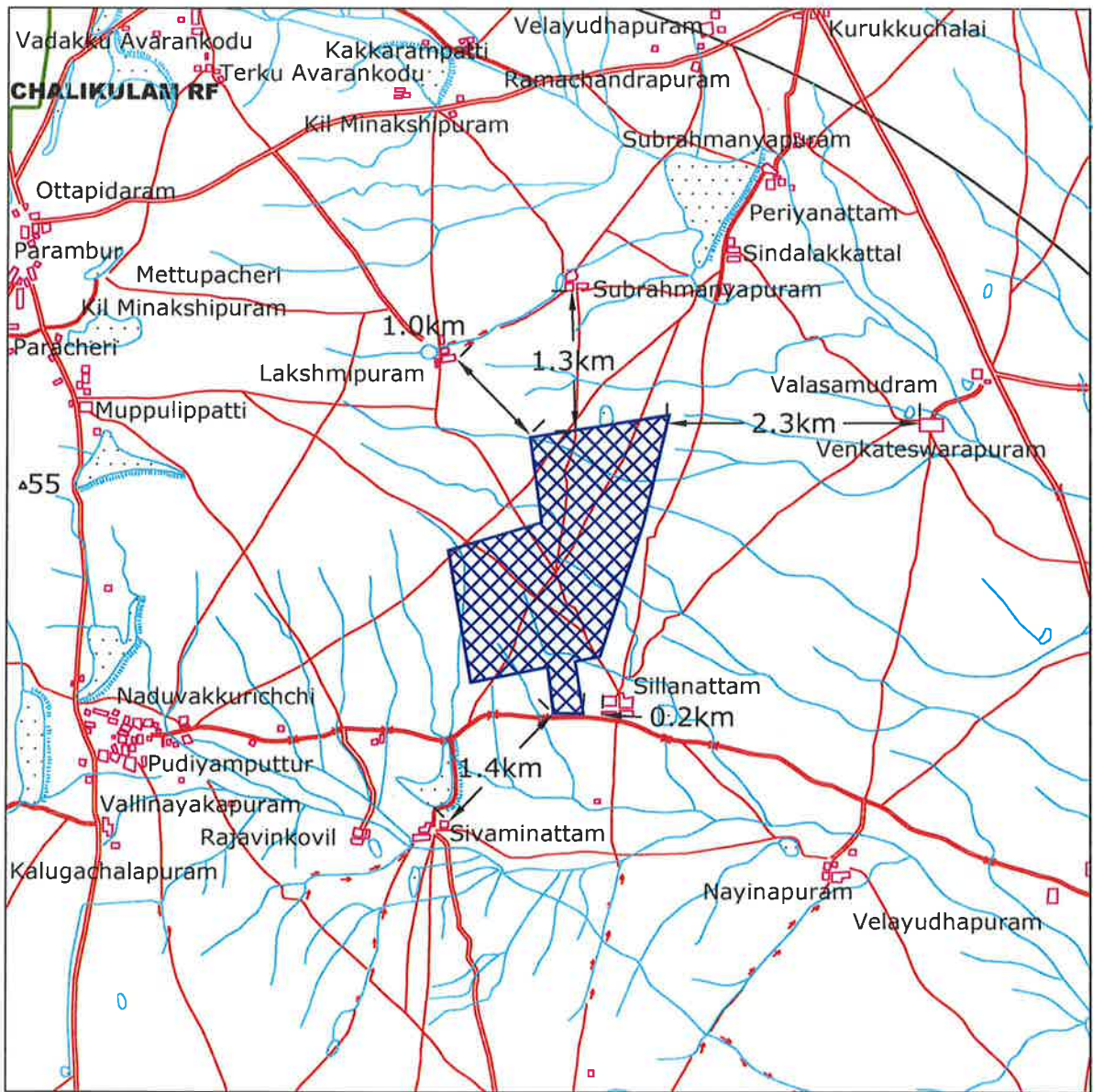
LEGEND

 ASH POND

 PROJECT SITE

SCALE

 0 2km



LEGEND

-  ROADS
-  STREAMS / TANKS
-  SETTLEMENTS
-  FOREST
-  SPOT HEIGHT
-  PROJECT SITE

FIG - 1.3


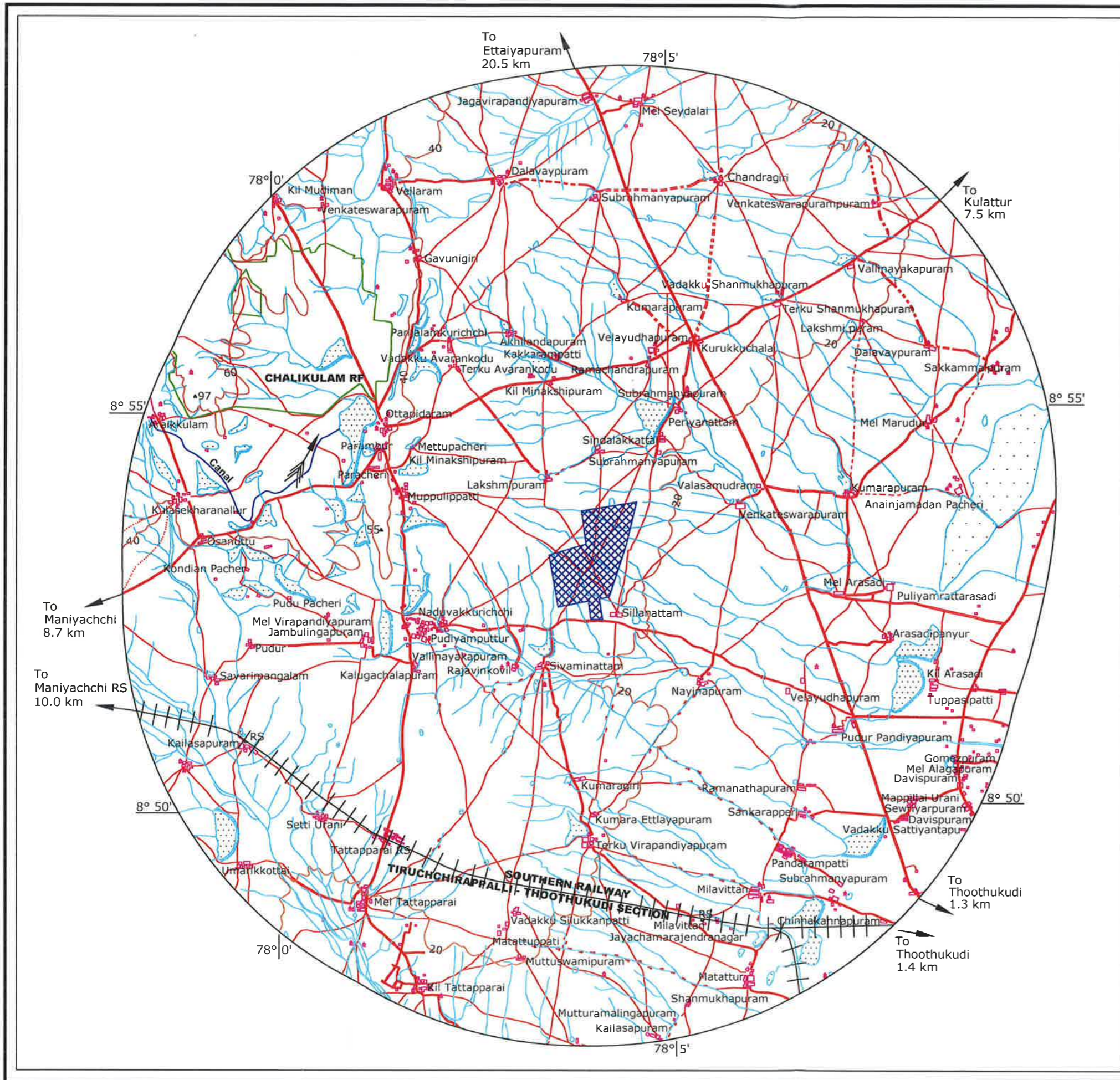
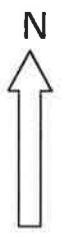
CLIENT :	M/s. KU THERMAL POWER PRIVATE LIMITED
PROJECT :	PROPOSED 1320 MW (2x660 MW) COAL BASED THERMAL POWER PLANT <small>Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.</small>
TITLE :	KEY MAP
PREPARED BY  B.S. ENVI-TECH (P) LTD., SECUNDERABAD	

FIGURE – 1.4





- LEGEND**
- ROADS
 - STREAMS / TANKS
 - CANAL
 - SETTLEMENTS
 - RAILWAY LINE
 - CONTOURS
 - FOREST
 - SPOT HEIGHT
 - PROJECT SITE



REFER TO THIS MAP AS:- 1:50,000
SHEET 58/L1&L5 FIRST EDITION
Published under the direction of
the Surveyor General of India - 1969

**Index to
Survey of India Toposheets**

58 G/16	58 K/4	58 K/8
58 H/13		58 L/5
58 H/14	58 L/2	SEA

SOURCE : FOREST DEPARTMENT

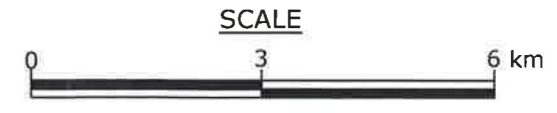


FIG - 1.5

CLIENT : M/s. KU THERMAL POWER PRIVATE LIMITED

PROJECT : PROPOSED 1320 MW (2x660 MW)
COAL BASED THERMAL POWER PLANT
Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.

TITLE : TOPOGRAPHICAL MAP SHOWING
10 km RADIUS AROUND THE PROJECT SITE

PREPARED BY
 B.S. ENVI-TECH (P) LTD.,
SECUNDERABAD

TABLE - 1.2
SALIENT FEATURES OF THE PLANT SITE

Feature	Details
Altitude	31 m above MSL
Latitude	78° 3'25.19"E - 78° 4'30.88"E
Longitude	8°52'26.04"N - 8°53'57.91"N
Village, Tehsil, District, State	Ottapidaram & Sillanattam Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu.
IMD Station	Madurai
Max. Temp., °C	41.4
Min. Temp., °C	14.8
Relative Humidity, %	38-79
Annual rainfall,	837.9 mm
Topography	Plain
Soil Type	Clayey
Nearest Water Bodies	Malattar - 12.3 km- NNE Kallar- 13.2 km- ENE Korampallam - 14.0 km- SSE Bay of Bengal - 11.0 km - E
Nearest Highway	National Highway (NH-45B) connecting Madurai - Thoothukudi is at 3.1 km in Eastern direction.
Nearest Railway station	Tattaparai RS - 6.7 km - SE
Nearest Industries	M/s. Sesa Sterlite Ltd, SIPCOT M/s. Ind-Bharath Thermal Power Ltd, Saminathan. M/s. V.V. Titanium Pigments Pvt Ltd, SIPCOT. M/s. Sesa Sterlite Ltd (Power Plant), Meelavittan. M/s. Ind-Bharath Power Gencom Ltd, Keelaarasadi. M/s. Kalpaga Chemicals Ltd, Silanatham.
Nearest Village	Sillanatham - 0.2 km - SE Sivaminattam- 1.4 km - SW Lakshmipuram - 1.0 km - NW Subrahmanyapuram - 1.3 km - N Venkateswarapuram - 2.3 km - E
Bird Sanctuary/National Parks	Shenderney Wildlife Sanctuary - 93.0 km - WSW Agasthyakoodam Biological Park - 92.0 km - WSW
Nearest Port	Thoothukudi - 18.2 km - SE
Nearest Town	Thoothukudi - 10.2 km - SE
Inter State Boundary	Tamil Nadu - Kerala - 90.0 km - W
Nearest Air port	Thoothukudi Airport - 17.5 km - SSE
Sensitive Area	(Islands of Gulf of Mannar) ➤ Kosavari Tivu - 15.0 km - ESE ➤ Van Tivu (Church Island) - 14.3 km - ESE
Nearest Forest	Chalikulam RF - 5.5 km - WNW
Historical places	None within 10 km radius

**all distances mentioned in the above table are aerial distances*



sanctuaries, national parks, elephant/tiger reserves within 10km radius of the study area.

The nearest Marine Sanctuaries (Islands of Gulf of Mannar) are beyond 10.0 km and they are:

- Kosavari Tivu – 15.0 km – ESE
- Van Tivu (Church Island) - 14.3 km - ESE

There are no ecological sensitive locations, archaeological monuments, places of tourist interests and defence installations within 10 km radius. The industries located within 10 km radius as per the information obtained from TNPCB Letter No.DEE/TNPCBd/TTN/F.RTI – 05/2015, Dated 18.08.2015 (enclosed as **Annexure – 1H.**)

1. M/s. Sesa Sterlite Ltd, SIPCOT
2. M/s. Ind-Bharath Thermal Power Ltd, Saminathan.
3. M/s. V.V. Titanium Pigments Pvt Ltd, SIPCOT.
4. M/s. Sesa Sterlite Ltd (Power Plant), Meelavittan.
5. M/s. Ind-Bharath Power Gencom Ltd, Keelaarasadi.
6. M/s. Kalpaga Chemicals Ltd, Silanatham.

1.5 REQUIREMENTS OF THE PROJECT

1.5.1 LAND

Total land requirement for the project is about 800 acres as per CEA. Project area is optimized as per EAC, MoEF&CC advise to 750 acres from the originally proposed area of 800 acres. The land falls under the jurisdiction of Ottapidaram & Sillanattam villages of Thoothukudi district of Tamil Nadu. The land belongs to various private parties. 725 acres has been acquired by KUTPPL with mutual consent of land owners.

Project site is located beyond 10.0 km from the Coastal region.

The project site does not fall in ayacut area of any irrigation project as per Tehsildar, Ottapidaram letter dated: 09.11.2011.

The project site is not part of Forest land as per Tamil Nadu Forest Department vide letter ref: C.No.D/2216/2013, dated: 18.07.2013. No



grazing land is involved in the project area. No presence of beach sand minerals and grains of mineral quartz in the project site. The test report is shown in **Annexure -1I**.

Mineralogical map of the proposed site (including soil type) and 10 km radius of the study area is shown in **Fig-1.6** from the map it can be seen that site is falls under Hornblende Biotite Gneiss which is rock present in the subsurface. Soil Map of the project site is shown in **Fig-1.7**

No settlements are located within the land proposed for project.

Vision document specifying prospective long term plan of the site is enclosed as **Annexure - 1J**.

1.5.2 FUEL - COAL

The proposed power plant will be operated as Independent Power Plant (IPP). The project will be implemented with super-critical technology.

The project will be using Imported coal or blended coal having ratio of 70 % Indigenous coal and 30 % Imported coal supported by the secondary fuel oil (LDO) for start-up and Heavy Oil for flame stabilization at low loads.

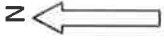
The following are the typical characteristics of the coal proposed for use in the power plant as fuel.

COAL ANALYSIS

		INDIGENOUS COAL	IMPORTED COAL	BLEND COAL (70% INDIGENOUS COAL AND 30% IMPORTED COAL)
Moisture	%	12 - 15	12-15	13.5
Ash Content		39 - 42	4-10	31.06
Fixed Carbon		21 - 25	41-59	31.1
Volatile Matter		22 - 24	34.5-41	27.5
Sulphur		0.3 - 0.4	0.10-0.50	0.40
Gross Calorific value	kcal/kg	3000 - 3600	4800-5500	3805

Source: KUTPPL



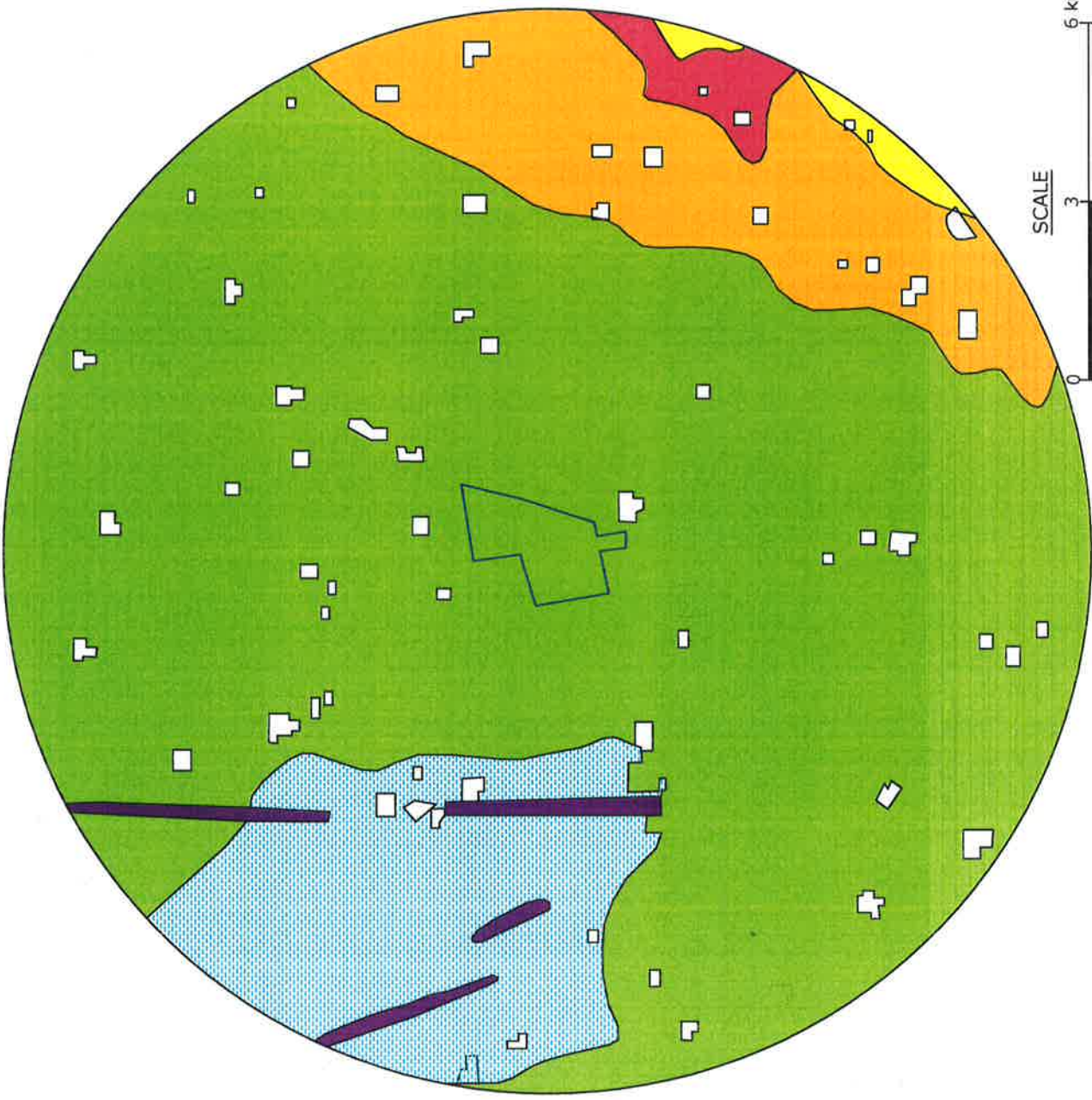


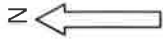
LEGEND

-  SAND AND SALT
-  SAND, SALT AND CLAY
-  QUARTZITE
-  GRANITE
-  HOMBLENDS, BLOTITE GNEISS
-  CHARNOCKITE
-  PROJECT SITE (HOMBLENDS, BLOTITE GNEISS)

FIG - 1.6

CLIENT :	M/s. KU THERMAL POWER PRIVATE LIMITED
PROJECT :	PROPOSED 1320 MW (2x660 MW) COAL BASED THERMAL POWER PLANT
TITLE :	MINERALOGICAL MAP
Ottapidaram & Sillanabham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India	
PREPARED BY B.S.ENVI-TECH (P) LTD., SECUNDERABAD	





LEGEND



DEEP, IMPERFECTLY DRAINED,
CALCAREOUS, CLAYEY SOILS



MODERATELY DEEP, SOMEWHAT,
EXCESSIVELY DRAINED, GRAVELLY CLAY SOILS



VERY DEEP, EXCESSIVELY DRAINED,
SANDY SOILS



VERY DEEP, IMPERFECTLY DRAINED,
CALCAREOUS, CRACKING CLAY SOILS



VERY DEEP, SOMEWHAT EXCESSIVELY,
DRAINED, LOAMY SOILS



VERY DEEP, EXCESSIVELY DRAINED,
SANDY SOILS



PROJECT SITE (VERY DEEP, IMPERFECTLY DRAINED,
CALCAREOUS, CRACKING CLAY SOILS)

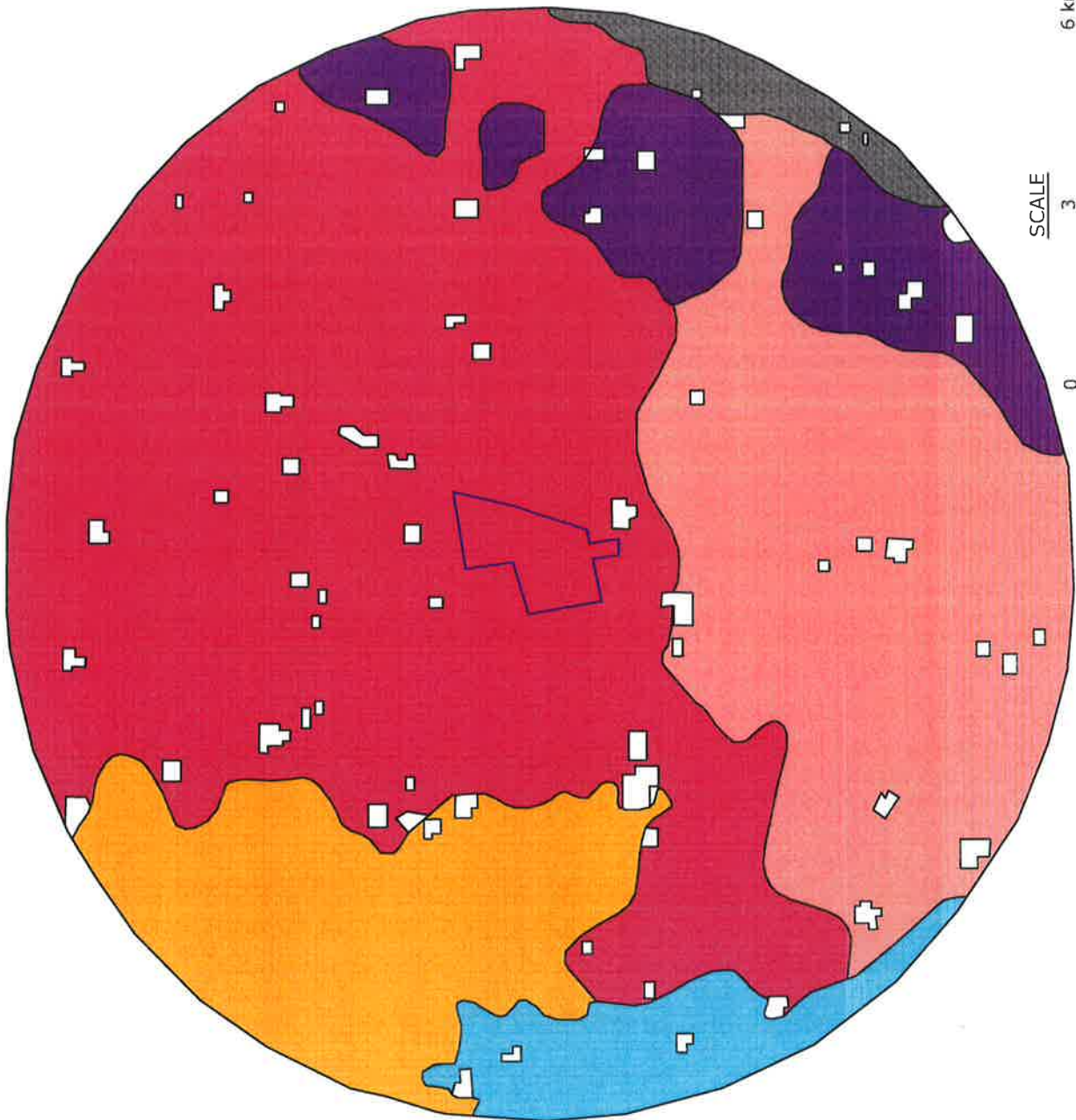


FIG - 1.7

CLIENT :

M/s. KU THERMAL POWER PRIVATE LIMITED

PROJECT :

**PROPOSED 1320 MW (2x660 MW)
COAL BASED THERMAL POWER PLANT**

Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.

TITLE :

SOIL CLASSIFICATION

PREPARED BY



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COAL REQUIREMENT

The estimated coal requirement of the plant based on coal quality is given below

ANNUAL COAL REQUIREMENT

Fuel		2x660 MW (1320 MW)
Imported Coal (100%)	TPH	620.43
	TPD	14891
	MTPA	4.62@ 85 % PLF
Or		
Blend Coal (70% Indigenous Coal and 30% Imported Coal)	TPH	812.51
	TPD	19500
	MTPA	6.05 @ 85 % PLF

MTPA - million tonnes per annum, TPH -Tonnes Per Hour, TPD-Tons per day

Source : KUTPPL

COAL LINKAGE

KUTPPL has entered into Fuel Supply Agreement (FSA) with PT. Krisma Pusaka Sejati for Imported Coal from Indonesia. [The Fuel Supply Agreement is enclosed as **Annexure - 1K.**]

KUTPPL have applied to Ministry of Coal (MOC), Govt. of India, for Indigenous coal linkage which is under progress.

COAL TRANSPORTATION

The coal imported from Indonesia as well as the Indigenous coal will be shipped into Thoothukudi Port. Coal received at Thoothukudi Port will be transported to the project site by rail through proposed railway siding. Incase of any delay in rail siding, the Coal will be transported by road.

Feasibility Report for establishment of Railway Siding for coal transportation has been prepared by M/s Jeeva Management & Financial Consultant Private Limited. The proposal is under examination of Southern Railway. The same is enclosed as **Annexure - 1L.**



The coal will be transported from stock yard to the power plant through a closed conveyor system. Alternatively, a separate study has been carried out M/s Jeeva Management & Financial Consultant Private Limited for impact of transportation of coal by road in case of delay in commissioning of railway siding by [M/s Jeeva Management & Financial Consultant Private Limited.] report of the same is enclosed as **Annexure - 1M.**

FUEL OIL

Start-up, warm-up and low load operation (up to 30%) will be carried out by HFO/LDO for which storage tanks (2 x 1000 KL) and associated facilities have been envisaged for the plant. HFO/LDO will be brought to the plant by road tankers and unloaded into the storage tank

DETAILS OF FUEL OIL STORAGE

Fuel	No. of Tanks	Design Capacity (KL)
LDO	1	500 (each)
HFO	2	1000 (each)

Source: KUTPP

1.5.3 WATER

The project is based on air cooled condensate system, due to which, the water consumption for the plant is very less. After taking other consumptive water needs into account, the total water requirement is estimated to be 260 m³/hr. COC considered for auxiliary cooling is 5. This requirement will be obtained from Desalination plant of South Ganga Water Technologies Private Limited (SGWTPL) through pipeline.

SGWTPL is operating Desalination plant located at 10.7 Km. the capacity of the plant is about 3MLD (presently). South Ganga obtained CRZ Environmental clearance up to 10MLD capacity. SGWTPL will supply desalinated water to the proposed KUTPPL. The water requirement per day will be 6.24MLD.

Water supply agreement signed between KUTPPL & SGWTPL Ganga Waters Technologies Private Limited on 9-11-2011 is enclosed as **Annexure -1N.**



SGWTPL has obtained CRZ clearance vides F.No. 11-48/2011-IA.III dated 16 February 2012 from Government of India MoEF&CC (Enclosed as **Annexure - 10**) for the Desalination plant. They submitted Marine Environmental Impact Assessment and Dispersion Study for the desalination plant prepared by Institute of Ocean Management, Anna University, Chennai to MoEF&CC based on which CRZ clearance was issued.

1.5.4 POWER EVACUATION

The power generated will be stepped up to 400kV and will be evacuated to the 400kV line bays to the grid. The nearest pooling station(400/765kV) is at Ettayapuram which is at a distance of 40Km from site.

Most of the power generated will be sold through long term contract PPA. Some portion of the generation is proposed to be sold through Merchant sale / trading route. Depending on the modalities, separate access agreement for transmission of electricity generated from generator terminals to consumer point will be entered into Power Traders like Power Trading Corporation or NTPC Vidyut Vyapar Nigam Ltd etc with transmission utilities and wherever applicable with the distribution utilities - in due course of time.

1.5.5 MANPOWER

The total manpower of power plant during operation period is estimated to be 450 persons.

The manpower requirement during construction and operation is given below:

REQUIREMENT OF MANPOWER

	Direct	Indirect
During Construction (Executives and Supervisory Staff)	125	-
During Construction (Manpower -Peak)	-	2000
During Operation (unskilled & skilled)	450	-



Preference will be given to local persons from neighboring villages based on suitability during construction and operational phase.

1.5.6 TOWNSHIP

Township will be constructed within the plant site for the employees of the power plant in 30 acres. The township will include the residential quarters for all the employees, guest house, recreation and health facilities. About 350 employees will be accommodated in township.

1.6 NEED FOR THE PROJECT

Electricity being critical infrastructure on which the socio-economic development of the country depends, the supply of electricity at reasonable rate to rural & Industrial India is essential for its overall development. Equally important is availability of reliable and quality power at competitive rates to Indian industry to make it globally competitive and to enable it to exploit the tremendous potential of employment generation.

The National Electricity Policy has set up the goal of adding new generation capacity not only to eliminate the energy & peaking shortage but also to have a spinning reserve of at least 5% in the system. At present, the country is facing peak deficit of around 10.6% and in spite of appreciable capacity addition, there will remain overall peak deficit of 11.8% and 11.4% in the country during 12th & 13th Plans respectively.

The proposed 1320 MW Power Project, comprising of two (2) units of 660MW each is contemplated by M/S KU THERMAL POWER PRIVATE LIMITED (KUTPPL) to be developed as a green field project. Looking into the present and future power scenario of the country, there is no doubt about the absorption of the energy to be generated at the proposed plant. Considering all the above aspects, the proposed power project of 2x660MW is justified from demand supply consideration.

*Source : Feasibility Report



CHAPTER - 2

PROJECT DESCRIPTION



CHAPTER - 2 PROJECT DESCRIPTION

2.0 1320 MW COAL FIRED SUPERCRITICAL POWER PLANT

KUTPPL proposes to establish Coal based Thermal Power Plant of 1320 MW capacity with super-critical technology based boilers. The Plant will use blended coal (70% Indigenous and 30% Imported coal from Indonesia) or 100% Imported Coal.

2.1 PLANT LAYOUT

Layout of the power plant has been optimized considering the space requirements of all the equipment, systems, buildings and structures, coal storage area, ash silos, start-up fuel oil tanks and pump house, water treatment plant, cooling tower, cooling water pump house, 400kV switchyard etc., for the 2X660 MW plant. Necessary plant drainage system would be provided at the proposed power plant site.

In laying various facilities, consideration has been given to the following general aspects:

- Auxiliary cooling towers and 400kV switchyard.
- Coal storage yard
- Ash Pond area (100 acres).
- Water treatment facilities
- Provision of space for Flue Gas Desulphurisation Unit.
- Availability of adequate space for fabrication/storage of construction equipment and materials.

The total land required for the proposed project is 750 acres (Approx. 304 Ha). The proposed land use break-up is presented in **Table-2.1**.



TABLE - 2.1
LAND BREAKUP OF THE PROJECT SITE

S.No	Description	Area (Acres)
1	Main Plant	125.00
2	Water Storage	25.00
3	Railway Corridor	120.00
4	Coal storage	75.00
5	Ash Pond	100.00
6	Other BOP Facilities	115.00
7	Township	30.00
	Sub Total	590.00
8	Greenbelt	160.00
	Total	750.00

Source;KUTPPL

The layout of the plant is shown in **Fig - 2.1**.

2.2 POWER GENERATION PROCESS

Super-critical steam technology will be adopted for the power generating Units. The power plant will utilize Imported or Blended Coal which is a mix of Indigenous Coal and Imported Coal. The Indigenous Coal is proposed to be sourced from coal mines allotment as per linkage and Imported Coal from M/s PT. Krishapusaka Sejati, Indonesian Mines for which the Fuel Supply Agreement has been entered into by KTUPPL.

Air Cooled Condensate system will be adopted for the steam coming out from the Turbine exhaust. The bottom ash will be collected in wet form and fly ash in dry form. Bottom ash will be disposed to the ash pond. Fly Ash will be extracted in dry form and stored in storage silos for the purpose of utilization. Unutilized fly ash will be converted into slurry form and will be disposed to the ash pond alongwith bottom ash.

Switchyard will be located near the power block. The power generated at the plant will be evacuated to the grid at 400 kV level through 3 Nos. of outgoing feeders and to the local Tamil Nadu state grid at 220

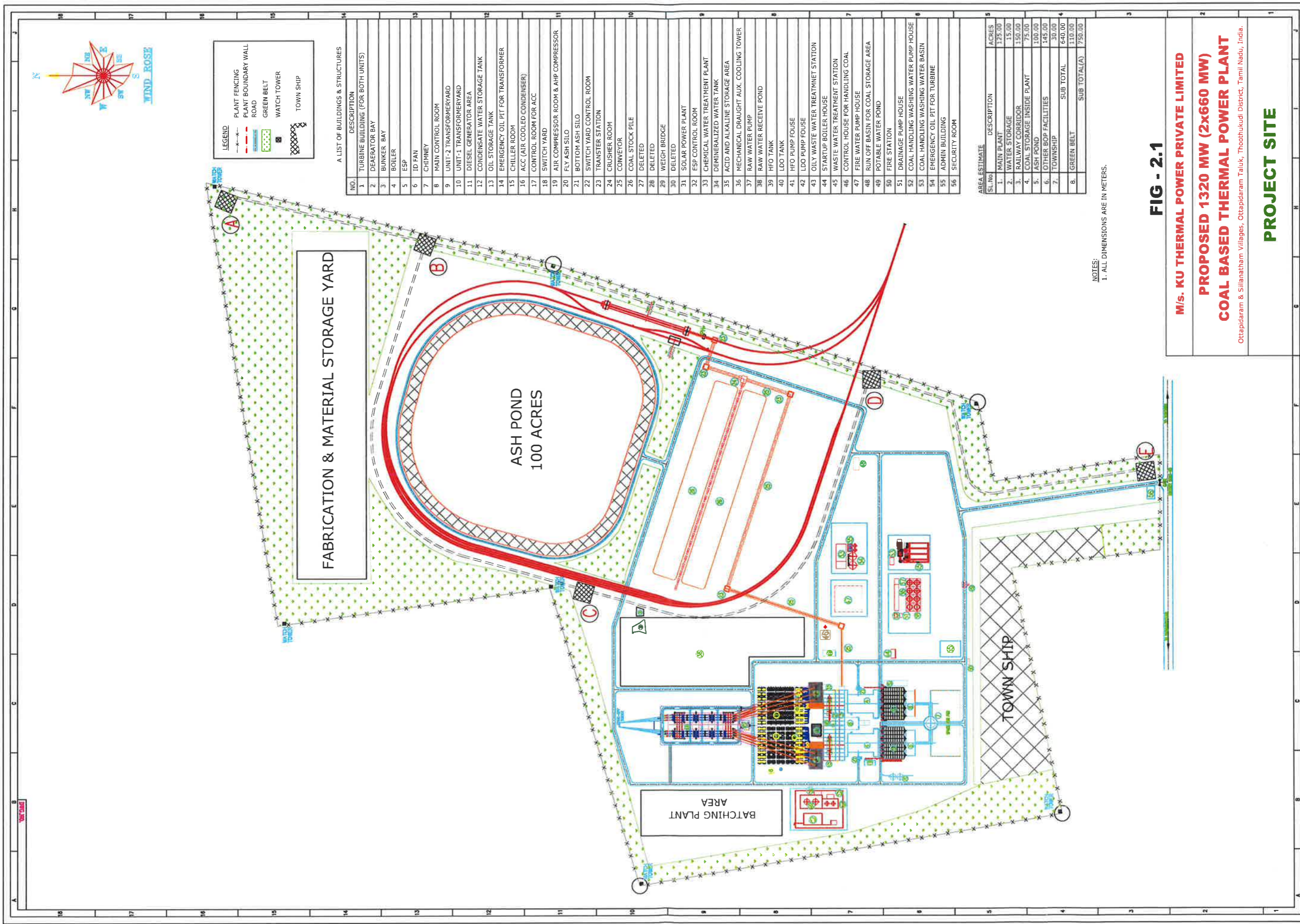


FIG - 2.1

M/s. KU THERMAL POWER PRIVATE LIMITED
PROPOSED 1320 MW (2x660 MW)
COAL BASED THERMAL POWER PLANT
 Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.

PROJECT SITE

kV level through 4 Nos. of outgoing feeders. The power consumers will be connecting to the outgoing gantry of the switchyard located in the power plant.

The plant will be designed in compliance with applicable National and International Codes and Standards such as ASME, ASTM, DIN, BS, IEC, IEEE, IS, etc. The plant will comply with all local statutory regulations and requirements, such as Indian Boiler Regulations (IBR), CCoE, Indian Factories Act, Indian Electricity Act, Environmental Regulations, etc.

2.3 PROJECT DESCRIPTION WITH PROCESS DETAILS

Coal will be fired in a boiler to produce steam at about 259 bar, 565°C, which will be fed to steam turbine which will drive the generator connected rigidly to it. The power output from the generator through appropriate electrical system will be fed to the grid for distribution to consumer.

Exhaust steam from the turbine will be cooled in the air cooled condenser. Water for auxiliary systems of boiler, turbine and generator etc. In addition water is required for bottom ash handling system, dust suppression system of coal handling, firefighting systems, drinking (in plant and township). Make up for the power cycle etc. Similarly water used in other systems mentioned above will be recycled to the extent possible after suitable treatment. However, make-up will be required to be added for replenishing the loss due to evaporation, blow down and other consumptive use. To minimize the make-up, effluent water from different process in the power station will be chemically treated so as to make it suitable for use in the development of green belt, sanitation, dust suppression etc.

About 260 m³/hr of make-up water will be required for 1320 MW power plant (including township and other services) planned at the location.

Fly Ash from coal burning in the boiler will be collected in ESP and conveyed pneumatically to storage silo within the premises. Total ash generated in the power plant will be collected in dry form and sent for further utilisation. In case of disposal to ash pond/dyke, it will be by High Concentrate Slurry Disposal (HCSD).

A typical process diagram for a coal fired power plant is given in **Fig - 2.2**

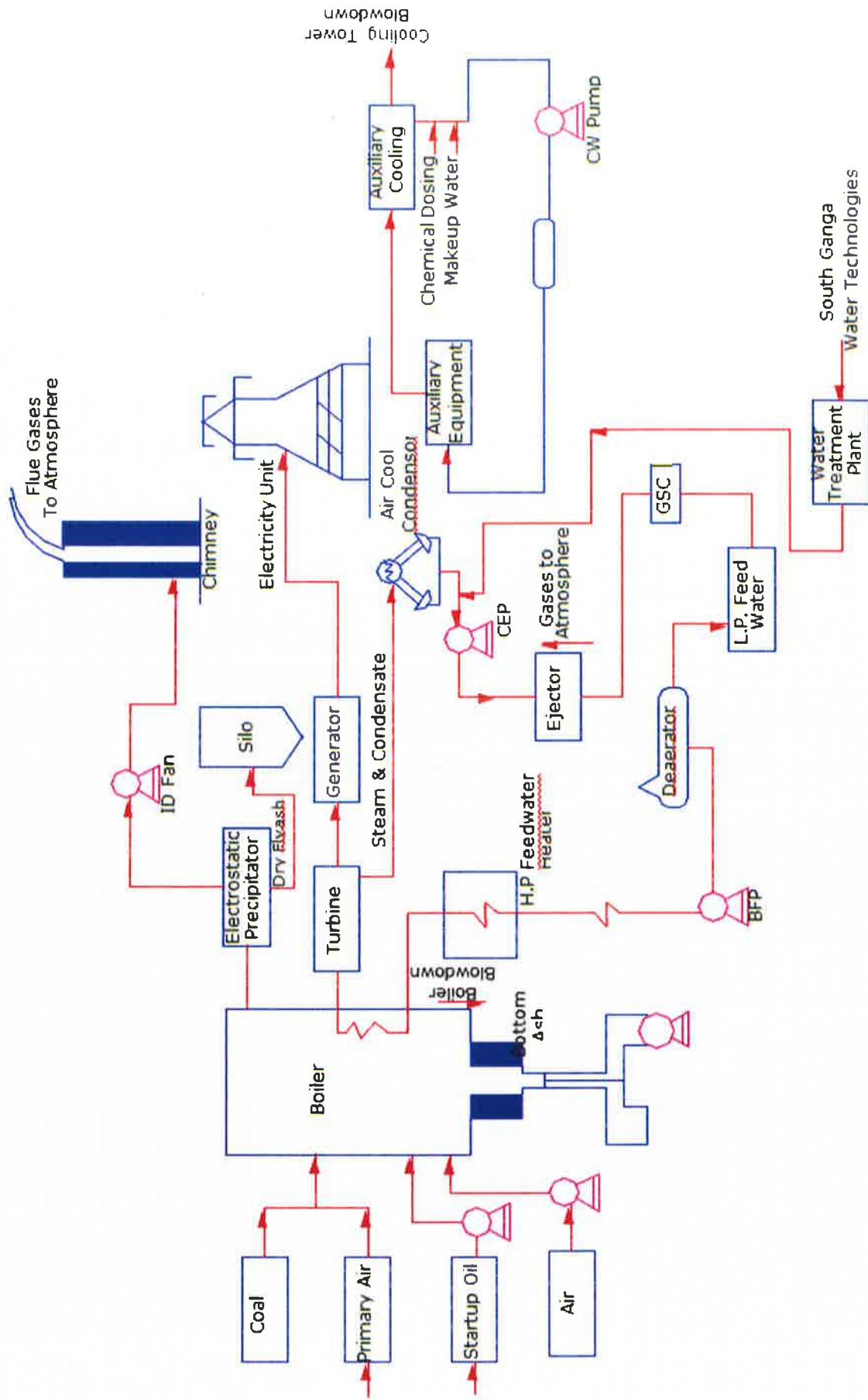
2.4 PLANT DESCRIPTION - TECHNICAL FEATURES

2.4.1 STEAM GENERATOR AND ACCESSORIES

2.4.1.1 STEAM GENERATOR

- a) The steam generators would be Super Critical Pulverized Coal fired, reheat, once through, balanced draft type of unit rated to deliver around 2200 T/Hr(at BMCR) & 2100 T/Hr(at TMCR) of superheated steam at around 259 kg/cm² (a) and 565°C when supplied with feed water at a temperature of about 290-292°C at the economizer inlet. Steam temperature at reheater outlet will be 568°C.
- b) Steam generator will be designed for base load and cyclic operations in accordance with the latest provisions of Indian Boiler Regulations.
- c) Capacity of steam generating units would be so selected as to ensure adequate margin over the requirement of Turbine at 100% TMCR and VWO condition in order to cater to auxiliary steam requirement for soot-blowing operation, and also for start-up of the adjacent unit, and de-rating of the steam generating units after prolonged use. The steam generators would be designed to operate with “the HP Heaters out of service” condition (resulting in lower feed water temperature at Economizer inlet) and deliver steam to meet the turbo-generator requirement at base load. Economizer section of the boiler would be non-steaming type with provision for re-circulation during start-up, chemical cleaning etc.

FIG - 2.2
A TYPICAL PROCESS DIAGRAM FOR A COAL FIRED POWER PLANT



Super heater section would be designed so as to maintain rated steam temperature of 565°C (+/-5°) at outlet over the range of 60% TMCR to 100% BMCR load. Main steam de-superheating stations with provision for spraying water tapped off from feed water piping downstream of HP heaters would be provided. Tri sector air pre-heaters would be provided wherein primary and secondary air will be heated by counter flow of flue gas. Air preheater is equipped with a set of soot-blowers of automatic sequential electrically operated type, arranged for on-load cleaning of the heating elements.

- d) Draft system of each boiler would be provided with two (2) Secondary Air Fans and two (2) Induced Draft Fans with suitable capacity and control arrangement. Each flow path will be independently capable of meeting the requirement at 60% boiler MCR load.
- e) Coal preparation and firing system will be equipped with each steam generator and would be equipped with suitable coal pulverising system to the boiler consisting of bunkers, gravimetric / volumetric mill feeders, coal pulverizers, PA and seal air fans and conveying pipes. Two (2) primary air fans will be provided to carry the pulverized coal from the coal pulverizers to the burners. Two (2) Seal air fans are provided to provide seal air fan to the mills and coal feeders taking suction from Primary Air duct.
- f) The steam generating units will be provided with arrangement for startup by LDO and for flame stabilization by heavy fuel oil/ furnace oil.
- g) Start-up and recirculation system will be provided with recirculation pump for startup of the boiler. Associated equipment like mixing chamber, flash tank, and drain receiving vessel will be provided. Drain from the vessel will be diverted to the condenser using drain pumps if the drain water quality satisfies the boiler water requirements, otherwise same will be discharge into the boiler blow down sump.

h) The complete boiler will be top supported type and would be provided with all supporting steel structures, platforms, galleries, elevator and stairways for easy approach and maintenance of the unit. Adequate weather protection would be provided for instruments and operating personnel.

2.4.1.2 ELECTROSTATIC PRECIPITATOR

Each steam-generating unit would be provided with an electrostatic precipitator to collect the fly ash. Precipitator will have four / six parallel gas paths, any of which can be isolated for maintenance when required, keeping the other paths in operation. Each path will have n+1 field in series for collection of fly ash, of which, “n” fields will be in service and the other one will remain as a standby. Efficiency of ESP will be such that the outlet dust burden does not exceed 50 mg/Nm³ at 100% BMCR with one field out of service in all paths. Further space provision will be kept in the layout to accommodate one more field in future to maintain future environmental pollution norms.

2.4.1.3 CHIMNEY

One common twin- flue chimney is envisaged for both units. The chimney height will be 275m as per environmental norms.

2.4.1.4 MILL REJECT SYSTEM

Pneumatic (pressure / vacuum) mill reject handling will be provided to handle the mill rejects and transfer to the mill reject silo located near the mills. Rejects from the silo will be transported by means of trucks.

2.4.1.5 FLUE GAS DESULPHURIZING SYSTEM

Space provision for installation of Flue Gas Desulphurizing (FGD) system will be made in the layout.

2.4.2 STEAM TURBINE & AUXILIARIES

2.4.2.1 STEAM TURBINE:

- a) The steam turbine would be tandem coupled, single reheat, regenerative, condensing, multi cylinder machine with seven (7) or eight (8) uncontrolled extractions for regenerative feed heating. The turbine would be designed for main steam parameters of around 247 kg/cm² (a) and 560°C before emergency stop valves of HP turbine and reheat steam parameters of about 42 kg/cm² (a) and 565°C at inlet to IP turbine to achieve the above turbine cycle heat rate. The LP turbine will exhaust against average condenser pressure of 0.15 kg/cm². Turbine valve wide open (VWO) capacity will not be less than 105% of TMCR.
- b) The turbo-generator will be equipped with digital electro-hydraulic governing system ensuring stable operation under any grid fluctuation and load throw off condition.
- c) HP and LP turbine bypass station will be provided as a part of turbine package. The bypass station will act not only as a protection to the unit during pressure rise resulting from sudden load throw off but also enable operation of the unit at loads lower than the controllable range of load. This will also permit quick, repeated hot starts of the unit on its tripping. The HP bypass station could be sized for a flow corresponding to about 60% of boiler MCR.
- d) The unit will generate its rated capacity at generator terminals continuously at cooling water inlet temperature of 32°C to 33°C. It will also be capable of operating continuously under the HP feed water heaters out of service and at full load.

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

Description	Value
Output under TMCR condition	660 MW
Turbine throttle steam pressure	247 Kg/cm ²
Turbine throttle main steam	560°C
Reheat steam temperature at turbine	565°C
Variations in rated steam	As per IEC
Pressure drop in reheat circuit	10% of HPT
Frequency variation range	(+) 3% to (-) 5%

2.4.2.2 AIR COOLED CONDENSER AND AIR EVACUATION PUMPS

The exhaust steam from LP turbine is directly cooled in a system of finned tubes by ambient air Mechanical draft or natural draft to move the air through fin tube heat exchange elements. Majority of direct dry cooling installations employ mechanical draft fans and are termed as Air Cooled Condensers (ACC). The finned tubes are generally arranged in the form of an 'A' frame (or delta) over a forced draft fan with steam distribution manifold connected horizontally along the apex of 'A' frame. Each cell consists of a number of finned tube bundles arranged in parallel along two walls of 'A' frame cell. Steam flowing down inside tubes condenses due to the cooling effect of ambient air drawn over external finned surface of the tubes by the fans. The condensate drains from finned tubes in to condensate manifolds and then drains into a condensate tank before being pumped to the conventional condensate cycle. To reduce pressure drop in steam conveying system, ACC will be installed close to the turbine hall.

Two (2) 100% capacity operating ejector (or) vacuum pumps will be provided to create vacuum by removing air and non- condensable gases from the condenser during plant operation. In addition to the above hogging ejection will be provided and will operate during startup.

2.4.2.3 BOILER FEED PUMPS AND DRIVES

Two (2) 50% capacity, horizontal, multistage, barrel casing, steam turbine driven and one (1) 50% capacity, horizontal, multistage, barrel

casing, centrifugal type motor driven boiler feed pumps will be provided. Electrically driven boiler feed pump will have one (1) matching capacity single stage booster pump driven by the feed pump motor and turbine driven boiler feed pumps will have one (1) matching capacity single stage booster pump driven by separate motors. A variable speed hydraulic coupling will be provided between the drive motor and the main feed pump of each set to regulate feed water flow to boiler for the motor driven pump set. All the feed pumps will be provided with minimum flow re-circulation control arrangement to protect the pump under low load operation. Two (2) turbine driven pumps will normally operate while the motor driven pumps will be used during start up and also serve as standby. Capacity of motor driven feed pump is selected such that one turbine driven and one motor driven pump will meet the boiler BMCR requirements.

2.4.2.4 DE-AERATING HEATER AND CLOSED FEED WATER HEATERS

- a) Each unit will be provided with a variable pressure type de-aerating heater with a feed water storage tank of adequate capacity. Vent condenser will be provided with the de-aerator to minimize wastage of steam. The de-aerator will be spray-cum-tray type and will be designed to de-aerate all the incoming condensate and drain flow to keep the oxygen content of the condensate below the permissible limit of 7 ppm. Alternatively, combined de-aerator and storage tank will be provided.
- b) Four (4) LP Heaters and Three (3) HP heaters (tentative) will be provided. The feed water heaters will have both drain cooling and de superheating zones in addition to the normal condensing zone as necessary. High pressure heaters as well as low pressure heaters will have individual bypassing arrangement in order to allow isolation and maintenance of individual heaters. The recommendations of ASME TDP-1 will be followed for prevention of water damage to the turbine.

2.4.2.5 CONDENSATE EXTRACTION PUMPS

Three 50% (or) Two (2) 100% capacity, Horizontal, centrifugal canister

type, motor driven condensate extraction pumps will be provided. Condensate extraction pumps will take suction from condenser hot well/tank and discharge to the deaerator through CPU, Gland steam condenser and LP heaters. Connections for condensate supply to the following major services will be tapped off from this condensate discharge header:

- LP bypass desuperheating spray
- Turbine exhaust hood spray
- Gland sealing system desuperheating
- Fuel oil & HVAC PRDS desuperheating

2.4.2.6 HP-LP BYPASS SYSTEM

60% capacity HP bypass with matching LP bypass valves, pressure reducing and de-superheating facilities will be provided with controls, to reduce hot/ warm start time with proper steam/turbine metal temperature matching. The provision of this system also considerably reduces the loss of condensate due to boiler vents and operation of boiler safety valves, which are then scarcely used.

2.5 WATER SYSTEM

2.5.1 CLOSED CYCLE COOLING WATER

Closed Cycle Cooling Water (CCCW) system would be adopted for cooling and other water requirements of steam generator auxiliaries, turbine auxiliaries and generator auxiliaries and common auxiliaries like station air compressors, ash handling plant equipment etc. DM water would be used as closed cycle cooling water. 2x100% CCCW pumps will be adopted for each 660 MW unit.

Return hot CCCW will be cooled in Plate Type Heat Exchangers (PHE) in the primary circuit, using Auxiliary Circulating Water (ACW) in the secondary circuit. 3x50% PHEs will be employed for each 660 MW unit.

Make-up to the primary side closed loop would be from unit DM make-up system.

2.5.2 AUXILIARY CIRCULATING WATER SYSTEM

The plant Auxiliary Cooling water system will include the Auxiliary Circulating Water pumping system and Induced draft cooling towers. One common ACW pump house will be provided at outlet channel of cooling towers for both the 660 MW units with three (3) pumps, two (2) working and one (1) standby. Piping from ACW pump house to BTG area and from BTG area to cooling tower will be of mild steel construction with suitable corrosion protection and lining and will be laid above ground/underground based on the layout requirements..

ACW from the PHEs will be cooled in the Induced draft Cooling Towers (IDCT). One IDCT with suitable number of cells will be employed for each 660 MW unit. Cold water from IDCT will be led to common channel and in-turn to the fore bay of ACW pump house by gravity.

Depending on the ACW quality, it is proposed to adopt a design of 5 COC (minimum). Cold blow down will be adopted and would be drawn from the discharge side of ACW pumps. Blow down will be taken to the Effluent Treatment Plant for treatment and re-use in plant water system to the extent possible and the balance for the development and maintenance of green belt.

ACW make-up water will be taken from desalinated water storage reservoir to compensate the loss on account of evaporation in IDCTs and blow down.

Chlorination will be done by chlorination plant to control the organic growth and will be provided with suitable chemical treatment using acid dosing & scale cum corrosion inhibitors dosing.

WATER STORAGE AREA

An area of 25 acres for water storage (storage depth – 2.0 m) has been provided for water reservoir inside the plant boundary for storage of 30 days water requirement to meet any contingency ,in case of any

breakdown or close down of the De- Salination plant. It is expected that the service provider will be in action within this 30 days, otherwise there is no option but to shut down the plant.

2.6 COAL HANDLING SYSTEM

2.6.1 REQUIREMENT

The estimated coal consumption for the power station would be as indicated below:

Coal Requirement	100% Imported coal	Blend coal (70% Indigenous & 30% imported)
Coal requirement in Million Tonnes / Year	4.62	6.05
Coal requirement in Tonnes/ hr	620.43	812.83

Notes:

1. Station heat rate is considered as 2343 ((THR (1850) / Boiler Efficiency (0.87)) X 1.07x1.03 = 2343 ~ 2343) kcal/kWh (Based on unit with CERC values for supercritical Units).
2. Plant load factor is considered as 85%.
3. GCV of Imported coal considered is 4986 kCal/Kg & Indigenous Coal as 3300 kCal/Kg

2.6.2 BRIEF DETAILS OF COAL HANDLING AND TRANSPORTATION

Imported coal will be received at Thoothukudi port by ships. The coal will be unloaded from ships and loaded on to railway wagon. From port railway wagon will be moved to plant site via Thattaparai station. Railway siding will be developed at site to receive coal from Thattaparai station. From the siding, the coal will be transported by conveying system. Till the time Railway siding is in place, the coal will be moved from

Conveyors are proposed below the wagon tippler to convey coal to the stockyard through various transfer points. Two conveyors (1W+1S) are envisaged with 1800 TPH capacity each to transport uncrushed coal size of (-) 300 mm. There will be four crushers (2W + 2S) with

capacity of 1800 TPH each. Coal will be crushed to (-) 20 mm size and are fed to bunkers directly.

Alternatively, crushed coal will be stocked in coal stock yard. Coal stocking capacity will be such that it cater to needs of boiler for 30 days.

One stacker reclaimer is proposed for two coals. Capacity of stacker cum reclaimer is 1800 TPH. Each coal stock pile length will be around 650 m and will stack coal to a height of around 10 m reclaiming from the stock pile will be done using reclaimer and coal is conveyed directly to the bunkers.

Necessary base with drainage facility will be considered for stocking the coal. The conveyors capacity will be adequate to fill the bunkers in two shift operation (Max 14hrs as per CEA norms).

Coal Storage area

An area of 75 acres has been earmarked for coal storage. This area will accommodate coal of 30 days requirement at an estimated consumption of 15000 tonnes/day.

The area requirement has been estimated considering the lead time required for the container movement, unloading and transportation to the plant site so that sufficient coal is available for plant operation for 30 days

2.6.3 DUST EXTRACTION / DUST SUPPRESSION/ VENTILATION SYSTEM

Agglomerated dust suppression (ADS) with Stainless steel nozzles will be provided for control of fugitive dust emissions from dust generation points such as transfer points, feeders, crusher house, etc.

Dust extraction system will be provided at crusher house and tipper floors with all needed bag filters, vent fans, etc. Necessary spray system and compacting arrangement will be provided in the coal stock pile area.

2.6.4 FIRE PROTECTION SYSTEM

The coal stock area in the yard as well as crusher house/transfer houses including conveyors are protected against fire by the hydrant network system connected to the plant hydrant system network. Fire detection provision is made for the crushers/screens with an alarm in the coal plant & main plant control rooms. The system will be provided as per TAC norms.

2.7 ASH HANDLING SYSTEM

The broad parameters of ash based on the coal quantity and quality indicated above will be as follows:

	100% Imported coal	Blend coal (70% Indigenous & 30% imported)
Coal consumption at full load (100%)	620.43 TPH	812.83 TPH
Ash content considered for design	5.52%	31.06%
Ash generated per hour in Tonnes	34.25	252.43
Ash generated per year in Million Tonnes @85%PLF	0.251	1.876
Ash pond area in acres required for 25 years plant life considering full fly ash utilization from 4th year onwards for two units - Note4	13.35 acres	98.37 acres
Ash pond area provided	100 acres	

- Estimation of Bottom Ash and Fly Ash generated over the life period of the power plant and the Ash dyke area requirement has been provided in **Annexure- 2 A**

- Moist ash or High Concentration Slurry disposal has been envisaged for emergency disposal of ash from the Power Plant. During normal operation dry ash disposal is proposed.
- Progressive utilization of Fly Ash as per the directive of MoEF has been taken into account while computing the above ash quantities.

2.7.1 BOTTOM ASH HANDLING SYSTEM

Bottom ash will be extracted by using a Dry bottom chain conveyor system. This will save water requirement, as the cooling medium will be air.

The dry ash collected from bottom ash hopper will be conveyed by a series of chain conveyor system (Pan Conveyor). The cooled ash from chain conveyor will be discharged into Bottom ash silo. From there, it is disposed to Ash pond using High Concentrate Slurry Disposal system.

2.7.2 COARSE ASH HANDLING SYSTEM

Coarse Ash will be collected from Economizer Hoppers, Air Pre-heater Hoppers and Flue gas Duct Hoppers along the flue gas path and will then be extracted and conveyed by pneumatic conveying system to Fly ash silos.

2.7.3 FLY ASH HANDLING SYSTEM

Pneumatic conveying system (either vacuum system or pressure system) will be employed for extraction of fly ash from the electrostatic precipitator hoppers in dry form. This dry ash will either be taken to buffer hopper or to the wetting head/collector tank units. The dry ash buffer hoppers and wetting head/collector tank units will be located adjacent to the ESP. Dry ash from buffer hoppers will be transported to main storage silos located near the plant boundary. There will be three (3) nos. of fly ash silos. Storage capacity of each silo will cater to 24 hours normal generation of fly ash from one unit of 660 MW.

2.7.4 HIGH CONCENTRATION SLURRY DISPOSAL SYSTEM

It is envisaged to have slurry HCSO system sized for 100% generation of ash from the generating units for emergency disposal. All equipment necessary for this method of ash disposal will be provided.

2.7.5 ASH DYKE

98.37 acres of ash dyke area including bund is required for the project. About 100 acres has been earmarked. A minimum 50 m width green belt has been considered all around the ash dyke.

2.8 FUEL OIL SYSTEM

Light diesel oil (LDO) will be used as start-up fuel in the boilers and Heavy Furnace oil (HFO) will be used for flame stabilization during low-load operation. Fuel oil support is envisaged up to 45% BMCR.

One LDO tank of 500 kL capacity and two HFO tanks of 1000 KL each capacity are envisaged for two units. HFO and LDO storage tanks will be located in the enclosed dyke and will be designed and installed meeting the CCOE norms.

Fuel oil is transported to the project by road tankers. Unloading facilities comprising of road tanker unloading bays, unloading pumps will be installed for unloading the road tankers into the storage tanks.

Fuel oil pressurizing and heating system comprising of pressurizing pumps, HFO heaters will be installed to meet the requirements of the boilers.

2.9 COMPRESSED AIR SYSTEM

Five (5) numbers of 40 Nm³/min capacity, about 7.5 kg/cm²(g) discharge pressure non-lubricating type reciprocating or rotary screw type compressors will be provided for supplying instrument air (IA) and service air (SA). Out of these, three (3) numbers will cater instrument air requirements of two (2) units and one (1) numbers for service air for two (2) units with one compressor as common standby for Instrument air & service air.

CHAPTER - 3

DESCRIPTION OF ENVIRONMENT



CHAPTER-3: DESCRIPTION OF ENVIRONMENT

3.1 STUDY AREA

The study area covers 10 km radius around the project boundary of **KUTPPL** at Ottapidaram & Sillanattam villages, Ottapidaram Taluk at Thoothukudi District in Tamil Nadu.

STUDY PERIOD

The baseline environmental quality represents the background scenario of various environmental components in the study area.

The Draft EIA report was prepared based on site specific baseline data collected during the period October to December 2011, by M/s. Vimta Labs. During EAC, MoEF appraisal meeting, the committee observed that the baseline data was collected in the period October to December 2011, which is rainy season in Tamilnadu. The Committee, hence advised to collect fresh data during non-monsoon and submit the revised Final EIA report.

Fresh baseline data was collected by BSET during the period May to July, 2015 (study period) and presented in this chapter.

3.2 METHODOLOGY OF EIA STUDY

The various steps involved in Environmental Impact Assessment study of this proposed power plant are divided into the following phases.

- Collection of Fresh Baseline data for non-monsoon season i.e during May – July , 2015
- Identification of significant environmental parameters and assessed to study the existing status within the impact zone with respect to air, water, noise, soil and socio-economic components of environment.
- Study of various activities of the proposed project to identify the area's leading to impact/change in environmental quality.

- Identification/Prediction of impacts for the identified activities and to study level of impact on various environmental components.
- Evaluation of impacts after superimposing the predicted/quantified scenario over the baseline scenario.
- Formulation of Environmental Management Plan for implementation in the proposed project.

3.2.1 COLLECTION OF BASELINE STATUS

MICRO METEOROLOGY

An auto weather monitoring station was installed (on top of colony building of adjacent Ind Bharat Power plant) to record meteorological parameters like Wind speed, Wind direction, temperature, and relative humidity on hourly basis continuously for the period covering the months of May – July '15 on hourly basis.

Wind speed, wind direction data recorded during the study period was used for computation of relative percentage frequencies of different wind directions. The meteorological data thus collected has been used for interpretation of the existing Ambient Air Quality status, and the same data has been used for prediction of impacts of future scenario due to the project.

AMBIENT AIR QUALITY

The scenario of the existing ambient air quality in the study region has been assessed through a network of eight ambient air quality stations during the study period within an area of 10 km, radius and around the project.

The Ambient air quality monitoring network has been designed keeping in view the available climatological norms of predominant wind direction and wind speed of this particular region.

The following points were also taken into consideration in designing the network of sampling station:

- Topography / Terrain of the study area
- Populated areas within the study area
- Residential and sensitive areas within the study area.

The existing Ambient Air Quality (AAQ) status has been monitored for PM₁₀, PM_{2.5}, SO₂, NO_x, Ozone and CO. PM₁₀ & PM_{2.5} at each station have been monitored on 24 hourly basis. CO was monitored on 8 hourly basis. One set of samples from all stations were analyzed for Mercury.

Pre calibrated Respirable dust samplers have been used for monitoring of the existing AAQ status. Methodologies adopted for sampling and analysis were, as per the approved methods of Central Pollution Control Board (CPCB). Maximum, minimum, average and percentile values have been computed from the raw data collected at all individual sampling stations to represent the ambient air quality status of the study area.

NOISE ENVIRONMENT

Noise monitoring has been carried out at eight locations to identify the impact due to the existing sources on the surroundings in the study area during study period. Noise levels were recorded during the day and night times.

WATER ENVIRONMENT

Water samples from seven locations within 10 km radius during study period were collected for assessment of the existing physico-chemical and bacteriological quality

Methodologies adopted for sampling and analysis were according to the IS methods. Field parameters such as pH, Temperature and Dissolved Oxygen were monitored on site. The parameters thus analyzed were compared with IS 10500. The activities surrounding the source during sampling were taken into consideration in the interpretation of the water quality of that particular source.

LAND ENVIRONMENT

Remote sensing techniques were used to assess the land use/land cover in 10 km radius. Representative soil samples were collected from eight locations during study period within 10 km radius of project of plant for analysis of the physico chemical characteristics. Standard procedures were followed for sampling and analysis. The samples collected were also analysed to check the suitability for growth of native species in and around the proposed project. Information on Flora and Fauna in the study area has been incorporated as part of the Ecological survey.

SOCIO - ECONOMIC ENVIRONMENT

A socio economic assessment of the positive and negative impacts on the people likely to be directly and indirectly affected by the project was conducted along with other studies during the EIA study. The assessment facilitated an understanding of the needs, demands, preferences, capacities and constraints of the people in the vicinity of the project operation.

3.2.2 STUDY OF VARIOUS ACTIVITIES

Various operations involved in the project have been studied in detail to identify areas having impact on various environmental components. The study is based on primary survey and secondary source of information.

3.2.3 QUANTIFICATION/PREDICTION OF IMPACTS

The identified impacts based on the above study are quantified using various mathematical models.

3.2.4 EVALUATION OF IMPACTS

The quantified incremental impacts are superimposed on the baseline status of various environmental components to have an overall scenario. The overall scenario estimated has been checked for compliance with various statutory requirements/standards.

3.2.5 FORMULATION OF AN ENVIRONMENTAL MANAGEMENT PLAN

Based on the environmental status & quantified impacts, a detailed Environmental Management Plan has been formulated for implementation during the operational phase of project of power plant. A detailed environmental monitoring programme has been drawn for implementation.

3.3 BASELINE ENVIRONMENT

3.3.1 MICRO METEOROLOGY OF THE STUDY AREA

REGIONAL METEOROLOGY

Climate of the region is classified as tropical. In winter, there is much less rainfall than in summer. The average annual temperature is 29.2 °C in Thoothukudi. Precipitation here averages 621 mm. Precipitation is the lowest in August, with an average of 3 mm. Most precipitation falls in November, with an average of 238 mm. At an average temperature of 31.6 °C, May is the hottest month of the year. In January, the average temperature is 26.5 °C. It is the lowest average temperature of the whole year.

SITE METEOROLOGY

An auto weather monitoring station was installed (on top of colony of adjacent Ind Bharat Power Plant) during the months of May – July '15 to record various meteorological parameters on hourly basis to understand the wind pattern, Temperature variation, solar insolation and relative humidity variation etc.

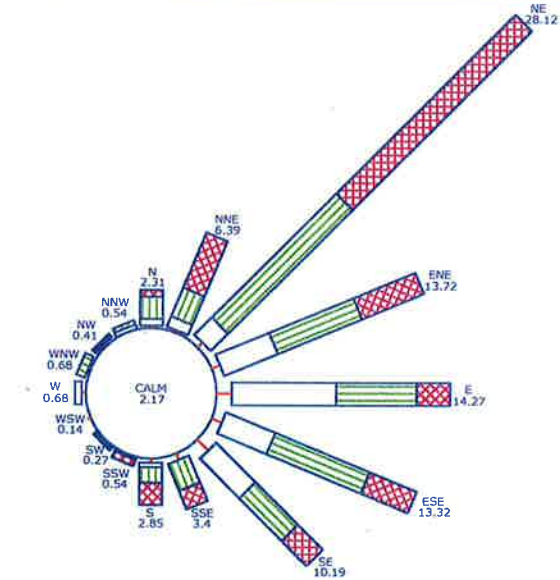
Percentage frequencies of wind in 16 directions have been computed from the recorded data of May to July, 2015 during the study period for 8 hourly (01-08hrs, 09-16 hrs and 17-24 hrs) and 24 (00-24hrs) intervals to plot wind roses. **Fig - 3.1 and 3.2** represents the wind pattern of the study period.

FIG - 3.1
WINDROSE DIAGRAM

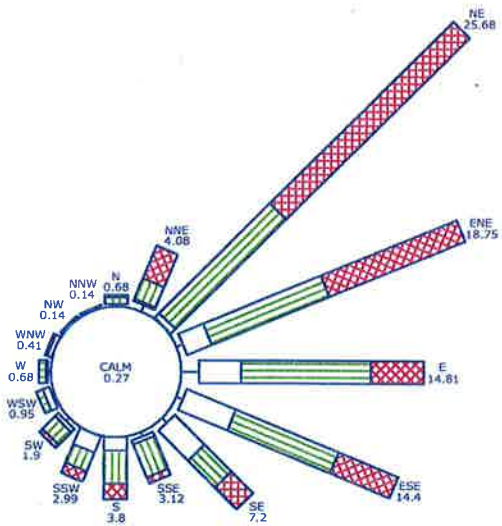


CLIENT : M/s. KU THERMAL POWER PRIVATE LIMITED (KUTPPL)
 PROJECT : PROPOSED 1320 MW (2x660 MW)
 COAL BASED THERMAL POWER PLANT
 LOCATION : Ottapidaram & Sillanatham Villages, Ottapidaram Taluk,
 Thoothukudi District, Tamil Nadu, India.

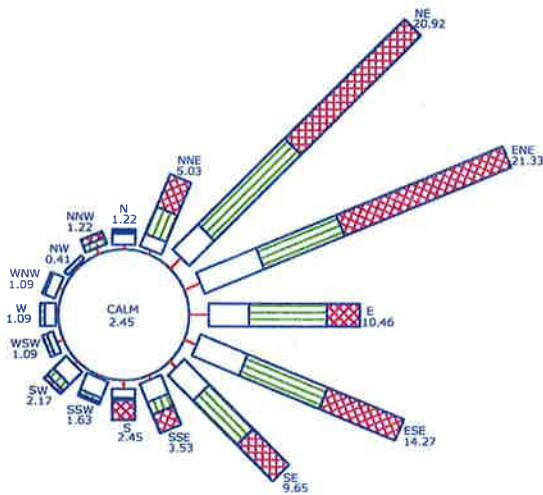
PERIOD : MAY-JUNE - JULY - 2015



DURATION : 01- 08 HRS.



DURATION : 09- 16 HRS.



DURATION : 17- 24 HRS.

NOTE : All readings are in percentage occurrence of wind

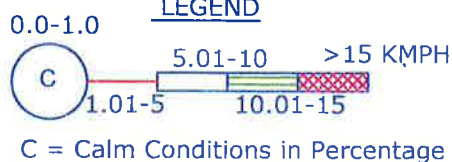
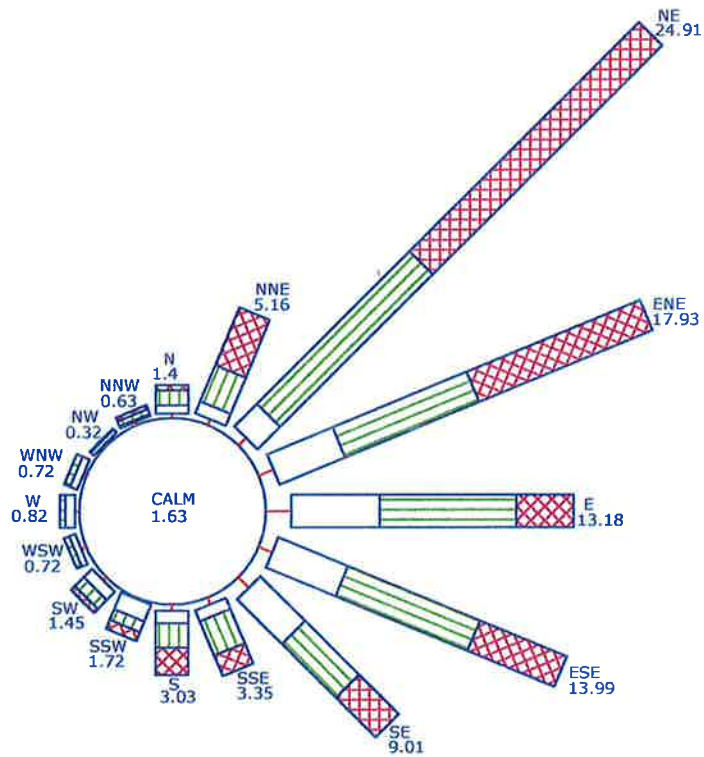


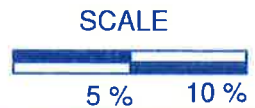
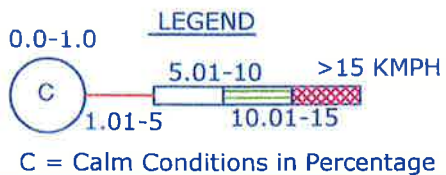
FIG -3.2
WINDROSE DIAGRAM

CLIENT : M/s. KU THERMAL POWER PRIVATE LIMITED (KUTPPL)
 PROJECT : PROPOSED 1320 MW (2x660 MW)
 COAL BASED THERMAL POWER PLANT
 LOCATION : Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India. PERIOD : MAY-JUNE - JULY - 2015



DURATION : 01- 24 HRS.

NOTE : All readings are in percentage occurrence of wind



WIND PATTERN DURING 01:00 - 08:00 HOURS

The predominant wind directions during this period were from NE-ENE-E-ESE-SE sector accounting to about 79.62% of the total time. Average wind speeds during this period were varying between 1-15 kmph and during sometime the wind were more than 15 kmph. The wind of less than 1.0 kmph was treated as calm, about 2.17% of the time the winds were under calm condition.

WIND PATTERN DURING 09:00 - 16:00 HOURS

The predominant wind directions during this period were from the NE-ENE-E-ESE-SE sector accounting to about 80.84 % of the time. Wind speeds during this period were varying between 1-15 kmph. The wind of less than 1.0 kmph was treated as calm, about 0.27 % of the time the winds were under calm condition.

WIND PATTERN DURING 17:00 – 24:00 HOURS

The predominant wind directions during this period were from NE-ENE-E-ESE-SE sector accounting to about 76.63 % of the total time. Wind speeds during this period were varying between 1-15 kmph. The wind of less than 1.0 kmph was treated as calm, about 2.45 % of the time the winds were under calm condition.

WIND PATTERN DURING 01:00 –24:00 HOURS (MAY '15-JULY '15)

Predominant Wind direction during the period was from NE-ENE-E-ESE-SE sector accounting to about 79.02% of the total time. Wind speeds during this period were varying between 1-15 kmph. The winds of less than 1.7 kmph were treated as calm, about 1.63% of the time the winds were under calm condition.

SUMMARY OF THE WIND PATTERN

Duration [Hrs]	Predominant Wind Direction	Wind Rose Enclosed As
01:00 – 08:00	NE-ENE-E-ESE-SE	FIG – 3.1
09:00 – 16:00	NE-ENE-E-ESE-SE	
17:00 – 24:00	NE-ENE-E-ESE-SE	
01:00 – 24:00	NE-ENE-E-ESE-SE	FIG – 3.2

3.3.2 AMBIENT AIR QUALITY

In order to identify the background air quality data and also to represent the interference from various industrial and local activities, screening techniques have been used for identification of air quality stations in the study areas. The following points have been considered for the selection of air quality monitoring stations.

- Predominant wind directions
- Topography of the study area
- Terrain and sensitive areas
- Populated areas near to the plant area
- Magnitude of the surrounding industries

3.3.2.1 IDENTIFICATION OF VARIOUS INDUSTRIAL OPERATIONS IN THE STUDY AREA:

The following activities are present in the 10 km radius of the Project site, which are responsible for the background air quality.

TOPOGRAPHY / TERRAIN AND SENSITIVE AREAS OF THE STUDY AREA

The site is located at an elevation of 31 m above Mean sea level (MSL). There are no sensitive areas with the study area.

Based on the above, the AAQ stations have been identified and locations of ambient air quality stations are presented in **Table-3.1**.

3.3.2.2 IDENTIFICATION OF AMBIENT AIR QUALITY MONITORING STATIONS:

Ambient air quality of the study area has been assessed through a network of 8 ambient air quality locations. These stations are designed keeping in view of the climatological conditions of the study region.

TABLE - 3.1
AMBIENT AIR QUALITY MONITORING STATIONS

Station Code	Locations	w.r.t Project Site		Representation
		Distance [Km]	Direction	
A1	Project site	-	-	-
A2	Sillanattam	0.2	SE	Crosswind
A3	Rajavinkovil	1.7	SSW	Crosswind
A4	Pudiyamputtur	3.1	WSW	Downwind
A5	Ottapidaram	4.7	WNW	Downwind
A6	Lakshmipuram	1.0	NW	Downwind
A7	Venkateshwarapuram	2.4	E	Upwind
A8	Mel Arasadi	5.2	E	Upwind

The above monitoring stations are located such that a representative background ambient air quality levels are obtained. **Fig - 3.3** shows the location of ambient air quality monitoring stations in the study area.

Methodologies adopted for sampling and analysis are as per the approved methods of Central Pollution Control Board (CPCB).

3.3.2.3 ANALYSIS OF BASELINE CONCENTRATIONS [Study Area]

PARTICULATE MATTER - PM₁₀

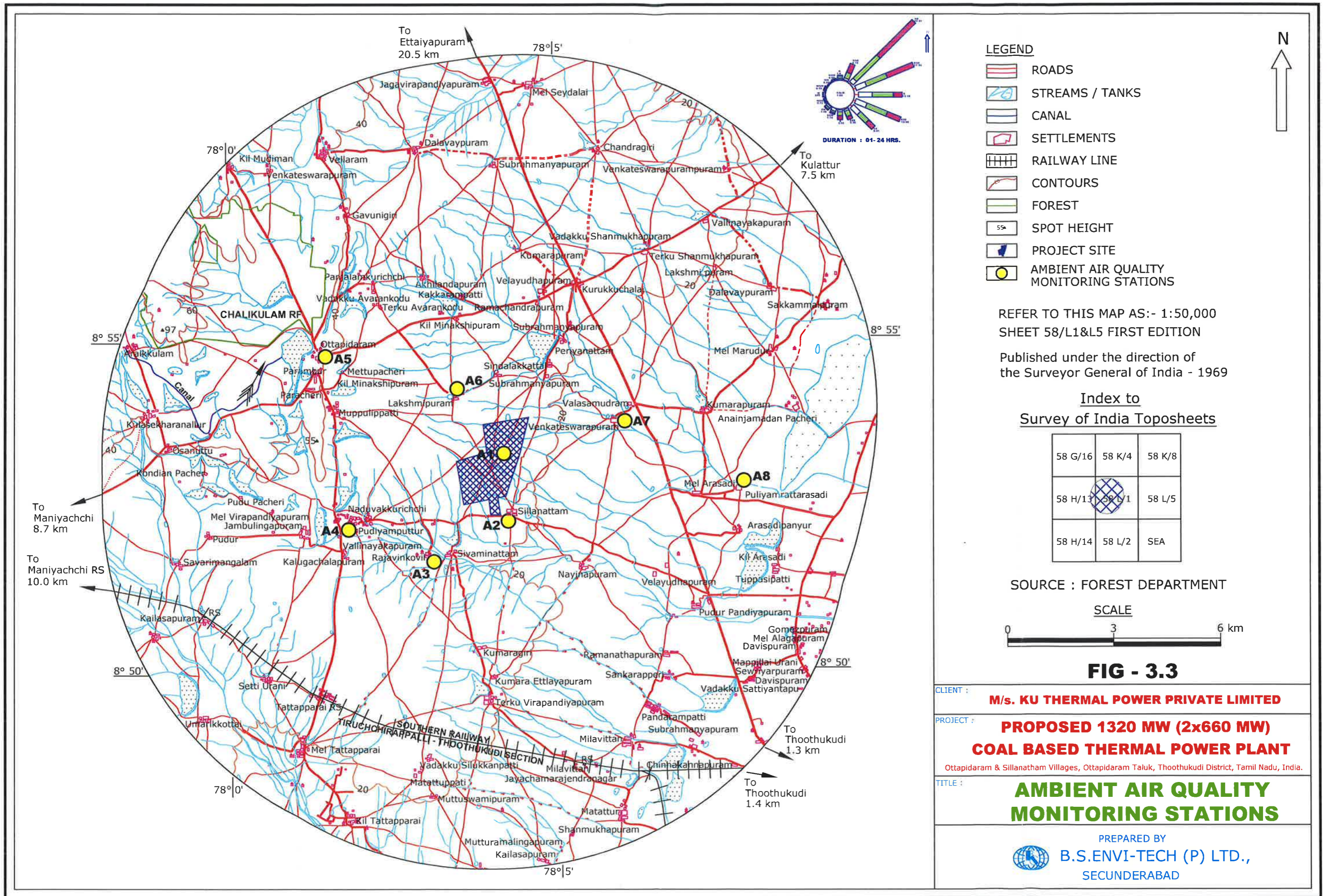
PM₁₀ values monitored at 8 locations showed 98th percentile values in the range of 39.2 - 44.5 µg/m³. The values of PM₁₀ monitored in the study area are well within the limits of NAAQ standards.

FINE PARTICULATE MATTER - PM_{2.5}

PM₁₀ values monitored at 8 locations showed 98th percentile values in the range of 23.5 - 27.0 µg/m³. The values of PM₁₀ monitored in the study area are well within the limits of NAAQ standards.

SULPHURDIOXIDE - SO₂

98th percentile value of Sulphur dioxide in the study area from the monitored data was in the range of 9.4 - 10.4 µg/m³. The values of



SO₂ monitored in the study area are well within the limits of NAAQ standards.

OXIDES OF NITROGEN - NO_x

Ambient air quality status monitored for nitrogen oxides in the study area were in the range with 98th percentile values between 10.5 – 11.9 µg/m³. NO_x monitored in the study area are well within the limits of NAAQ standards.

OZONE

Ambient air quality status monitored for Ozone in the study area were in the range with 98th percentile values between 23-32 µg/m³. Ozone monitored in the study area is well within the limits of NAAQ standards.

CARBON MONOXIDE - CO

CO concentration at all the locations was found to be less than 1 ppm. Summary of AAQ monitoring at each location is given in **Table - 3.2** and date wise ambient air quality data is enclosed in **Annexure - 3A**.

TABLE - 3.2
SUMMARY OF AAQ MONITORING (µg/m³)

Station Code	Locations	98 TH PERCENTILE VALUES				
		PM ₁₀	Pm _{2.5}	SO ₂	NO _x	Ozone
A1	Project site	44.5	27.0	10.4	11.9	29
A2	Sillanattam	39.2	23.5	9.4	10.8	31
A3	Rajavinkovil	40.8	25.0	10.2	11.7	22
A4	Pudiyamputtur	43.0	24.6	9.6	10.5	27
A5	Ottapidaram	44.2	24.9	10.0	11.5	23
A6	Lakshmipuram	42.6	25.5	9.9	10.7	25
A7	Venkateshwarapuram	43.1	24.4	10.3	11.4	28
A8	Mel Arasadi	41.9	25.6	9.8	10.6	32

Note: CO at all locations was found < 1.0 ppm

MERCURY MONITORING

Mercury analysis was done for one sample from each village in PM₁₀ sample collected as part of ambient air quality monitoring Protocol followed for ambient Hg monitoring is enclosed as **Annexure - 3B**.

Mercury values were recorded less than 0.1 ng/m³ at all sampling locations.

3.3.2.4 DATA CORRABORATION

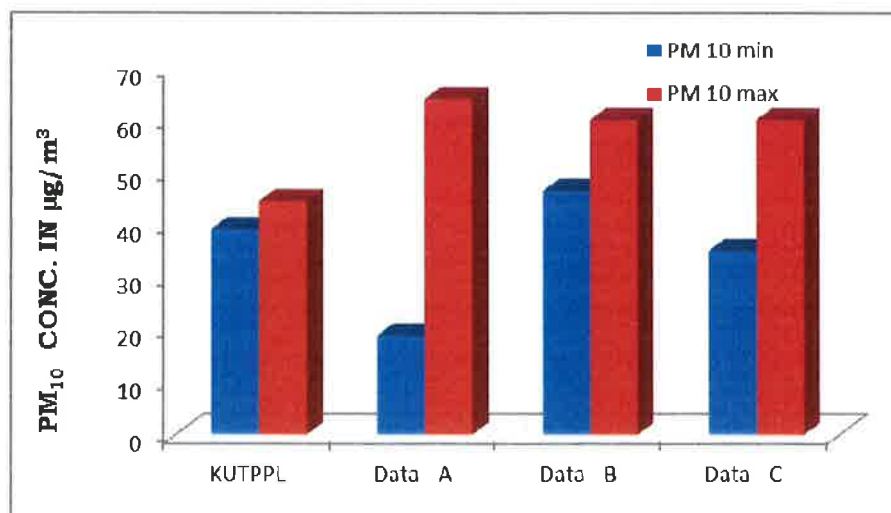
Data collected during May to July, 2015 has been corroborated with other data available with the existing industries and data of proposed projects.

Due to non availability of the latest baseline data for the region, the following available data which is one year old has been considered for corroboration

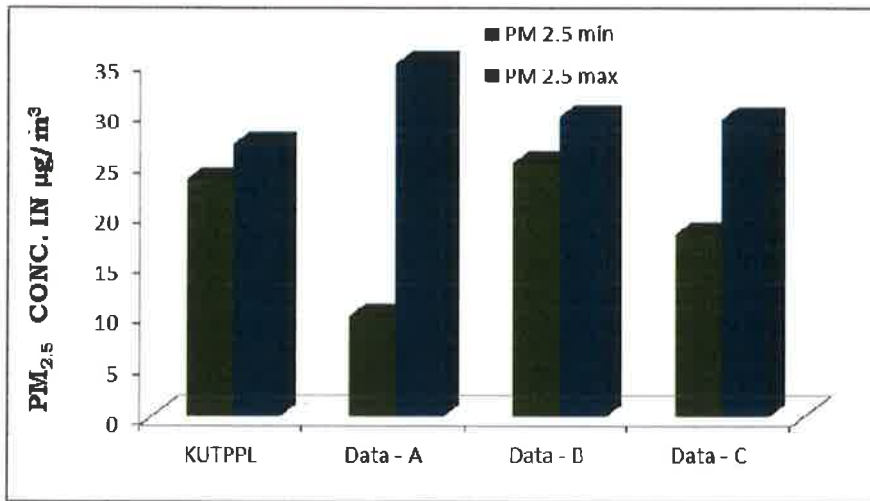
- a) Data Recorded by Existing Sterilite through online auto ambient air quality monitoring for October, 2014 – **Data - A**
- b) TNPCB monitored data for August, 2014 for existing Sterilite Industries – **Data - B**
- c) Monitored Data of M/s Vimta Labs Limited for EIA studies of Sterlite Industries for July- September, 2014 for proposed project – **Data - C**

The data collected from the above industries is enclosed as **Annexure – 3C**. Graphs below shows the comparison of the data

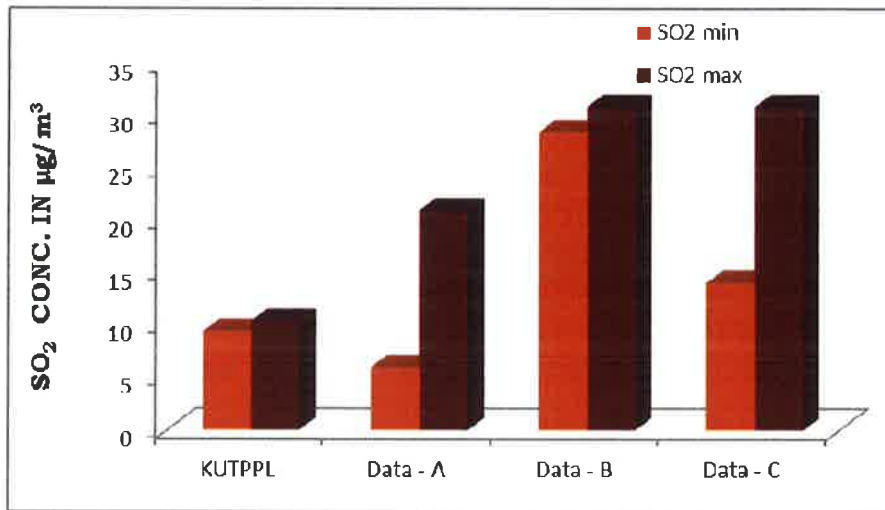
PARTICULATE MATTER – PM₁₀



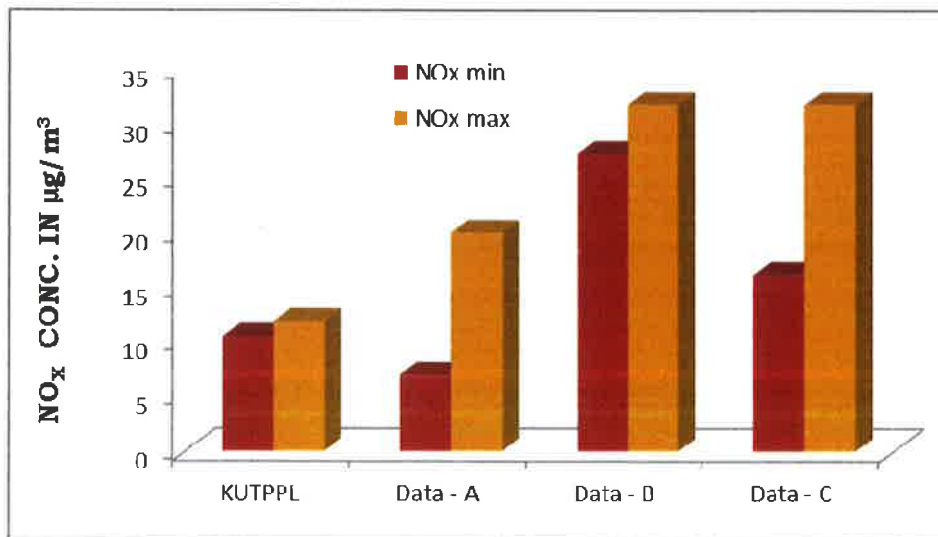
PARTICULATE MATTER – PM_{2.5}



SULPHUR DIOXIDE– SO₂



OXIDE OF NITROGEN– NO_x



Monitored data collected during May-July, 2015 could not be corroborated with the above industries due to change in locations of monitoring and period of data. Data monitored by TNPCB and data recorded by M/s Sterlite Industries are within the factory premises reflecting respective activities. However summary of the data showing comparison is given in the below table

AMBIENT AIR QUALITY DATA ($\mu\text{g}/\text{m}^3$) COLLECTED FOR CORRABORATION

	KUTPPL Data	Data - A	*Data - B	Data - C
Data Period	May-July, 2015	October, 2014	August, 2014	July-September, 2014
PM10	39.2-44.5	19-64	46.5-60.0	35.1-60.0
PM2.5	23.5-27.0	10-35	25.1-29.7	18.1-29.5
SO2	9.4-10.4	6-21	28.5-30.9	14.1-30.9
NOX	10.5-11.9	7-20	27.2-31.7	16.2-31.7

3.3.3 NOISE ENVIRONMENT

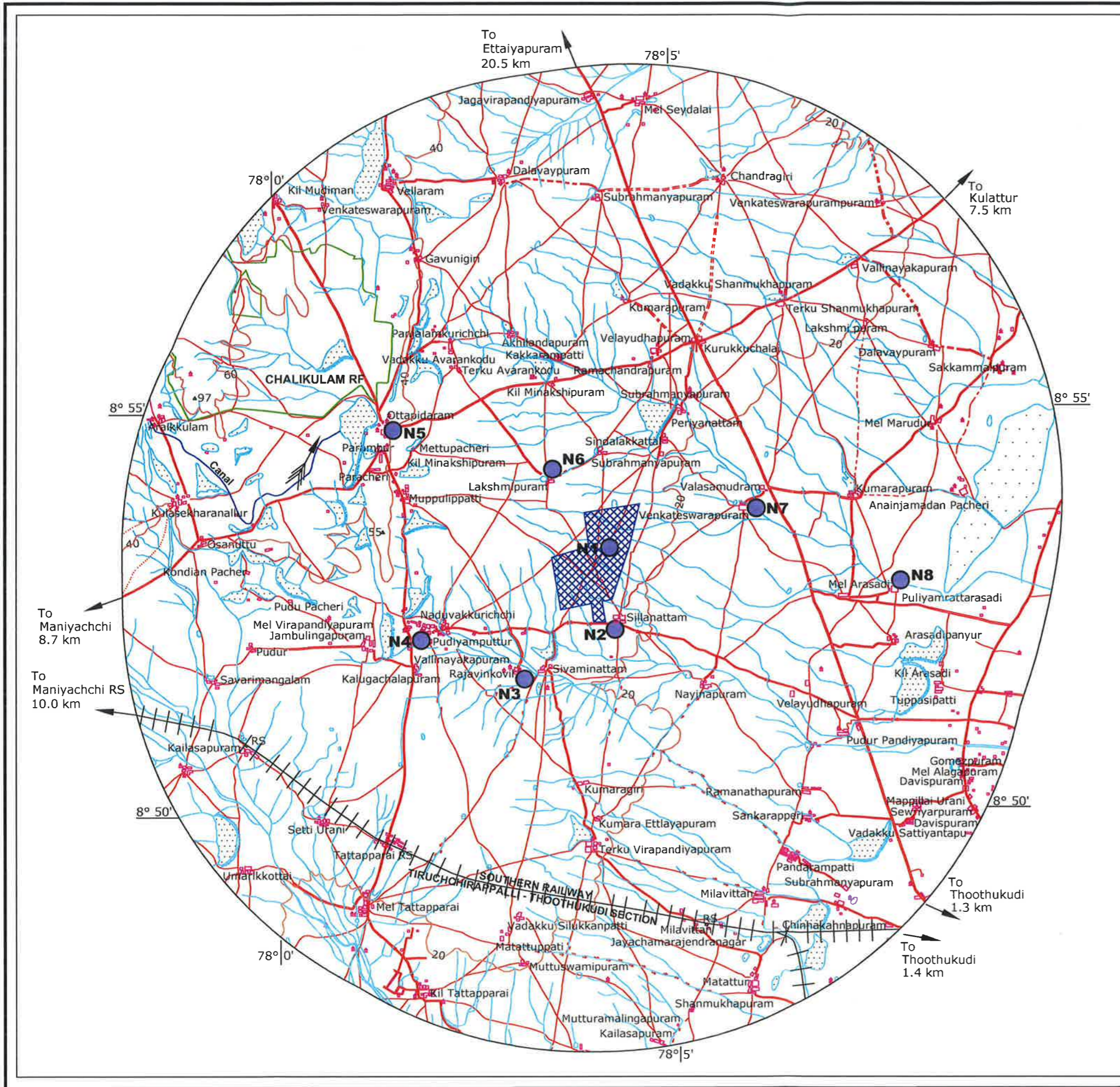
In order to know the baseline noise levels, in and around the Project site. Noise levels were measured at the 8 villages in the study area.

Details of noise monitoring stations are given in **Table - 3.3**.

**TABLE-3.3
 NOISE MONITORING STATIONS**

Code	Locations	w.r.t Project site	
		Distance [km]	Direction
N1	Project site	-	-
N2	Sillanattam	0.2	SE
N3	Rajavinkovil	1.7	SSW
N4	Pudiyamputtur	3.1	WSW
N5	Ottapidaram	4.7	WNW
N6	Lakshmipuram	1.0	NW
N7	Venkateshwarapuram	2.4	E
N8	Mel Arasadi	5.2	E

The noise recording stations are shown in **Fig - 3.4** and the summary of the day - equivalent and night - equivalent values recorded at various locations in the study area is given in **Table - 3.4**.



LEGEND

- ROADS
- STREAMS / TANKS
- CANAL
- SETTLEMENTS
- RAILWAY LINE
- CONTOURS
- FOREST
- SPOT HEIGHT
- PROJECT SITE
- NOISE LEVEL MONITORING STATIONS



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58 G/16	58 K/4	58 K/8
58 H/13		58 L/5
58 H/14	58 L/2	SEA

SOURCE : FOREST DEPARTMENT

SCALE



FIG - 3.4

CLIENT : **M/s. KU THERMAL POWER PRIVATE LIMITED**

PROJECT : **PROPOSED 1320 MW (2x660 MW) COAL BASED THERMAL POWER PLANT**

Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.

TITLE : **NOISE LEVEL MONITORING STATIONS**

PREPARED BY
B.S. ENVI-TECH (P) LTD.,
 SECUNDERABAD

The day equivalent noise levels were found to be due to local activities in the villages. Noise levels recorded in the night time were found to be less. Noise levels recorded in the day and night time were found to be less than 54 dB (A).

TABLE - 3.4
EQUIVALENT NOISE LEVELS IN THE STUDY AREA (10 KM RADIUS)

CODE	LOCATION	dB (A)	
		Day Equivalent	Night Equivalent
N1	Project site	54.3	44.6
N2	Sillanattam	53.6	43.9
N3	Rajavinkovil	52.1	42.4
N4	Pudiyamputtur	50.5	40.8
N5	Ottapidaram	49.7	40.0
N6	Lakshmipuram	48.9	39.2
N7	Venkateshwarapuram	52.0	42.3
N8	Mel Arasadi	51.8	42.1

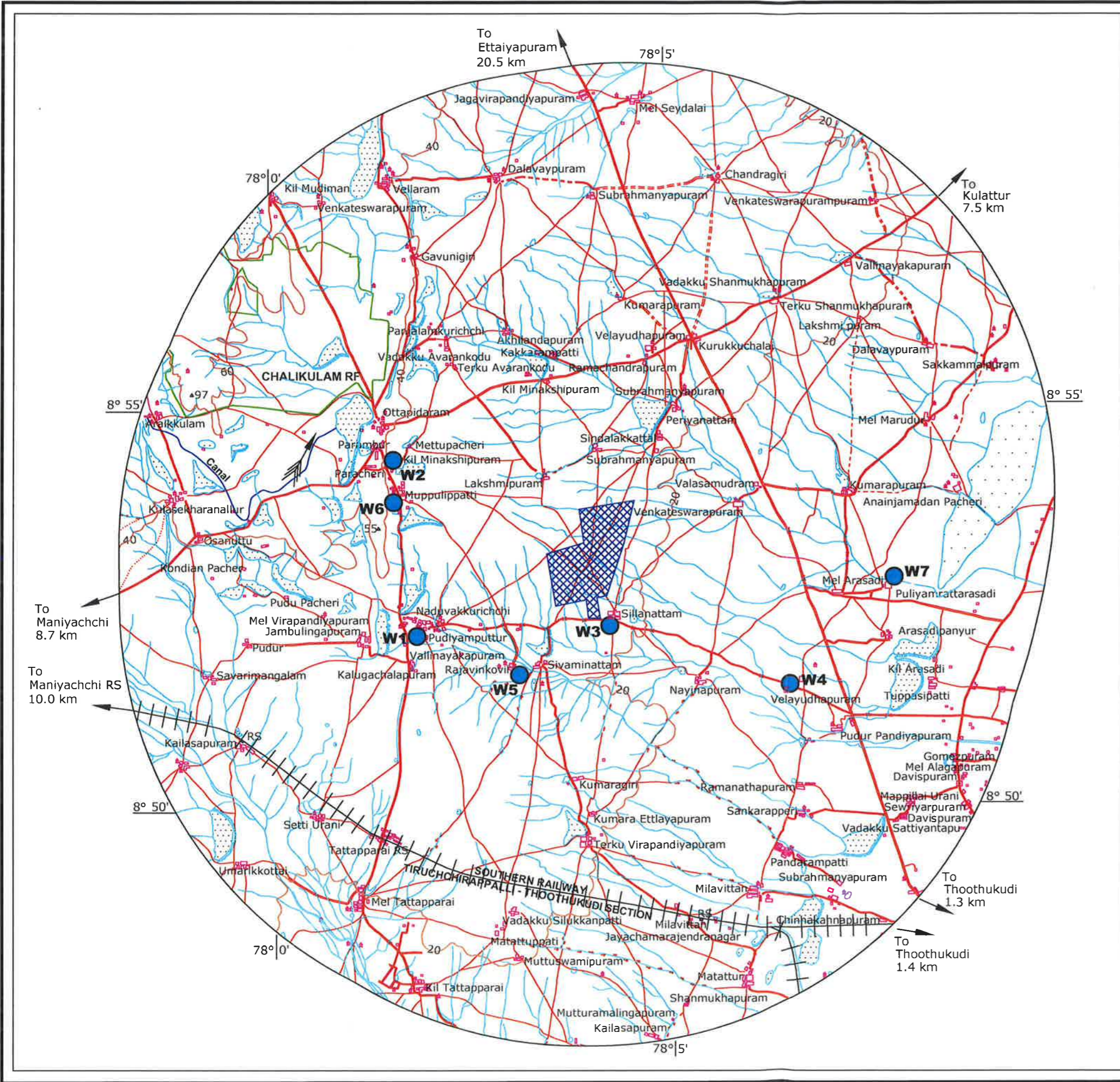
3.3.4 WATER ENVIRONMENT

Assessment of baseline data on Water environment includes

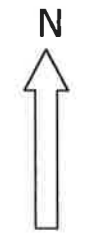
- a) Identification of surface water sources
- b) Identification of ground water sources
- c) Collection of water samples
- d) Analysing water samples collected for physico-chemical and biological parameters.

Assessment of water quality in the study area includes the quality assessment of parameters as per the Indian standard IS 10500 (drinking water standard). The locations of water sampling are shown in **Fig - 3.5**.

Seven water samples from various locations in and around the Project site within 10 km radius were collected for assessment of the physico-chemical and bacteriological quality. Methodologies adopted for sampling and analysis were according to the IS methods. Field parameters such as pH, Temperature, Taste and odour were monitored on site. The parameters thus analysed were compared with IS 10500. Details of water sampling locations are given in **Table-3.5**.



- LEGEND**
- ROADS
 - STREAMS / TANKS
 - CANAL
 - SETTLEMENTS
 - RAILWAY LINE
 - CONTOURS
 - FOREST
 - SPOT HEIGHT
 - PROJECT SITE
 - WATER QUALITY MONITORING STATIONS



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58 G/16	58 K/4	58 K/8
58 H/13		58 L/5
58 H/14	58 L/2	SEA

SOURCE : FOREST DEPARTMENT

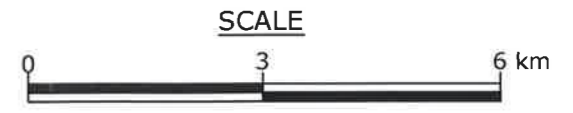


FIG - 3.5

CLIENT : M/s. KU THERMAL POWER PRIVATE LIMITED

PROJECT : PROPOSED 1320 MW (2x660 MW)
COAL BASED THERMAL POWER PLANT
Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.

TITLE : WATER QUALITY MONITORING STATIONS

PREPARED BY
 B.S. ENVI-TECH (P) LTD.,
SECUNDERABAD

TABLE-3.5
WATER SAMPLING LOCATIONS

Code	Locations	Source	w.r.t Project site	
			Distance [km]	Direction
W1	Pudiyamputtur	Surface water	3.1	WSW
W2	Kil Minakshipuram	Surface water	4.1	WNW
W3	Sillanattam	Borewell	0.2	SE
W4	Velayudhapuram	Borewell	4.7	ESE
W5	Rajavinkovil	Borewell	1.7	SSW
W6	Muppalapatti	Borewell	3.4	WNW
W7	Mel Arasadi	Borewell	5.2	E

Annexure - 3D represents the water quality data at the above locations.

3.4 LAND ENVIRONMENT

3.4.1 GEOLOGY

Thoothukudi district comprises hard crystalline rocks of Archean group composed of Charnockites, Hornblende Biotite Gneiss, Quartzite etc., and the remaining area is covered by sedimentary rocks ranging in age from Tertiary to recent and made up of sandstone and alluvium. The geological succession details of the Thoothukudi district is given in the **Table**.

DETAILS OF GEOLOGICAL SUCCESSION

AGE	FORMATION	LITHO UNIT
Quaternary	Holocene to Recent	Red Soils, Coastal Sands, River Alluvium, Laterite, Red Teri Sand, Kankar Shell Limestone, Calcareous Sandstone.
Tertiary	Mio-pliocene	Hard compact Calcareous Sandstone, Limestone
Archeans	Precambrian	Pink granites, Quartzites Calcgranulites, Peninsular gneiss

The project site lies in Hornblende Biotite Gneiss of Archean age. The general strike direction of the Hornblende Biotite gneiss is North-South to Northeast to Southwest with gentle slope. The weathering zone extends up to 8-12 m. The predominant rock type within 10 km radius is Hornblende Biotite Gneiss followed by Sand and silt

formation of Quaternary age. These Quaternary formations are found in the eastern boundary of 10 km radius. The charnockite mound is present in the north western side of 10 km radius. The Hornblende biotite gneiss rocks are considered as hard rock formations and the bearing strength is very high.

3.4.2 GEOMORPHOLOGY

The prominent geomorphic units identified in the district are 1) Fluvial, 2) Marine, 3) Fluvio-marine, 4) Aeolian and 5) Erosional landforms depending on the environment of formation. Taruvaikulam-Tuticorin surface, Kulattur surface, Vaippar surface, Nagalapuram-Vedanatham surface and Volinokkam-Vembar surface are some of the erosional geomorphic units in the northern part of the district. Karamaniyar surface, Tambraparni surface, Tiruchendur-Kayapattinam surface and Vallanadu surface are the geomorphic units in the southern part of the district.

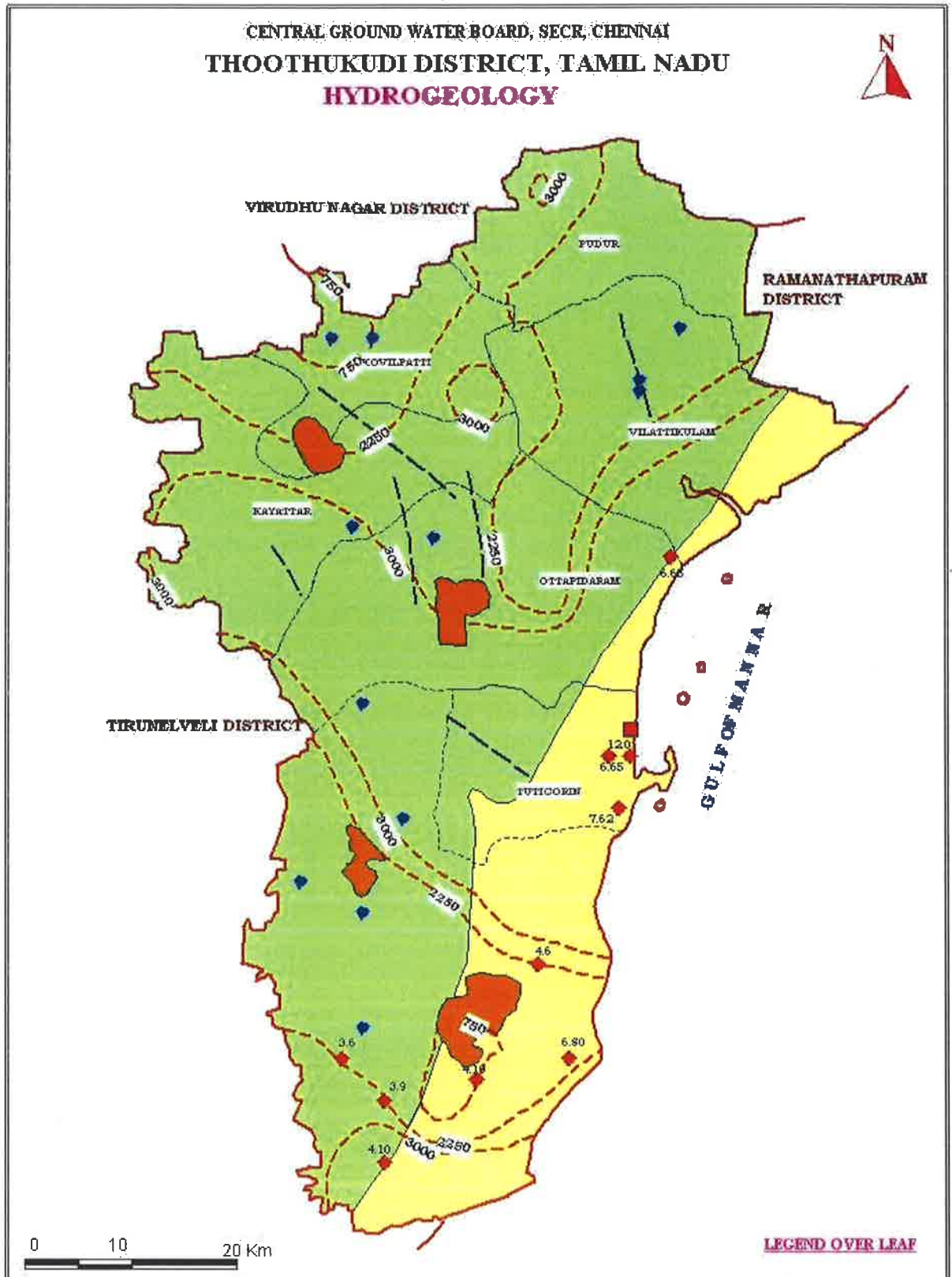
The number of red sandy tracts formed of the sand dunes locally known as Teri sand complex are the important feature in the coast. These Teri sands extend in width from 6 to 8 km from the coast. Adaippanvilai Teri, Kudiraimozhi Teri and Vaippar-Vembar Teri are some of the important Teri areas, which are having elevation in the range of 15 to 62m above MSL.

3.4.3 HYDROGEOLOGY

The district is underlain by both porous and fissured formations. The important aquifer systems in the district are constituted by i) unconsolidated & semi-consolidated formations and ii) weathered and fractured crystalline rocks. The Hydrogeological map of Thoothukudi district was given in **Fig - 3.6**.

Based on the morpho-genetic and geological diversities, the ground water potential in the aquifer of various geological formations has been inferred. On the basis of hydrogeological and hydrochemical regime prevalent in the study area the hydrogeological units and sectors are identified. Water bearing formations in the study area are subdivided into two hydrogeological units namely weathered mantle and fissured formations and porous formations. The weathered formations and shallow alluvial formations and porous sand stones

FIGURE - 3.6



and tertiary formations constitute the shallow aquifers. The fissures and fractured formations of hard rocks and granular zones of unconsolidated sedimentary formations constitute the deeper aquifers.

The porous formations in the district include sandstones and clays of Recent to subrecent and Tertiary age (Quaternary). The Recent formations comprising mainly sands, clays and gravels are confined to major drainage courses in the district. The maximum thickness of alluvium is 45.0 m bgl, whereas the average thickness is about 25.0 m. Ground water occurs under water table and confined conditions in these formations and is being developed by means of dug wells and filter points. The productive zones are encountered in the depth range of 29.5 to 62 m bgl. Alluvium, which forms a good aquifer system along the Vaippar and Gundar river bed which is one of the major sources of water supply to the villages.

3.4.4 SOILS

The district is covered by Black Cotton soil in the west with isolated red soil patches in high ground. The sandy soil is present in the coastal tract. Alluvial soil is restricted to river flood plain and coastal part. Alkaline and saline soils are also noticed at places. Soil type and its fertility of an area are essential to plan for cropping. Soils are primarily derived from parent rocks. The colour, texture and mineral content are normally used to classify the soils. The soils in the study area are classified into 6 types. The soil map of the study area is prepared based on the National Bureau of Soil Survey and Land Use Planning (IOAR), Nagpur. The project site is located in the very deep, imperfectly drained, calcareous, cracking clay soils. The soil classification details are given in the **Table**.

DETAILS OF SOIL CLASSIFICATION

S.NO	SOIL CLASSIFICATION
1	Deep, imperfectly drained, calcareous, clayey soils
2	Moderately deep, somewhat excessively drained, gravelly clay soils
3	Very deep, excessively drained, sandy soils
4	Very deep, imperfectly drained, calcareous, cracking clay soils
5	Very deep, somewhat excessively drained, Loamy soils
6	Very deep, excessively drained, Sandy Soils

Soil classification map of the project site and its surroundings of 10 km radius are as shown in **Fig-3.7**.

3.4.4.1 SOIL QUALITY

Soil samples were collected from eight sampling locations within an area of 10 km radius around the Project site for analysis of the physico-chemical characteristics of the soil quality. **Fig-3.7** and **Table-3.6** shows the location of soil sampling stations.

TABLE-3.6
SOIL SAMPLING STATION

Code	Locations	w.r.t Project site	
		Distance[km]	Direction
S1	Project site	-	-
S2	Sillanattam	0.2	SE
S3	Rajavinkovil	1.8	SSW
S4	Pudiyamputtur	3.1	WSW
S5	Ottapidaram	4.7	WNW
S6	Lakshmipuram	1.0	NW
S7	Venkateshwarapuram	2.4	E
S8	Mel Arasadi	5.2	E

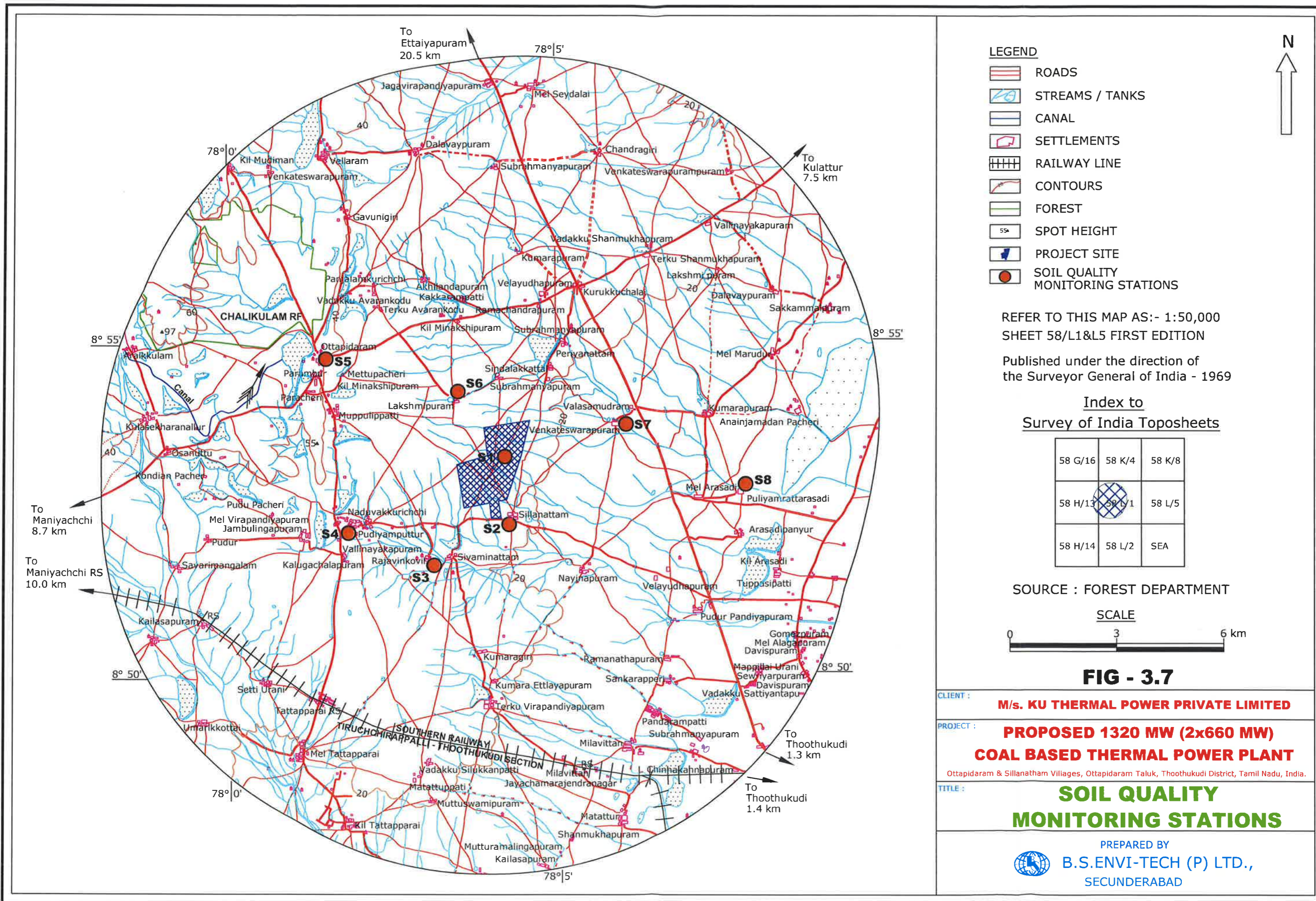
Results of soil sampling analysis are given in **Annexure - 3E**.

3.4.5 PHYSIOGRAPHY AND LANDUSE PATTERN

The study area exhibits plain terrain with a gentle slope towards east.

3.4.6 LAND USE PATTERN

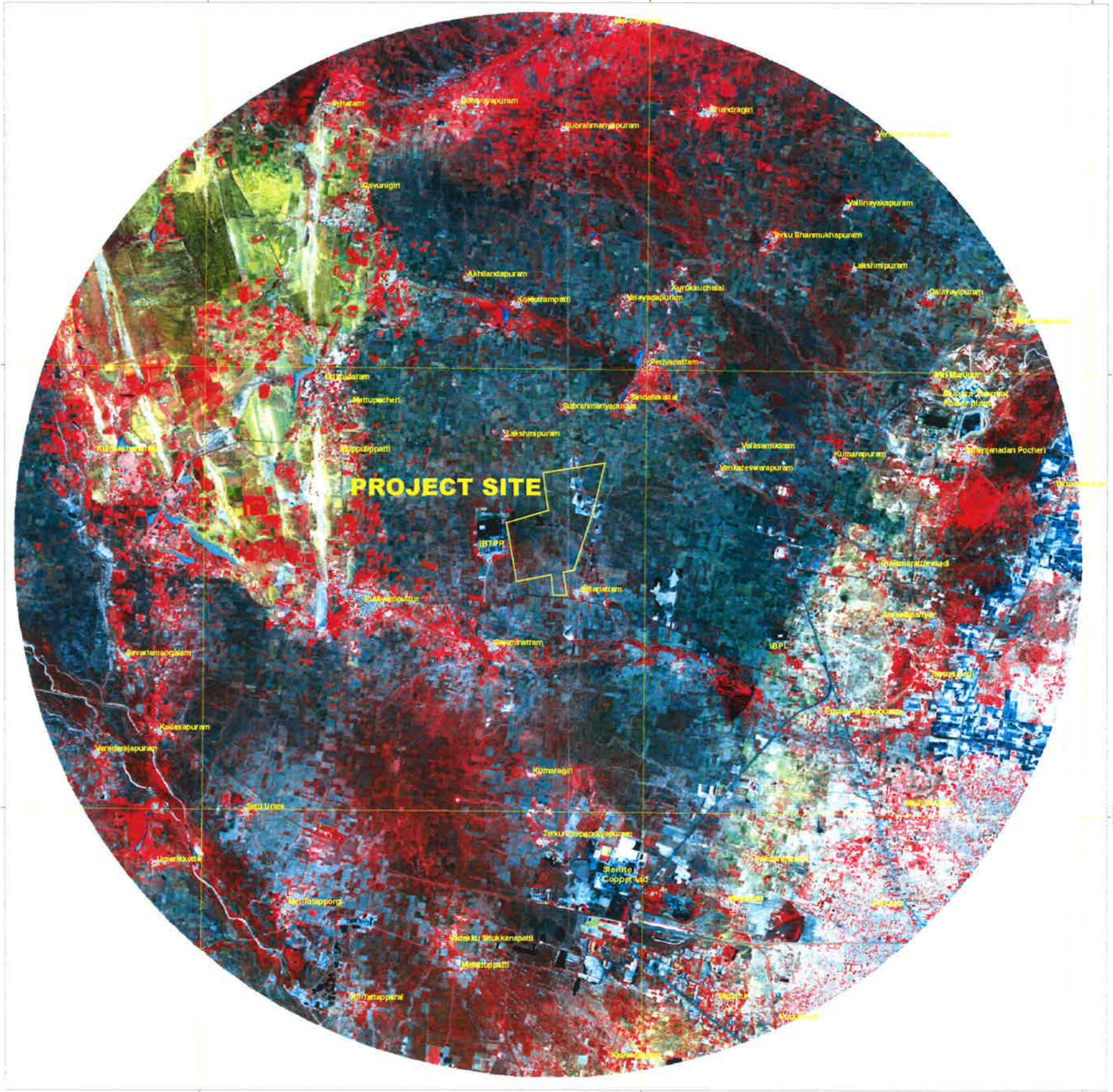
Landuse pattern of the study area has been assessed through Remote Sensing methodology using 1:50000 IRS-P6, LISS-IV MX data dated 02.06.2015 on 1:50000 scale. **Fig - 3.8** shows the satellite imagery of 10 km radius around the plant. Level - I landuse/ landcover categories identified in the area are built-up, agricultural land, wasteland, forest, water bodies and others. The land use pattern of the study area is given below and in detail presented in below.



High Resolution Satellite Image Showing 10 km Radius from Proposed Power Plant Site Near Ottapidaram Village, Tamilnadu

Satellite & Sensor: Resourcesat-2, LISS-IV FMX
Date of Acquisition : 02-Jun-2015

Topo Sheets: Part of 58 H/13 & 58 L/1



PROJECT SITE



1:50,000

FIG - 3.8

**SPATIAL DISTRIBUTION OF LEVEL-II LAND USE / LAND COVER
CLASSES WITH IN 10KM RADIUS AREA**

S. No.	Land use/Land cover categories	Area	
		In hectares	Percentage
1.	Built-up land Village / town	2557	8.10
	Industry	353	1.12
2.	Agricultural land Single crop	12568	39.80
	Double crop	8421	26.67
	Fallow land	424	1.34
	Agricultural Plantation	961	3.04
3.	Forest Scrub / Degraded Forest	1199	3.80
4.	Waste Lands Land with or without scrub	2191	6.94
5.	Water bodies River / Tank / Reservoir	1567	4.96
6.	Others Salt Pans	730	2.31
	Vacant Land	355	1.12
	Built-up under Development	101	0.32
	Quarry	147	0.48
	Total	31574	100.00

DESCRIPTION OF LAND USE/LAND COVER CLASSES

1. BUILT-UP LAND

It is defined as an area of human habitation developed due to non-agricultural activities. It comprises dwellings, roads, vacant land, etc. In the study area the built-up land consists of settlements like Naduvakkurichi, Ottapidaram, Mela Arasadi, Sankaraperi, V.Pudur, Milavittan and Mappilaiurani (CT)

The total area estimated in this category is 2910 Ha. or 9.22 % of the study area.

2. AGRICULTURAL LAND

It is defined as the land primarily used for cultivation of agricultural crops. Major crops in the area are like ground nut, sunflower

gossypium and several vegetable red chillies, Brinjal, Bhendi and leafy vegetable crops.

The main source of water for this activity is through canals/River/groundwater. The Agricultural land in the study area accounts for 22374 Ha. or 70.85 % of the total study area.

3. WASTELAND

These are the lands, which are lying un-utilised and can be brought under good vegetative cover. This category is mainly observed on the fringes of the forest areas which predominantly consists of shrubs and stoney waste. This category is observed in patches in the entire study area. It occupies an area of 2191 Ha. or 6.94 % of the total area.

4. WATER BODIES: RIVER/STREAM

These classes comprise areas of surface water either impounded in the form of ponds, lakes and flowing streams etc. The water bodies account for 1567 Ha. or 4.96 % of the total study area.

5. FOREST LAND

The Forest land in the study area accounts 1199 Ha. or 3.80 % of the total study area.

6. OTHERS

The other land in the study area accounts 1333 Ha. or 4.23 % of the total study area.

SALT PANS: The total land occupied by salt pan in the study area is 730 ha. The total salt pans in the study area are 712 which are at reaping stage and 363 salt pans filledup with water and yet to reach reaping stage. There are no abandoned salt pans in the study area.

The nearest salt pan is at 7.8 km. From 7.8 km the salt pans extend towards the sea in Eastern direction.

Fig - 3.9 shows the Landuse and Landcover map of 10 km radius.

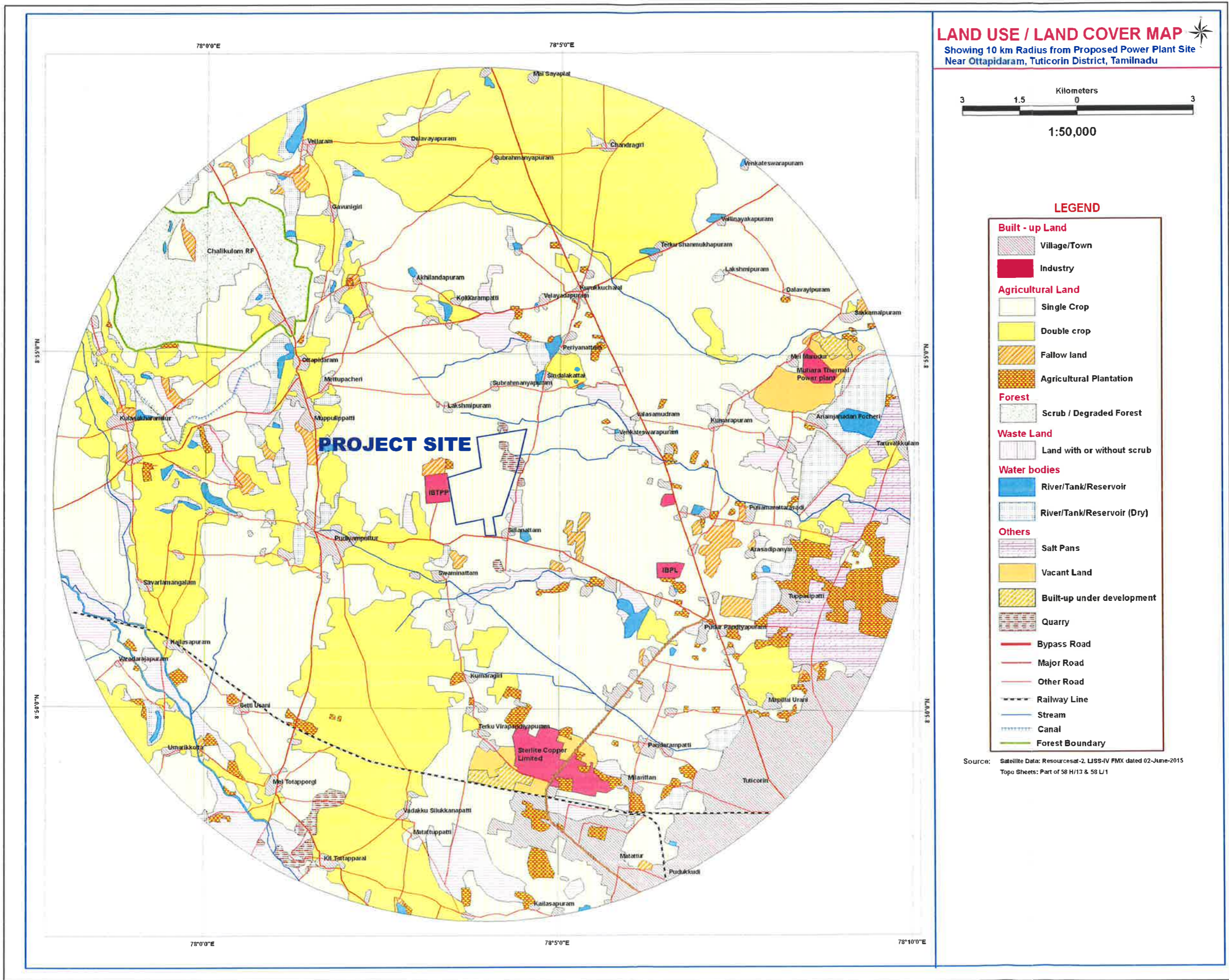


FIG - 3.9

3.5 FLORA AND FAUNA STUDIES

The data pertaining to Ecology was retained from the Earlier Final EIA report.

3.5.1 OBJECTIVES OF THE STUDY

The objectives of the present study were undertaken with a view to understand the biological resources.

The detailed studies mainly consists of

- Project site as core zone
- 10 km radius area around project site as buffer zone

The objectives of the study were to:

- Generate baseline data from field observations;
- Predict changes as a result of impact in the composition and functioning of components of the ecosystem;

3.5.2 METHODOLOGY FOR THE SURVEY

The study area for the ecological studies covers:

- Listing of the floristic and faunal species composition in study area
- Identification of sensitive locations or protected areas as per Wildlife Protection act, 1972.
- Identification of endemic, endangered, protected and vulnerable plant and medicinal plant and animal species

To accomplish above objectives, a general flora and faunal study in study area was carried out. The survey includes:

- Reconnaissance survey for the selection of sampling sites;
- Compilation of secondary data;
- Generation of primary data to understand baseline ecological status, important floristic and faunal elements, sensitive habitats and rare species; and
- Generation of data from local villagers about importance and status of plants and animals.

3.5.3 SECONDARY DATA

VEGETATION STRUCTURE OF TAMILNADU

The great plant wealth and diversity of Tamilnadu is due to immense variety of climate, altitude and edaphic factors. Vegetation of the state can be broadly divided into four categories.

- Coastal vegetation
- Island vegetation
- Vegetation of the interior plains; and
- Vegetation of the hills and mountains.

LITTORAL VEGETATION

The soil is sea sand often blown and accumulating in low dunes with adequate time, but poor in nitrogen and mineral nutrient. Most of these have been converted into Casuarina plantation. The forest type occurs in reserve forest of Pichavaram, the littoral forests consists of plant species *Borassus flabellifer*, *Anacardium occidentale*, *Lantana camara*, *Pandanus tectorius*, *Opuntia dillenii*, *Cassia auriculata*, *Sesuvium portulacastrum*, *Cyperus arenarius*. These are found in the chalikulam reserved forest of Thoothukudi district.

PLANTATION

The division contains plantations of cashew, *Eucalyptus* sp, *Casuarina*, *Bambusa arundanacea*, *Prosopis juliflora* and other miscellaneous species.

As per records of forest department and also physical walk through studies along coastal line in study area reveals that there are no mangrove forest blocks or mangrove dusters along the coast.

3.5.4 PRIMARY SURVEY-TERRESTRIAL

Preliminary surveys were conducted depending upon the phytogeographic conditions of the study area 8 terrestrial ecological locations is selected within 10 km of the study area. Only one reserve forest i.e. Chalikulam reserve forest and rest of the area vegetation is

open scrub type .The selected locations are given in **Table-3.7**. The locations are represented in **Fig-3.10**

TABLE-3.7 DETAILS OF TERRESTRIAL SAMPLING LOCATIONS

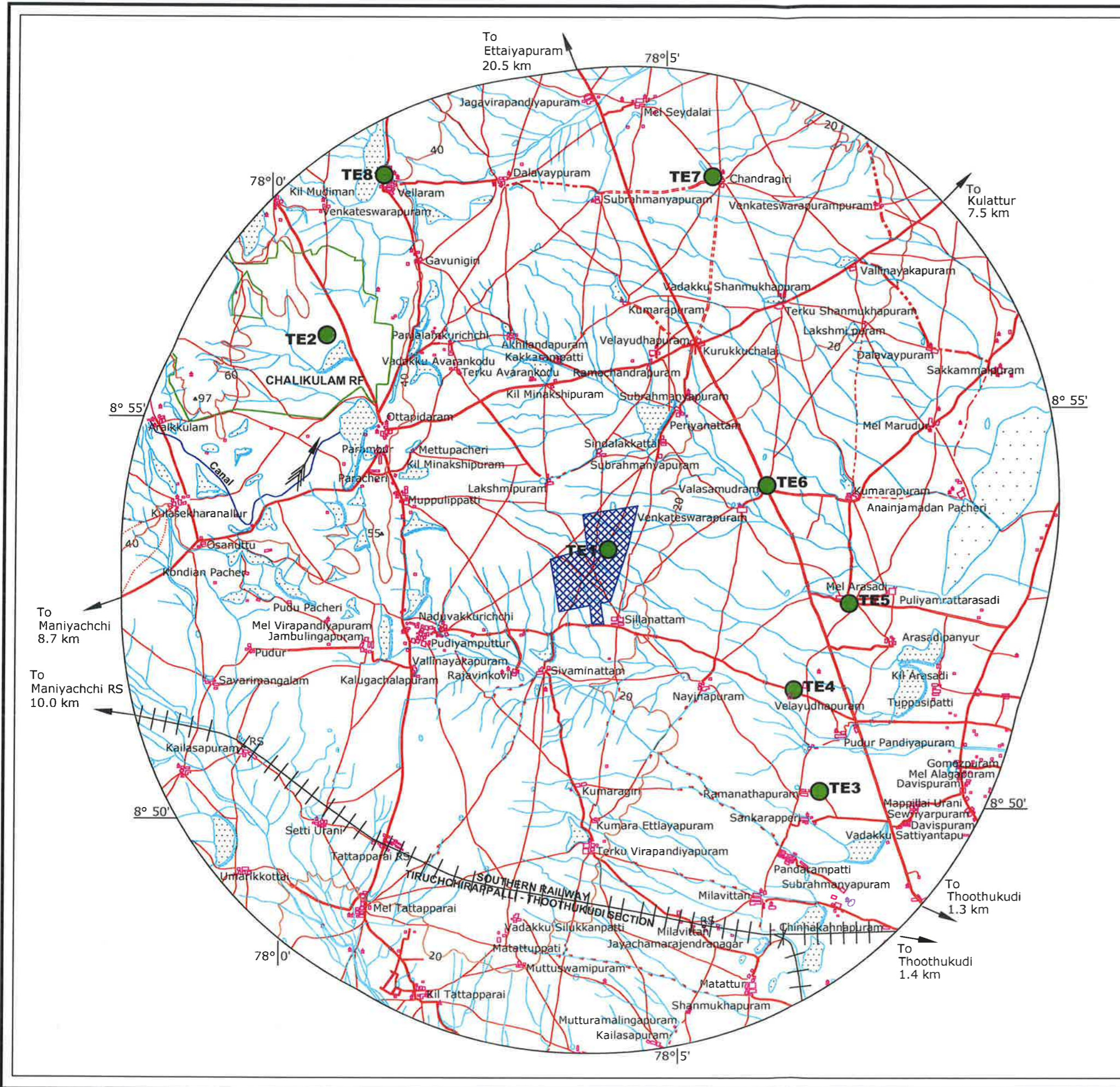
Location code	Name of the location	Distance from Site (km)	Direction from Project site
TE-1	Project site	-	-
TE-2	Chalikulam reserve forest	5.5	NW
TE-3	Ramnathpuram village	6.0	SE
TE-4	Velaudhypuram village	4.6	SE
TE-5	Mel arasadi village	5.2	E
TE-6	Valasmudram village	2.8	ENE
TE-7	Chandragiri village	7.7	NNE
TE-8	Vellaram village	8.7	NNW

3.5.4.1 METHODOLOGY

The sampling stations for terrestrial studies were selected at different locations to carryout phytosociological studies, Tree and shrubs were sampled by taking quadrates of 10 m² distributed randomly. Their girths (GBH) at 132 cm from ground were recorded. The herbaceous vegetation was also sampled by list count quadrate method. The data obtained was further used to estimate relative frequency, relative density, abundance, relative dominance and Importance value Index. Phytosociological parameters were calculated as presented in below Table.

DETAILS OF PHYTOSOCIOLOGICAL PARAMETERS

Sr. No.	PARAMETERS	DETAILS
1.	Basal area	$\frac{\text{Total basal area of species}}{\text{area sampled}}$
2.	Relative Basal area	$\frac{\text{Dominance for species}}{\text{Total dominance for all species}} \times 100$
3.	Density	$\frac{\text{Number of species}}{\text{Area Sampled}}$
4.	Relative Density	$\frac{\text{Number of species}}{\text{Area Sampled}} \times 100$
5.	Frequency	$\frac{\text{Number of pots in which species occurs}}{\text{Total number of plots sampled}}$
6.	Relative Frequency	$\frac{\text{Number of pots in which species occurs}}{\text{Total number of plots sampled}} \times 100$
7.	Importance value index	$\frac{(\text{Relative density} + \text{Relative dominance} + \text{Relative Frequency})}{100}$
8.	Shannon Weiner's Diversity Index	Where, $H = \sum \frac{n_1}{n} \log_2 \frac{n_1}{n}$ H = Shannon wiener diversity index n ₁ = number of individuals of each individual species in the sample. n = total number of individuals of all species in the sample.



- LEGEND**
- ROADS
 - STREAMS / TANKS
 - CANAL
 - SETTLEMENTS
 - RAILWAY LINE
 - CONTOURS
 - FOREST
 - SPOT HEIGHT
 - PROJECT SITE
 - TERRESTRIAL MONITORING STATIONS

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58 H/14	58 L/2	SEA

SOURCE : FOREST DEPARTMENT

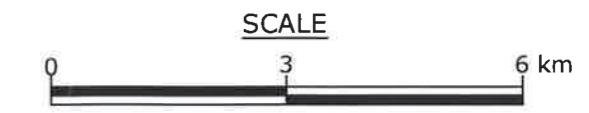


FIG - 3.10

CLIENT : M/s. KU THERMAL POWER PRIVATE LIMITED

PROJECT : PROPOSED 1320 MW (2x660 MW)
COAL BASED THERMAL POWER PLANT
Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.

TITLE : TERRESTRIAL MONITORING STATIONS

PREPARED BY
 B.S. ENVI-TECH (P) LTD.,
SECUNDERABAD

3.5.4.2 FLORISTIC COMPOSITION- PRIMARY SURVEY

LIFE FORM SPECTRUM

Raunkiaer defined life forms as the sum of adaptations of plants to climate. Braun-Blanquet (1951), whose system is adapted in this study, modified the Raunkiaer's system. Following six of the ten classes created by Braun-Blanquet is present in the study area and details are presented in below Table.

DETAILS OF RAUNKIAR CLASSIFICATION

Sr. No.	CLASSIFICATION	DETAILS
1.	Phanerophytes	Shrubs and trees
2.	Therophytes	annuals including ferns
3.	Hydrophytes	Water plants except plankton
4.	Hemicryptophytes	Plants with perennial shoots and buds close to surface
5.	Epiphytes	parasitic plants

During field survey, maximum 162 number of plant species (except algae, fungi and bryophytes) were recorded from the study area. Lists of all species recorded in the study area is enclosed as **Annexure-3F** and their analyses are presented in below Table.

CLASS WISE DISTRIBUTION OF PLANT SPECIES IN THE STUDY AREA

Type of Species	No.	%
Phanerophytes (P)	73	45.06
Therophytes (T)	48	29.62
Hydrophytes (H)	16	9.88
Hemicryptophytes (He)	21	12.96
Geophytes (G)	3	1.86
Epiphytes	1	0.62
Total	162	100

COMMENTS ON THE LIFE FORM SPECTRUM

In the study area, maximum number of species are phanerophytes (45.06%) followed by therophytes (29.62%). These classes are followed

by hemicryptophytes (12.96%) and hydrophytes (9.88%). Geophytes (1.86%) and Epiphytes were found in very few numbers.

Presence of large number of phanerophytes (shrubs and trees) and therophytes (annuals or herbaceous vegetation) indicates semi-arid to tropical vegetation structure.

3.5.5 IMPORTANCE VALUE INDEX AND DIVERSITY INDEX

The Importance Value Index (IVI) is a statistical quantity which gives an overall picture of the importance of the species in the vegetative community. It considers the relative values of density, frequency and basal area of every species in given area. It thus incorporates three important parameters which are measures of diversity and productivity of every species. In any community structure, the quantitative value of each of the frequency, dominance and density cover has its own importance. But the total picture of ecological importance cannot be obtained by one of these vegetation structure in respect to varying environmental factors can also be studied through such study of basal area, density and frequency of the community. The Importance value index as such, gives the total picture of sociological structure of species in a community but it does not give the dimension or share of relative values of frequency, density and dominance. The importance value varies between 1.17 and 55.02 and the highest IVI (55.02) for *Croton parsiflorus* recorded in pant site and lowest IVI (1.17) for *Sida acuta* recorded in pant site.

Diversity means variety or variability. Species diversity therefore refers to the variation that exists among the different living forms. It is estimated that there are more than 50 million different species of living organisms on the earth. With the growing concern of species going extinct at a very rapid pace, identification of the different species of plants and animals and conserving them is of primary importance. Species indicates the extent of biodiversity in the ecosystem. Species diversity is a statistical abstraction with two components. For better understanding of plant diversity, the Shannon-Weiner index of diversity was used. Diversity index is increasing with the floral spectra (more species means that more wide species diversity) that shows the undisturbed scenario of ecosystem. The index is given as;

$$H' = - \sum (P_i \ln P_i)$$

Where P_i = Proportional abundance of the i^{th} (individual) species

H' = Shannon-Weaver diversity index

The species diversity varies between 2.12-3.30 in studied population and highest was recorded in TE-1 (site) and lowest in TE-4 (Puliamarattarasadi). The species diversity indices are presented in below Table.

DETAILS OF IMPORTANCE VALUE INDEX AND DIVERSITY INDEX

Type of Species	Range of IVI	Diversity index
Herbaceous vegetation		
Project site	1.20-56.41	3.30
Chalikulam reserve forest	1.64-35.40	3.54
Ramnathpuram village	1.19-41.12	2.45
Velaudhypuram village	4.56-45.67	2.79
Mel arasadi village	4.12-42.54	2.76
Valasmudram village	3.45-56.68	2.34
Chandragiri village	3.21-45.21	2.67
Vellaram village	5.65-50.32	3.00
Perennial vegetation		
Pant site	2.21-28.41	1.12
Chalikulam reserve forest	6.7-66.45	3.69
Ramnathpuram village	2.56-41.21	2.67
Velaudhypuram village	6.71-45.21	2.12
Mel arasadi village	5.71-42.45	2.56
Valasmudram village	5.47-44.65	2.76
Chandragiri village	6.72-48.52	2.34
Vellaram village	5.62-46.78	2.56

3.5.6 FOREST BLOCKS IN STUDY AREA

As per forest records, there is only one reserved forest i.e. chalikulam R F exist in 10 km from Project site.

3.5.7 PLANTATIONS

Commercial plantations like Eucalyptus, Casuarina could be observed along the sea coast and open area, waste lands near village areas. Cashew, Guava and mango plantations are also recorded from these areas.

3.5.8 ENDANGERED PLANTS

Commercial plantations like Eucalyptus, Casuarina could be observed along the sea coast and open area, waste lands near village areas. Cashew, Guava and Mango plantations are also recorded from these areas.

3.5.9 TERRESTRIAL-FAUNA

3.5.9.1 FAUNA-PRIMARY SURVEY

Field observations studies were conducted in seven village areas and in Project site. The details are presented in below Table.

DETAILS OF FAUNAL SAMPLING LOCATIONS

Location Code	Name of the Location	Distance from Site (km)	Direction w.r.t Project site
TF-1	Project site	-	-
TF-2	Chalikulam reserve forest	5.1	NW
TF-3	Ramnathpuram village	6.2	SE
TF-4	Velaudhypuram village	4.8	SE
TF-5	Mel Arasadi village	5.2	E
TF-6	Valasmudram village	3.0	ENE
TF-7	Chandragiri village	8.5	NNW
TF-8	Vellaram village	7.6	NNE

MAMMALS

The commonly observed or reported mammals in study area are presented in below Table.

LIST OF MAMMALS OBSERVED IN THE STUDY AREA

Sr. No.	Zoological Name	Local Name	Conservation status as per Wild life Protection Act (1972)
1	Herpestres edwardsinyula	Common Mongoose	Part-II of Schedule -II
2	Lapus nigricollis	Indian Hare	Schedule-IV
3	Rousettus leschenaultia	Fruit Bat	Schedule-IV
4	Bandicota benghalensis	Bandicoot	Schedule-IV
5	Bandicota indica	Rat	Schedule-IV
6	Funumbuls palmarum	Squirrel	Schedule-IV
7	Mus rattus	Indian rat	Schedule-IV
8	Hystrix indica	Porcupine	Schedule-IV
9	Mus musculus	Common Mouse	Schedule- VI

AMPHIBIANS AND REPTILES

Amphibians are noticed mainly restricted to open waste land and marshy areas. Frogs and toads were present in this area. No tailed amphibians were cited in the survey. Reptilian fauna is comparatively rich; however below table gives the details of different amphibians and reptiles in the study area. 5 reptiles and 2 amphibians are recorded from study area.

LIST OF REPTILES AND AMPHIBIANS OBSERVED IN THE STUDY AREA

Sr. No.	Technical Name	Local Name	Conservation status as per Wild life Protection Act (1972)
Reptiles			
1	Hemidactylus sp	House Lizard	Schedule IV
2	Calotes vesicolor	Common garden lizard	Schedule IV
3	Chameleon zeylanicus	Indian chameleon	Schedule IV
4	Bangarus sp	Krait	Schedule-IV
5	Naja naja	Indian cobra	Schedule IV
Amphibians			
6	Rana tigrina	Common frog	Schedule IV
7	Bufo melanosticus	Toad	Schedule IV

LOCAL/ MIGRATORY BIRDS IN STUDY AREA

22 species of birds observed/recorded in the study area is presented in below Table. All species are local migrants only and falls under schedule-IV of Wildlife Protection Act, 1972.

LIST OF BIRDS OBSERVED IN THE STUDY AREA

Sr. No.	Technical Name	Local Name	Conservation status as per Wild life Protection Act (1972)
1.	Phalacrocorax niger	Little cormorant	Schedule IV
2.	Ardea purpurea manilensis	Eastern purple heron	Schedule IV
3.	Ncticorax nycticorax	Night heron	Schedule IV
4.	Ardea gray if gray if	Paddy bird	Schedule IV
5.	Egretta garzetta	Little Egret	Schedule IV
6.	Bubulcus ibis	Cattle Egret	Schedule IV

Sr. No.	Technical Name	Local Name	Conservation status as per Wild life Protection Act (1972)
7.	Haliastur Indus	Brahmny kite	Schedule IV
8.	Milvus migrans	Pariah kite	Schedule IV
9.	Eudynamis scolopaceus	Koel	Schedule IV
10.	Coracias benghalensis indica	Southern Indian roller	Schedule IV
11.	Acridotheres tristis tristis	Common myna	Schedule IV
12.	Corvus splendens portugatus	Ceylon house crow	Schedule V
13.	Passer domesticus indicus	Indian house sparrow	Schedule IV
14.	Orthotomus sutorius	Tailor bird	Schedule IV
15.	Aythya ferina	Common pochard	Schedule-IV
16.	Nettapus cormanadalincicus	Common teal	Schedule-IV
17.	Perdu asiatica	Jungle bush quail	Schedule-IV
18.	Pavo cristatus	Peacock	Schedule-I
19.	Burhinus oediceus	Satone curlew	Schedule-IV
20.	Streptopelia chinensis	Spotted dove	Schedule-IV
21.	Psittacula cyanocephala	Parakeet	Schedule-IV
22.	Contopus sinensis	Crow pheasant	Schedule-IV
23.	Passer domesticus	House sparrow	Schedule-IV

BUTTERFLIES

A total of 4 species of butterflies are recorded in the study area. The lists of identified butterflies from study area are presented in below Table.

LIST OF BUTTERFLIES OBSERVED IN THE STUDY AREA

Sr. No.	Technical Name	Local Name	Conservation status as per Wild life Protection Act (1972)
1	Euploca cora	-	Schedule-IV
2	Euploca crassa	-	Schedule-IV
3	Euploca dicciotianua	-	Schedule-IV
4	Graphlum agamemnos	Tailed jay	Schedule-IV

ENDANGERED ANIMALS

A comprehensive Central Legislation namely Wild Life (Protection) Act was enforced in 1972 to provide protection to wild animals. Schedule-I of this act contains the list of rare and endangered species, which are completely protected throughout the country. The list of wild animals and their conservation status as per Wild Life Act (1972) are presented in above Tables. 42 species recorded/reported from study area, out of which 1 species belongs to schedule-II and rest of the animals belongs to schedule-IV of Wildlife protection Act, 1972 and there are no endangered, threatened wild animal species in study area.

3.6 SOCIO ECONOMIC ENVIRONMENT

The description of the demographic and socio-economic environment within the study area is based on Census Data (CD based data) of Thoothukudi District. Presently, the study area falls in Thoothukudi district of Tamilnadu state.

The census data has been analyzed with respect to various demographic and socio-economic parameters for the study area and the results are represented in the following sections. Further, as the population consists of nearly equal parts of rural and urban population, the census data has also been analyzed with respect to rural and urban category.

POPULATION

The population profile shows that total population of the study area villages is 335040.

The villages falling in this Study area are Sindalakottai, Minakshipuram, Swaminatham, Venkateswarapuram, Lakshmiapuram, Ottapidaram, Jambulingapuram, Kalugachalapuram, Kumaragiri, Kumara Ettaiyapuram, Valasamuthram, Ramachandrapuram, Mela Arasadi, Ramanathapuram, Pudur pandiyapuram, T.Shanmugapuram, Lakshmiapuram, Chandragiri, Milavittan (CT), Mela Maruthur, Keela Arasadi, Govindapuram, K.Shanmukapuram, Umarikottai, Vellaram etc.

The total population density of the study area is about 1067 persons/sq. km. The population profile of the study area is given in **Annexure – 3G**.

**Population, Household Size & Sex Ratio (Females per 1000 Males)
 In The Study Area**

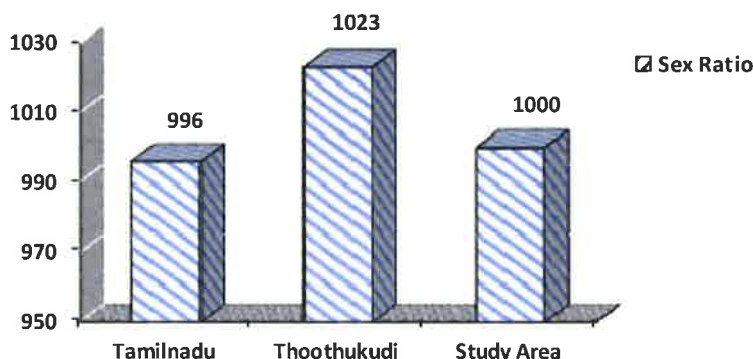
	Total (0-10 km)
Household	88711
Population	335040
Male Population	167818
Female Population	167522
Household Size	3-4
Sex Ratio	1000

Source: - Census: 2011

SEX RATIO

The sex ratio (No of females per thousand males) for the state (Tamilnadu) and district (Thoothukudi) is 996 and 1023 respectively. The average sex ratio in the whole study area is 1000 (as per census 2011). The details are given in **Annexure – 3G**. Comparative Sex Ratio is given in below Figure.

Sex Ratio in the Study Area



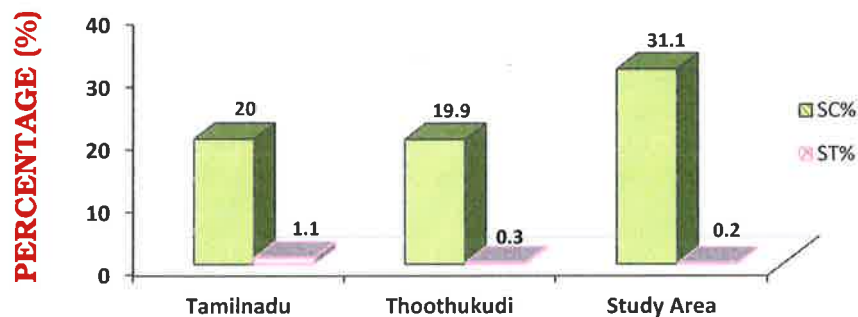
Scheduled Caste (SC) & Scheduled Tribe (ST) Population

The Percentage of SC population for state (Tamilnadu) and district (Thoothukudi) is 20.0% and 19.9% respectively. The percentage of SC population for the whole study area is 31.1%, which is higher than state and lower than district when compared with SC population percentage.

The percentage of ST population for state and district is 1.1% and 0.3% respectively. The percentage of ST population for the whole study area is 0.2%, which is lower than the state and district ST population percentage.

Comparative analysis of SC & ST population is given in below **Figure**. The details of SC & ST population are given in **Annexure- 3G**.

Comparative Analysis of SC & ST Percentage in the Study Area



LITERACY

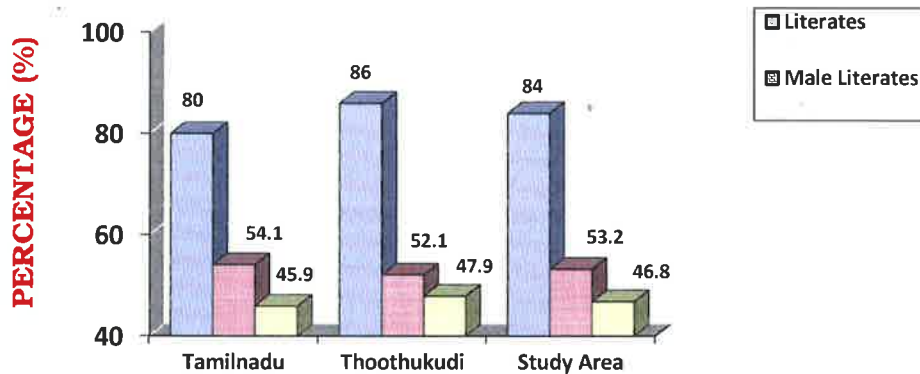
The literacy level for the state and district is 80.0% and 86.0% respectively. The literacy percentage of the whole study area is 84.0%, which is higher than state and lower than district level.

The literacy level of the male population for the state and district is 54.1% and 52.1% respectively. The literacy level of male population for the study area is 53.2% which is lower than state and higher than district level.

The literacy level of the female population for the state and district is 45.9% and 47.9% respectively. The literacy level of female population for the study area is 46.8% which is higher than state and lower than district level.

The Literacy status of the study area is given in **Annexure-3G**. Comparative analysis of literacy level is given in below **Figure**.

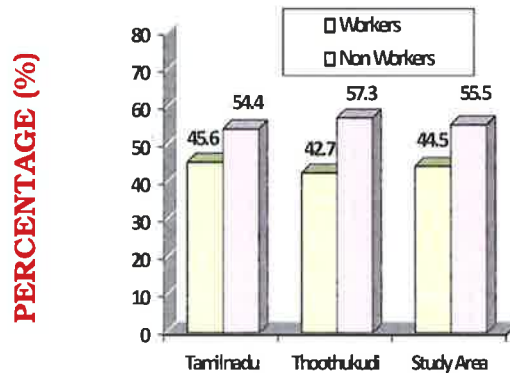
Comparative Analysis of Literacy Level in the Study Area



ECONOMIC PATTERN AND LIVELIHOOD

Total work participation rate in whole study area is 44.5% of the total population, which is lower than the state and higher than district worker participation rate (45.6% & 42.7% respectively). The main workers in the whole study area are 84.0% and marginal workers are 16.0% of the total labor force.

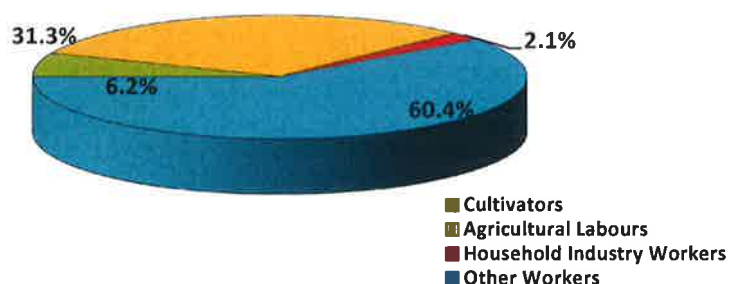
Comparative Analysis of the workforce in the Study Area



The employment pattern in the villages suggest that only 6.2% work as cultivators, 31.3% as agricultural labors, 60.4% as other workers and 2.1% as household industry workers. Most of the villagers are agriculturists. The occupation status in the study area is given in **Annexure-3G**.

Comparative analysis of zone wise work force is given in below **Figure**

Comparative Analysis of Economic Activity in the Study Area



The male workers in the study area account to 65.9% of the total working population. The female workers in the study area account to 34.1% of the total working population.

It has been observed that household activities such as pre-cooking, cooking, post-cooking, washing clothes, cleaning house, collection of fuel wood, care of children are left to women with negligible involvement of men. The details are given in below **Table**.

Work Participation: Male & Female

Category	Study Area			
	Male		Female	
	No.	%	No.	%
Total Workers	98195	65.9	50923	34.1
Main Workers	86716	69.2	38595	30.8
Marginal Workers	11479	48.2	12328	51.8
Cultivators	6071	65.5	3204	34.5
Agricultural Laborers	21558	46.3	25045	53.7
Household Industries	1487	46.7	1696	53.3
Other Workers	69079	76.7	20978	23.3

3.6.1 INFRASTRUCTURAL FACILITIES AND AMENITIES:

The infrastructure and amenities available in the area denote the economic wellbeing of the region. A review of infrastructural facilities available in the study area has been done based on the information given in the amenities census data (village level).

HOUSING

Housing facilities are provided in most of the villages.

DRINKING WATER

All the villages in the study area have drinking facility (Tap water, Well water, Tank water, Tube well water, Hand Pump, River water and other sources). The details of water sources available in villages are detailed as below:

Water source for drinking	No. of villages
Hand pumps	26
Open wells	26
Tap water	48
Tube Well	38
River Water	46

Source: Census: 2011

TRANSPORT & COMMUNICATION

Transport accessibility is one of the important factors required for the overall development of the area. Transportation and communication facility needs to be strengthened before any major development process is established. The study area is well connected by road. Most of the villages in the study area have road network services. Government bus services are available in some of the villages in the study area.

The details of communication facilities available in the study area are given below:

Total no. of villages in study area	44
Total No. of bus facilities in the study area	115
Total No. of rail facilities in the study area	86
Total No. of Black Topped (pucca) Road in the study area	44
Total No. of Gravel (kuchha) Road in the study area	51
Total No. of approach Foot path in the study area	44

Source: - Census: 2011

MARKET FACILITIES

Commercial activities form the backbone of the economy. The study tends to tell the kind of employment it generates to people of the area and kind of services it provides to attain better living. Major market facilities are available at Ottapidaram.

MEDICAL FACILITIES

The details of medical facilities available in the study area are given below:

Total No. of villages in study area	44
Total No. of medical facility	45
No. of villages having primary health center	64
No. of villages having Child welfare center	84
No. of villages having Maternity home	

Source: - Census: 2011

EDUCATIONAL FACILITIES

The details of educational facilities available in the study area are given below:

Total no. of villages in study area	44
Total no. of primary school facility	417
Total no. of middle school facility	177
Total no. of secondary school facility	173
Total no. of Senior secondary school facility	174
Total no. of college facility	520

Source: - Census: 2011

ELECTRICITY

In the study area, all the villages have electricity connection for their daily activities.

POST AND TELEGRAPH

The details of postal and telegraph facilities available in the study area are given below:

No. of villages having post office facility	83
No. of telephone connections available in the study area	44

Source: - Census: 2011

3.6.2 FOCUS GROUP DISCUSSIONS (FGD) & PRIMARY SURVEY

Focus Group Discussions (FGD) was done in 15 villages, in each and every village/Gram Panchayat office, to get the more insight and information about the socio-economic conditions of the villagers.

TOTAL NO OF MEMBERS ATTENDED THE FOCUS GROUP DISCUSSION (FGD) AND THEIR FAMILY PARTICULARS AND FAMILY SIZE.

Village	Total No of people attended the FGD	Total No of Family Members	Male	Female	Family size	No of Literates from the total family
3-5 Kms Radius						
Sindalakottai	10	40	28	12	4.0	35
Subramaniapuram	10	42	24	18	4.2	25
Minakshipuram	10	55	35	20	5.5	38
Swaminattham	10	32	20	12	3.2	25
Periyanattham	10	25	15	10	2.5	15
Rajavinkovil	10	35	24	11	3.5	26
Sillanatham	10	35	22	13	3.5	24
Pudiyamputhur (Part)	10	45	30	15	4.5	28
Naduvakkurichi	10	50	20	30	5.0	30
Nainarpuram	10	25	15	13	2.5	10
Sub-Total	100	384	233	154	3.8	256
3-5 Km						
Ottapidaram	10	45	30	15	4.5	26
Jambulingapuram	10	40	15	25	4.0	15
Kalugachalapuram	10	30	20	19	3.0	15
A.Velayudhapuram	10	40	15	25	4.0	15
Valinayakapuram	10	30	15	15	3.0	20
Sub-total	50	185	95	99	3.7	91
Grand Total	150	569	328	253	3.8	347

AVAILABLE DRINKING WATER FACILITIES IN THE STUDY AREA

SL No	Name of the village	Common Tap	Hand pump(HP)	Tube well(TW)	Power	R.O.Plant
0-3 Kms						
1	Sindalakottai	Tap	HP	-	YES	--
-2	Subramaniapuram	Tap		-	YES	--
3	Minakshipuram	Tap	HP	--	YES	--
4	Swaminattham	Tap	HP	--	YES	--
5	Periyanattham	Tap	HP	--	YES	--
6	Rajavnkovil	Tap	HP	--	YES	--
7	Sillanatham	Tap	HP	--	YES	--
8	Pudiyamputhur (Part)	Tap	HP	--	YES	--
9	Naduvakkurichi	Tap	HP	--	YES	--
10	Nainarpuram	Tap	HP	--	YES	--
3-5 kMS						
1	Ottapidaram	Tap	HP	--	YES	--
2	Jambulingapuram	Tap	HP	--	YES	+2 Km.
3	Kalugachalapuram	Tap	HP	--	YES	--
4	A.Velayudhapuram	Tap	HP	--	YES	--
5	Valinayakapuram	Tap	HP	--	YES	--

Source: FGD discussions, and personal observations in the village

COMMUNICATION, ROAD AND TRANSPORT

Development of communication, Road connectivity has generally been viewed as the most important economic infrastructural development. Economic benefits such as increased income, employment, productivity gain, better income distribution and opportunity for diversification can be generated through rural roads. Roads, communication bring better access to markets, higher prices for produce, and better access to health and educational facilities. Rural roads and transport allow better access to agricultural inputs like fertilizers and allow them to better market their surplus.

VILLAGES BY TYPE OF COMMUNICATION FACILITIES AVAILABLE

SL No	Name of the village	Post office	Bus stand/Stop	Bus frequency	Pucca/ Kutcha Road	Railway station
0-3 Kms						
1	Sindalakottai	2	1	2	1	2
2	Subramaniapuram	2	1	2	1	2
3	Minakshipuram	2	1	2	1	2
4	Swaminattham	2	1	2	1	2
5	Periyannattham	2	1	2	1	2
6	Rajavnkovil	2	1	2	1	2
7	Sillanatham	1	1	1	2	2
8	Pudiyamputhur (Part)	1	1	1	1	
9	Naduvakkurichi	1	1	1	2	2
10	Nainarpuram	2	1	2	1	2
3-5 Kms						
1	Ottapidaram	1	1	1	1	2
2	Jambulingapuram	1	1	1	1	2
3	Kalugachalapuram	2	1	2	1	2
4	A.Velayudhapuram	2	1	1	1	2
5	Valinayakapuram	2	1	2	1	2

1= Yes available 2 =No Not available

Source: Personal observations and FGD discussions

VILLAGES BY TYPE OF MEDICAL FACILITY AVAILABLE

SL No	Name of the village	MCW	Sub-Center	PHC	Hospital	RMP	Other Dispensary
0-3 Kms							
1	Sindalakottai	5 Kms	5+	5+	5+	5	
2	Subramaniapuram	+ 2Km	2+	10+	10+	+15	15+
3	Minakshipuram	2+	5+	10+	10+	2+	
4	Swaminattham	3+	5+	5+	5+	5+	
5	Periyannattham	5+	5+	5+	5+	3+	
6	Rajavnkovil	5 Kms	5 Kms	5+	5+	5+	
7	Sillanatham	+ 2Km	+ 2Km	5+	5+	5+	
8	Pudiyamputhur (Part)	2+	2+	PHC		RMP	Others
9	Naduvakkurichi	3+	Sub-C	5+	5+	5+	
10	Nainarpuram	5+	5+	5+	5+	5+	
3-5 Kms							
1	Ottapidaram				Hospital	RMP	Others
2	Jambulingapuram	5+	5+	5+	5+	5+	
3	Kalugachalapuram	2+	10+	10+	2+	10+	
4	A.Velayudhapuram	5+	10+	10+	5+	10+	
5	Valinayakapuram	5+	5+	5+	5+	5+	

Source: Distances are approximate and given by the Local people at FGD.



AVAILABLE EDUCATIONAL INSTITUTIONS IN THE STUDY AREA

SL No	Name of the village	Primary School	Middle school	High school (Km)	Adult center	Matric	College (Kms)	Others
0-3 Kms								
1	Sindalakottai	P	M<5 K	<10	AC	--	15	--
2	Subramaniapuram	P	M<5K	<5	AC	--	15	--
3	Minakshipuram	P	M<5 K	<5	AC	--	15	--
4	Swaminattham	P	M<5K	<5	AC	--	15	--
5	Periyanttham	P	M<5 K	<5	AC	--	15	--
6	Rajavnkovil	P	M<5K	<5	AC	--	15	--
7	Sillanatham	P	M<5 K	<5	AC	--	15	--
8	Pudiyamputhur (Part)	P	M<5K	<5	AC	--	15	--
9	Naduvakkurichi	P	M<5 K	<5	AC	--	15	--
10	Nainarpuram	P	M<5K	<5	AC	--	15	--
3-5 Kms								
1	Ottapidaram	P	M	<2	AC	--	15	--
2	Jambulingapuram	P	M<5 K	<5	AC	--	15	--
3	Kalugachalapuram	P	M<5K	<2	AC	--	15	--
4	A.Velayudhapuram	P	M<5 K	<5	AC	--	15	--
5	Valinayakapuram	P	M<5K	<2	AC	--	15	--

Source: Personal observation and FGD discussions with the villagers

AVAILABILITY OF CREDIT AGENCIES

Availability of credit facility in any area will definitely boost the economy of the individual but also whole Nation. The data is given in below table reveals the availability of credit agencies in the Ottapidaram taluk.

AVAILABLE CREDIT AGENCIES IN THE STUDY AREA

SL No	Name of the village	Commercial banks	Co-operative societies	Ag.Credit /Co-op-soc.	Non-Ag/Co-op/Soc.	Other /Co-op. Societies
0-3 Kms						
1	Sindalakottai	2	2	2	2	2
2	Subramaniapuram	2	2	2	2	2
3	Minakshipuram	2	2	2	2	2
4	Swaminattham	2	2	2	2	2
5	Periyanttham	2	2	2	2	2
6	Rajavnkovil	2	2	2	2	2
7	Sillanatham	2	2	2	2	2
8	Pudiyamputhur (Part)	1	1	1	1	1
9	Naduvakkurichi	1	1	1	1	1
10	Nainarpuram	2	2	2	2	2
3-5 Kms						
1	Ottapidaram	1	1	1	2	1
2	Jambulingapuram	2	2	2	2	2
3	Kalugachalapuram	2	2	2	2	2
4	A.Velayudhapuram	2	2	2	2	2
5	Valinayakapuram	2	2	2	2	2

Source: Personal observations and FGD discussions



CASTE PROFILE

The caste profile presented in below table denoted that majority belongs to Scheduled Caste (34.7%) followed by Yadav (24.0%), Vada Nayakar (22.0%), K.Nayaar (19.3%) in the study villages.

DISTRIBUTION OF MEMBERS ACCORDING TO CASTE WISE IN SAMPLE VILLAGES

S. No	Name of the village	Total No of people attended the FGD	Yadav	Vada Nayakar	K.Nayakar	Scheduled Caste
1	Sindalakottai	10	4	2	1	3
2	Subramaniapuram	10	3	3	2	2
3	Minakshipuram	10	2	4	1	3
4	Swaminattham	10	3	2	1	4
5	Periyanattham	10	3	1	3	3
6	Rajavnkovil	10	2	1	3	4
7	Sillanatham	10	2	2	3	3
8	Pudiyamputhur (Part)	10	1	3	2	4
9	Naduvakkurichi	10	2	2	1	5
10	Nainarpuram	10	2	2	1	5
	Sub-total	100	24	22	18	36
	3-5 Kms					
1	Ottapidaram	10	4	3	2	1
2	Jambulingapuram	10	2	2	3	3
3	Kalugachapuram	10	2	3	2	3
4	A.Velayudhapuram	10	1	1	2	6
5	Valinayakapuram	10	3	2	2	3
	Sub-total	50	12	11	11	16
	Grand Total	150	36	33	29	52
	%	100.0	24	22	19.3	34.7

LITERACY LEVEL

Literacy is one of the important factors for human resource development. The Literacy level in overall study area is 347 members out of the total 569 members. Out of the 347 total males 205 (59.7%) and 142 (40.9%) are females. Among the total 52.4% are illiterate, 20.5% are Primary, 19.9% are literates, 3.1% are high school, 2.6% are above 2.0% are Degree.

LITERACY LEVEL OF THE MEMBERS IN THE STUDY AREA

SLNo	Illiterate			Primary			Literate			High school			Above+			Degree			Total		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
Sindalakottai	10	10	20	2	7	9	4	0	4	0	0	0	0	0	0	2	0	2	18	17	35
Subramaniapuram	10	4	14	3	2	5	1	5	6	0	0	0	0	0	0	0	0	0	14	11	25
Minakshipuram	10	10	20	4	3	7	8	3	11	0	0	0	0	0	0	0	0	0	22	16	38
Swaminattham	6	8	14	5	2	7	3	0	3	0	0	0	0	0	0	0	0	0	15	10	25
Periyanattham	3	3	6	1	2	3	4	2	6	0	0	0	0	0	0	0	0	0	8	7	15
Rajavnkovil	10	7	17	2	2	4	2	3	5	0	0	0	0	0	0	0	0	0	14	12	26

SLNo	Illiterate			Primary			Literate			High school			Above+			Degree			Total		
Sillanatham	10	5	15	3	1	4	5	0	5	0	0	0	0	0	0	0	0	0	18	6	24
Pudiyamputhur (Part)	2	10	12	2	2	4	4	0	4	4	0	4	4	0	4	0	0	0	16	12	28
Naduvakkurichi	5	9	14	3	1	4	4	2	6	3	0	3	0	0	0	0	0	0	18	12	30
Nainarpuram	3	5	8	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	5	5	10
Sub-total	69	71	140	27	22	49	35	15	50	7	0	7	4	0	4	2	0	2	148	108	256
Ottapidaram	1	8	9	3	2	5	2	0	2	4	0	4	5	0	5	3	0	3	16	10	26
Jambulingapuram	2	2	4	2	0	2	7	2	9	0	0	0	0	0	0	2	0	2	13	2	15
Kalugachalapuram	4	4	8	4	3	7	2	0	2	0	0	0	0	0	0	0	0	0	8	7	15
A.Velayudhapuram	5	5	10	3	0	3	2	0	2	0	0	0	0	0	0	0	0	0	10	5	15
Valinayakapuram	3	8	11	3	2	5	4	0	4	0	0	0	0	0	0	0	0	0	10	10	20
Sub-total	15	27	42	15	7	22	17	2	19	4	0	4	5	0	5	5	0	5	57	34	91
Grand total	84	98	182	42	29	71	52	17	69	11	0	11	9	0	9	7	0	7	205	142	347

OCCUPATIONAL PROFILE

The occupational profile of the sample households indicates that majority are engaged in Agriculture labour work (40.7%), next is agricultural activity (28.1%), Mining activity (12.8%), and 18.3 % are accounted unemployed.

OCCUPATIONAL CATEGORY AMONG THE TOTAL FAMILY MEMBERS

S.No	Village	Cultivators	Mining activity	Ag. Labour	Unemployed	Total Family members
1	Sindalakottai	5	6	20	9	40
2	Subramaniapuram	10	10	20	2	42
3	Minakshipuram	20	3	20	12	55
4	Swaminattham	10	7	10	5	32
5	Periyangattham	8	3	10	4	25
6	Rajavnkovil	10	4	10	11	35
7	Sillanatham	8	4	15	8	35
8	Pudiyamputhur (Part)	10	5	20	10	45
9	Naduvakkurichi	15	5	25	5	50
10	Nainarpuram	5	5	15	3	28
	Sub-total	101	49	165	69	387
	3-5 Kms.					
1	Ottapidaram	25	10	12	3	50
2	Jambulingapuram	14	3	10	18	45
3	Kalugachalapuram	9	3	15	2	29
4	A.Velayudhapuram	6	10	20	4	40
5	Valinayakapuram	4	3	10	13	30
	Sub-total	59	24	67	35	194
	Grand Total	160	73	232	104	581

INCOME PROFILE

The income Profile of the study area is presented in below table

ANNUAL INCOME PROFILE OF THE MEMBERS IN THE STUDY AREA

S.No	Village	Up to Rs 12000/-	Rs 12000 /- -Rs 25000/-	Total Members
1	Sindalakottai	40	10	50
2	Subramaniapuram	20	8	28
3	Minakshipuram	20	26	46
4	Swaminattham	20	20	40
5	Periyanattham	15	15	30
6	Rajavinkovil	25	10	35
7	Sillanatham	20	20	40
8	Pudiyamputhur (Part)	20	20	40
9	Naduvakkurichi	22	28	50
10	Nainarpuram	15	13	28
	Sub-total	217	170	387
	3-5 Km			
1	Ottapidaram	25	20	45
2	Jambulingapuram	20	20	40
3	Kalugachalapuram	15	17	32
4	A.Velayudhapuram	25	20	45
5	Valinayakapuram	12	20	32
	Sub-total	97	97	194
	Grand Total	314	267	581

HEALTH PROFILE/DISEASE PATTERN

There are two Public health centers and one ANM center in the study area. One Govt. Hospital at Ottapidaram, one near Kailsauram, and other ANM center at Kutukuchallai. During discussions common diseases like cough, cold, and seasonal ailments were noticed to be prevailing. The hospital authorities gave the following information for a period of 01/05/2015 to 15/05 for the treatments they have undertaken. The Table below shows the list of diseases in the entire taluk, and other one is at Kailsapuram. There are 14 T.B. cases, 3 Thyroid, and 10 Asthmas cases recorded. The Major reasons given by Kailsapuram PHC is due to Sheep rearing the T.B is prevalent, in the second PHC, and the villagers expressed that due to burning of used tyres in the area. Some of the major diseases recorded by the Govt.Hospital Ottapidaram are Lower Respiratory Tract infection, Osteoarthritis, Upper Respiratory Tract infection, Dizziness and

Giddiness, Abrasion, Myalgia, Asthma, Acid Peptic Disease Essential – Hypertension.

KIDNEY PROBLEMS

Out of 15 villages no Kidney problem case was observed. Govt. hospital medical records given by the Ottapidaram Taluk also confirms this.

SALT PANS

The District constitutes 70 percent of total salt production of Tamil Nadu. Thoothukudi is the second largest producer of Salt in India next to Gujarat. Some health problems (skin diseases) may be caused due to standing in the salt water for long time. But it was observed that within the radius of 3-5 Kms in surveyed villages, nobody is working in the salt pan, and no diseases were reported in the study area. **(Discussions with the Focussed Group Discussions with the villagers confirm this statement).**

DISEASE PATTERN IN OTTAPIDARAM TALUK OF TUTICORIN DISTRICT

S.No	Name of the Disease	Adult		Child		Total
		Male	Female	Male	Female	
1	Lower Respiratory Tract infection	145	179	93	88	505
2	Osteoarthritis	139	242	2	1	384
3	Upper Respiratory Tract infection	79	99	30	57	265
4	Dizziness and Giddiness	56	150	3	5	214
5	Abrasion	77	33	31	49	190
6	Myalgia	39	103	2	2	146
7	Asthma	54	48	3	1	104
8	Acid Peptic Disease	37	63	3	1	104
9	Essential Hypertension	50	44	0	1	95
10	Chronic Obstructive Pulmonary disease	49	40	2	1	92
11	Prunitis	30	43	2	6	91
12	Pulmonary Tuberculosis	37	33	4	1	75
13	Worm infestation	14	26	10	15	65
14	Diabetes Mellitus	32	33	0	0	65
15	Impetigo	3	2	35	24	64
16	Dog bite	21	21	14	2	58
17	Pharyngitis	10	31	9	4	54
18	Acute Gastroentris	14	19	9	7	49
19	Leg Umbers	21	3	1	3	28

S.No	Name of the Disease	Adult		Child		Total
		Male	Female	Male	Female	
20	No Diagnosis entered	14	10	1	0	25
21	Conjunctivitis	4	12	3	1	20
22	Labour Natural	0	17	0	0	17
23	Cellulitis	7	8	1	0	16
24	Female Pelvic inflammatory disease	0	15	0	0	15
25	Amenorrhea	0	15	0	0	15
26	Dental-Dental caries with Pulpitis	6	5	2	0	13
27	Allergic contact Dermatitis	3	6	1	3	13
28	Tubectomy	0	11	0	0	11
29	Urinary Tract infection	4	7	0	0	11
30	Scabies	6	2	1	2	10
31	Enteric Fever	4	3	1	2	10
32	Seizure Disorders	3	4	2	1	10
33	Ischemic Heart disease	2	8	0	0	10
34	Labour natural with Lp	0	9	0	0	9
35	Asthmatic Bronchitis	3	4	0	0	7
36	Dental care with Apical Periodontal	6	1	0	0	7
37	Hypothyroidism	1	5	0	0	6
38	Dermatis	1	3	0	0	4
39	Dental caries	1	2	0	1	4
40	Epilepsy	2	2	0	0	4
41	Chemical Burn	3	0	0	0	3
42	Sleep disorders	3	0	0	0	3
43	Viral fever	1	0	0	1	2
44	Menorrhagia	0	2	0	0	2
45	Lymphadenopathy for evaluation	2	0	0	0	2
46	Rheumatic Heart Disease	0	1	1	0	2
47	Eczema	1	1	0	0	2
48	Tinea Versicolor	0	1	0	0	1
49	Pulmonary Tuberculosis Sequelae	1	0	0	0	1
50	Insect bite allergy	1	0	0	0	1
52	Chronic Renal Failure	0	1	0	0	1
53	Elective Caesarean delivery	0	1	0	0	1
54	Hordeolum Extremism/Stye Eye	0	1	0	0	1
55	Jaundice	0	0	0	1	1
56	Cerebrovascular Disease	1	0	0	0	1
57	Dental Caries with Acute Pulpitis	0	1	0	0	1
58	Osteomyelitis	1	0	0	0	1
59	Chronic Ischemic Heart Disease	1	0	0	0	1

S.No	Name of the Disease	Adult		Child		Total
		Male	Female	Male	Female	
60	Asthenia/Photophobia	1	0	0	0	1
61	Heart Disease-Congenital	0	1	0	0	1
62	Cabulus of Ureter	1	0	0	0	1
63	Renal Colic	1	0	0	0	1
64	Primary Dysmenorrhea	0	1	0	0	1
65	Benign Prostatic Hypertrophy	1	0	0	0	1
66	Oran phosphorous Poisoning	0	1	0	0	1
67	Haemarthrosis	0	1	0	0	1
68	Injury	0	1	0	0	1
69	Psoriasis	0	1	0	0	1
70	Dermatological Purpura	1	0	0	0	1
71	Fracture Radius	1	0	0	0	1

Source: Govt. Hospital, Ottapidaram- Date & Time 15/06/2015 Ottapidaram-
Tuthukudi District, TamilNadu.

3.6.3 DEVELOPMENT PROGRAMS IN THE STUDY AREA

The District leads in its salt contribution to the country, as it has a long coast line of 163.5 km. It is also one of the industrially developing districts in the state in as much as it is the base for major chemical and fertilizer units. The most famous Thoothukudi harbor is in the district. Besides fishing as an important allied activity, the district also has a place in agriculture, producing major crops like paddy, bajra, maize, black gram and green gram.

There are 3,00,426 families living in the rural area of the district. Of these 91,274 families have been identified to be living below the poverty line, constituting about 30.38 percent of total families in rural areas. In addition to BPL families, the State Government schemes cover 2,89,950 SC and 3,490 ST population and other weaker sections. The Union Government has introduced a number of schemes aimed at poverty alleviation and generation of gainful employment. In addition to the national level programmes, there are state level programmes designed to support and supplement the poverty alleviation efforts. Some of the major programmes being implemented in the district are:

1. Swarnajayanti Gram Swarozgar Yojana (SGSY)
2. Swarna Jayanti Shahari Rozgar Yojana (SJSRY)
3. Prime Minister's Employment Generation Programme (PMEGP)

4. Tamil Nadu Adi Dravidar Housing & Development Corporation (TAHDCO)
5. Credit Linked Capital Subsidy schemes of Govt. of India, Rural Godowns, Strengthening /development of Agricultural Marketing. Agri-clinics and Agri -Business centers (ACABC) Production of Post-Harvest Management.
6. Dairy Entrepreneurship Development Scheme: The scheme is implemented through NABARD in collaboration with the Department of Animal Husbandry and Banks.

There are large number of Rural Development Programs sponsored by the National Bank for Agriculture and Rural Development (NABARD) in the Farm and Non-Farm sectors for development of the rural areas.

The Major objective of the programs are to ensure that the people have access to better infrastructure facilities for the provision of selected social services with a view to improving the quality of life of all sections in the society. While contributing directly to social justice, this would also improve the capacity to work and the employability of both men and women, who have thus not been able to participate productively in the development process.

3.7 TRAFFIC DENSITY

The traffic studies have been conducted to know the prevailing traffic volumes on the existing roads. It is essential to consider these details for assessing the anticipated future traffic volumes as a part of overall impacts assessment for the plant.

The variations of traffic densities depend upon the working days and time and also vary in day and night times. In order to assess the prevailing traffic volumes on the roads, the survey was conducted during normal working days of the week by avoiding local holidays or abnormal situations to reflect the true picture of the traffic densities. The traffic study was conducted at two locations for 24 hours.

3.7.1 VEHICLE COUNT

The vehicles passing through the road (in both ways) were counted separately for

24 hours at the two selected locations from 0600 hrs to 0600 hrs next day continuously. Category-wise vehicle counting has been done continuously and recorded in the traffic volume count on hourly basis under respective categories.

3.7.2 CATEGORIZATION OF TRAFFIC

The engine driven vehicles were categorized into various heads viz. Trucks/Bus, Light carriage Vehicles (LCV), Car/Jeep, Multi Axle Vehicles, Two/Three Wheelers and Cycles/others.

3.7.3 SAMPLING LOCATIONS

The two traffic locations are represented in below Table.

DETAILS OF TRAFFIC MONITORING LOCATIONS

Location Code	Location Details
T-1	On SH-75 Road near Mel arasadi village
T-2	On NH 45-B Road near SH-75 crossing Junction

3.7.4 TRAFFIC DATA

The hourly vehicular traffic densities for continuous normal day at each location observed are presented in below **Tables A & B**.

TRAFFIC DENSITIES

Location Number : T-1
 Details of Location : On SH-75 Road near Mel Arasadi village

TABLE- A

Time (Hours)	Truck/ Bus	LCV	Cars/ Jeep	MAV	2/3 Wheelers	Cycle/ Others
0600-0700	14	5	3	4	9	3
0700-0800	17	9	5	5	14	4
0800-0900	16	8	4	8	17	3
0900-1000	29	10	6	10	35	5
1000-1100	41	7	9	11	53	3
1100-1200	30	7	9	31	91	6
1200-1300	45	15	10	35	69	4
1300-1400	37	18	15	27	58	8
1400-1500	42	22	13	25	60	3
1500-1600	50	19	11	29	63	6
1600-1700	27	9	10	21	48	7
1700-1800	29	8	9	13	51	4

Time (Hours)	Truck/ Bus	LCV	Cars/ Jeep	MAV	2/3 Wheelers	Cycle/ Others
1800-1900	25	9	8	11	42	6
1900-2000	26	11	9	10	35	7
2000-2100	20	6	8	5	22	6
2100-2200	11	6	7	3	11	4
2200-2300	9	4	5	3	9	2
2300-2400	4	1	2	1	3	1
0000-0100	2	1	1	1	2	-
0100-0200	2	-	-	-	1	-
0200-0300	1	-	-	-	-	-
0300-0400	1	1	1	1	-	1
0400-0500	2	2	2	3	3	1
0500-0600	6	4	3	3	6	3
Total	486	182	150	260	702	87
Equivalent PCU	486	182	150	780	351	43.5

Location Number : T-2

Details of Location: On NH 45-B Road near SH-75 Crossing junction.

TABLE- B

Time (Hours)	Truck/ Bus	LCV	Cars/ Jeep	MAV	2/3 Wheelers	Cycle/ Others
0600-0700	57	20	24	53	61	31
0700-0800	79	32	39	75	77	58
0800-0900	88	37	48	75	89	64
0900-1000	105	53	76	92	151	76
1000-1100	140	70	106	132	231	70
1100-1200	171	47	113	138	270	66
1200-1300	206	57	116	137	226	74
1300-1400	160	47	98	96	206	62
1400-1500	151	64	105	103	219	58
1500-1600	134	54	111	106	220	53
1600-1700	131	58	96	74	133	45
1700-1800	127	54	74	64	257	59
1800-1900	112	40	61	37	245	65
1900-2000	108	36	69	44	203	48
2000-2100	96	31	53	31	183	32
2100-2200	88	27	43	21	169	39
2200-2300	54	22	30	18	133	36
2300-2400	39	20	21	21	108	4
0000-0100	18	10	17	22	99	3
0100-0200	13	5	14	11	84	2
0200-0300	9	2	6	10	63	-
0300-0400	6	1	4	7	48	-
0400-0500	19	4	5	17	37	7
0500-0600	26	10	17	30	53	18
Total	2137	801	1346	1414	3565	970
Equivalent PCU	2137	801	1346	4242	1782.5	485

CHAPTER - 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES



CHAPTER-4: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The proposed project will have influence in two distinct phases:

- a) During construction phase which is temporary and of short term duration.
- b) During operation phase which may have long term effects

The environmental impacts due to the implementation of the proposed project are discussed separately for the construction and operation phase of the 1320 MW capacity coal based thermal power plant.

4.1 CONSTRUCTION PHASE

AIR ENVIRONMENT

The construction of proposed power plant would result in increase of fugitive dust concentrations due to fugitive dust. Frequent water sprinkling in the vicinity of the construction sites would be undertaken and will be continued even after the completion of plant construction. It will be ensured that both gasoline and diesel powered vehicles are properly maintained to comply with exhaust emission requirements.

NOISE ENVIRONMENT

Noise levels generated during construction activity sometimes may be high. Onsite workers working in noise prone areas would be provided with earmuffs & ear plugs.

WASTE WATER ENVIRONMENT

The Overall construction water requirement is estimated to be about 1 million cubic meters. Construction water requirements will be met from one of the following two alternatives.

- a. Tamilnadu Water Supply and Drainage Board.
- b. South Ganga Water Technologies Private Limited (SGWTPL)

LAND USE ENVIRONMENT

The construction activities for both the Stages including auxiliary facilities will be confined within the plant area of 750 acres.

The construction of the power plant would witness setting up of temporary labor colonies and temporary buildings to house the project personnel, which could modify the land use pattern.

During construction, the impact on soil is limited to the extent of Power plant area. This is mitigated by landscaping, paving the roads in post construction activity..

SOIL ENVIRONMENT

During construction phase, there will be impact on soil which is limited to the power plant construction areas. This impact is mitigated by landscaping /paving roads in post construction activity The impact on soil will be minimum as the construction activity.

TERRESTRIAL ECOLOGY

The impact on the terrestrial ecology will be confined to the project area of 750 acres. There is sparse shrub vegetation on the site.

4.2 OPERATIONAL PHASE

The major activities, which are likely to contribute impact on various environmental components during the operation phase, are as follows:

- a) Emissions from boilers due to combustion of coal
- b) Dust emission from coal stock pile and coal handling plant
- c) Noise from various noise generating sources
- d) Water consumption and wastewater generation
- e) Ash generation

The changes over the existing baseline quality of relevant environmental parameters as a result of the activities causing impacts due to operation have been predicted using suitable mathematical models coupled with qualitative and quantitative predictive techniques. After evaluation of the changes in relevant parameters, the overall impacts on the environment have been discussed.

4.2.1 AIR ENVIRONMENT

The proposed power plant will result in emission of Particulate Matter, Sulphur Dioxide and Oxides of Nitrogen due to combustion of coal in the boilers.

4.2.1.1 EMISSION DETAILS

The steam requirement of the plant will be met from two boilers each of 2200 tph capacity. Major pollutants emitted from coal burning are Particulate matter, SO₂ and NO_x. The emission details of the proposed power plant are given below in **Table -4.1**.

4.2.1.2 MODEL EMPLOYED

AERMOD Model with the following options has been employed to predict the ground level concentrations due to emissions from the proposed plant

1. Area being rural, rural dispersion parameters is considered.
2. Predictions have been carried out to estimate concentration values over radial distance of 10 km around the sources.
3. Polar receptor network has been considered.
4. Emission rates from the point sources and area sources were considered as constant during the entire period.
5. The ground level concentrations computed were as is basis without any consideration of decay coefficient.
6. Calm winds recorded during the study period were also taken into consideration.
7. 24 hourly meteorological data as per guidelines of IMD and MoEF of May-July, 2015) was considered for estimation of ground level concentration.

TABLE - 4.1
EMISSION DETAILS

	IMPORTED COAL		BLEND COAL (70 % Indigenous coal and 30 % imported coal)
	2 x 660 MW		2 X 660 MW
No. of units	2		2
Coal Consumption (t/hr/boiler)	310.215		406.26
Sulphur content (%)	0.50		0.40
No. Of stacks	1		1
No of Flues	2		2
Height of stack, m	275		275
Diameter of each flue(m)	7.0		7.00
Temperature of flue gas (°C)	140		140
Velocity of flue gas (m/s)	25		25.0
Particulate matter at the inlet of the stack (gm/sec/flue) (based on 50 mg/Nm ³ at outlet)	38	OR	49.20
Sulphur dioxide emission (gm/sec/flue)	861		903
Oxides of Nitrogen (gm/sec/flue) (based on 650mg/Nm ³ at outlet).	488		639

100 % emission considered as PM₁₀

8. An option for creation of data file giving average groundlevel concentrations for the meteorological data of May-July, 2015 has been used for post processing in **SURFER – 8** graphics package.

4.2.1.3 STACK HEIGHT

KUTPPL will install one bi-flue stack of 275 m height for two units as per CPCB guidelines.

4.2.1.4 METEOROLOGICAL DATA

The meteorological data recorded at site during May-July, 2015 continuously on hourly basis on wind speed, wind direction & temperature have been processed to extract the data required for simulation. Stability classes computed for each hour is based on wind speed & solar radiation. Mixing heights representative of the region have been taken from the available published literature.

The guidelines of Central Pollution Control Board and IMD have also been followed for the purpose of modelling. **Annexure – 4 A** gives the hourly meteorological data of the 24 hours of May, 2015 used for estimation of ground level concentrations.

4.2.1.5 MAXIMUM GROUND LEVEL CONCENTRATIONS

Ground level concentrations of PM, SO₂ and NO_x were estimated due to emissions from proposed 1320 MW coal based power plant of KUTPPL. The following table shows the incremental ground level concentrations:

INCREMENTAL GROUND LEVEL CONCENTRATION, µg/m³

		PM10	SO ₂	NO _x
Scenario – A	1320 MW KUTPPL plant with operation on Imported coal	1.22	27.7	18.7
Scenario – B	1320 MW KUTPPL plant with operation on Blend coal	1.32	29.0	20.2

Fig - 4.1 to Fig - 4.3 shows the distribution of ground level concentrations in the study area. 50 high 24-hourly average ground level concentrations are enclosed as **Annexure - 4 B**.

4.2.1.6 POST PROJECT SCENARIO

Predicted maximum incremental ground level concentrations are superimposed on the maximum baseline concentrations 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 below:

OVERALL SCENARIO WITHIN STUDY AREA ($\mu\text{g}/\text{m}^3$)

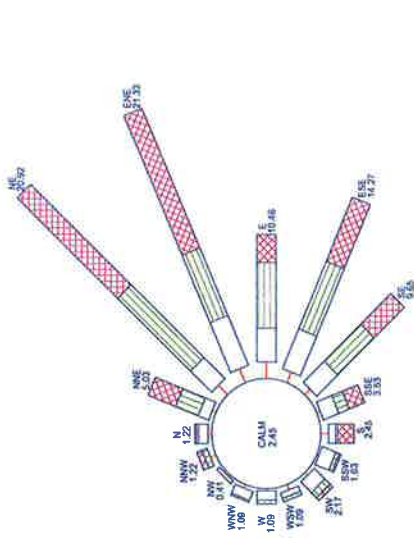
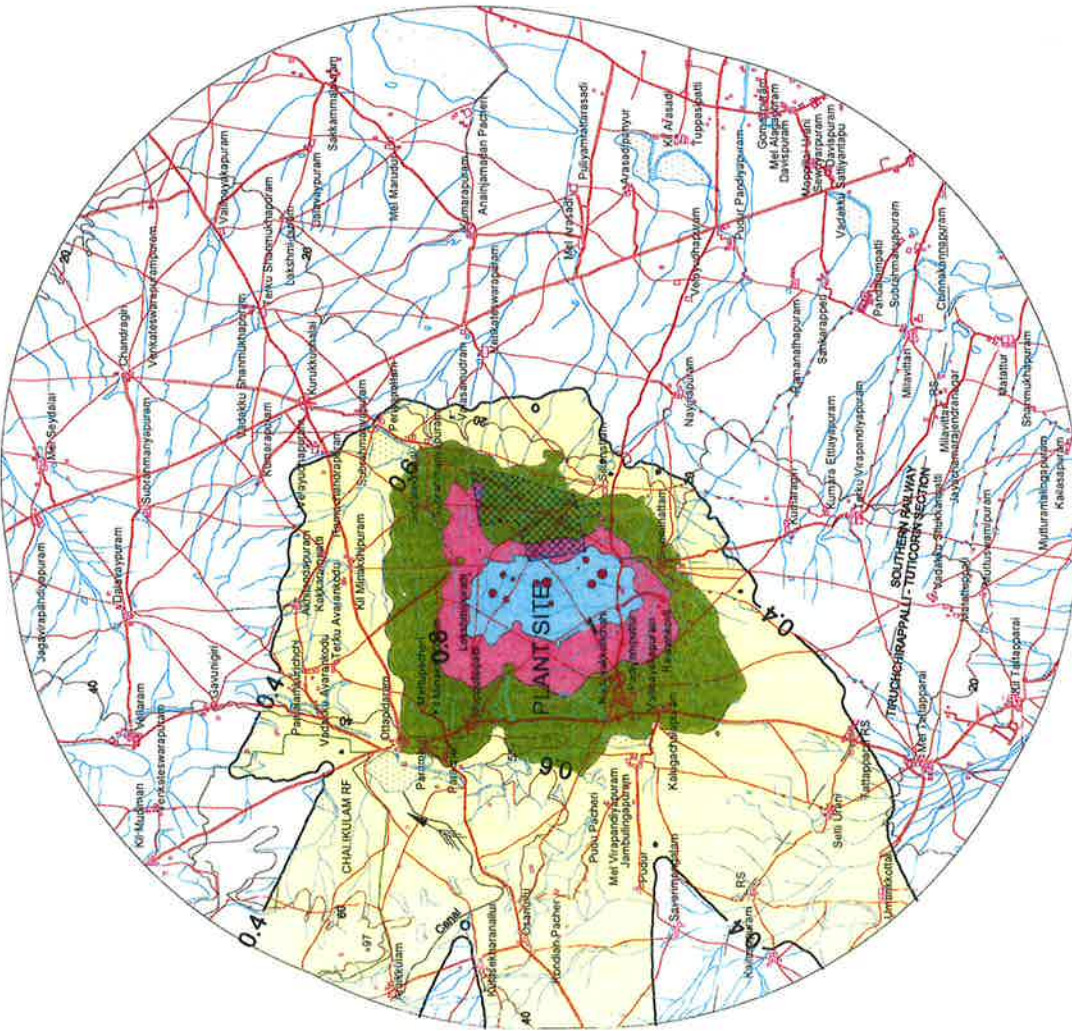
	PARTICULATE MATTER (PM10)	SULPHUR DIOXIDE SO₂	OXIDES OF NITROGEN NO_x
Baseline Scenario (max)	44.5	10.4	11.9
Predicted Ground level Concentration (Max) (Worst Case : Scenario - B)	1.32	29.0	20.2
Overall Scenario (worst case)	45.82 (100)	39.4(80)	32.1(80)

Note: Value in parenthesis is NAAQ standard for Industrial, Rural and Residential Areas

4.2.1.7 ESTIMATION OF CUMULATIVE GROUND LEVEL CONCENTRATIONS

Information on operating and proposed industries within 10 km radius of the study area was collected. The industries which are presently operating are

- Ind Bharath Thermal Power plant - 2 X 150 MW - 0.1 km - W
- Ind Bharath 3x63 MW Power station- 5.3 km - ESE
- Sterlite Copper Smelter - Sterlite Industries - 6.0km - SSE
- Sterlite Thermal Power Plant - 160 MW power plant
- Coastal Energen - Thermal Power Plant - 1 X 600 MW - 7.8 km - ENE



WIND ROSE - MAY-JULY, 2015



ISOPLETH INTERVAL (ug/m3)

SCALE (M)



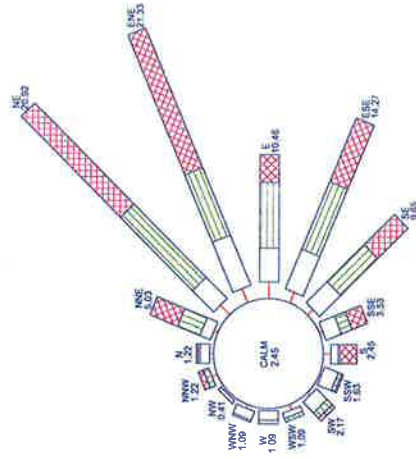
FIG - 4.1
PREDICTED GROUNDLEVEL CONCENTRATIONS
OF PARTICULATE MATTER - PM FOR THE WORST CASE SCENARIO - B
DUE TO EMISSIONS FROM 1320 MW KUTPPL POWER PLANT
FUEL : BLEND COAL

CLIENT : KU THERMAL POWER PVT LTD
 PROJECT : 1320 MW COAL BASED POWER PLANT



PREPARED BY

B.S. ENVI-TECH PVT. LTD., HYD.



WIND ROSE - MAY-JULY, 2015

ISOPLETH INTERVAL (ug/m³)



SCALE (M)

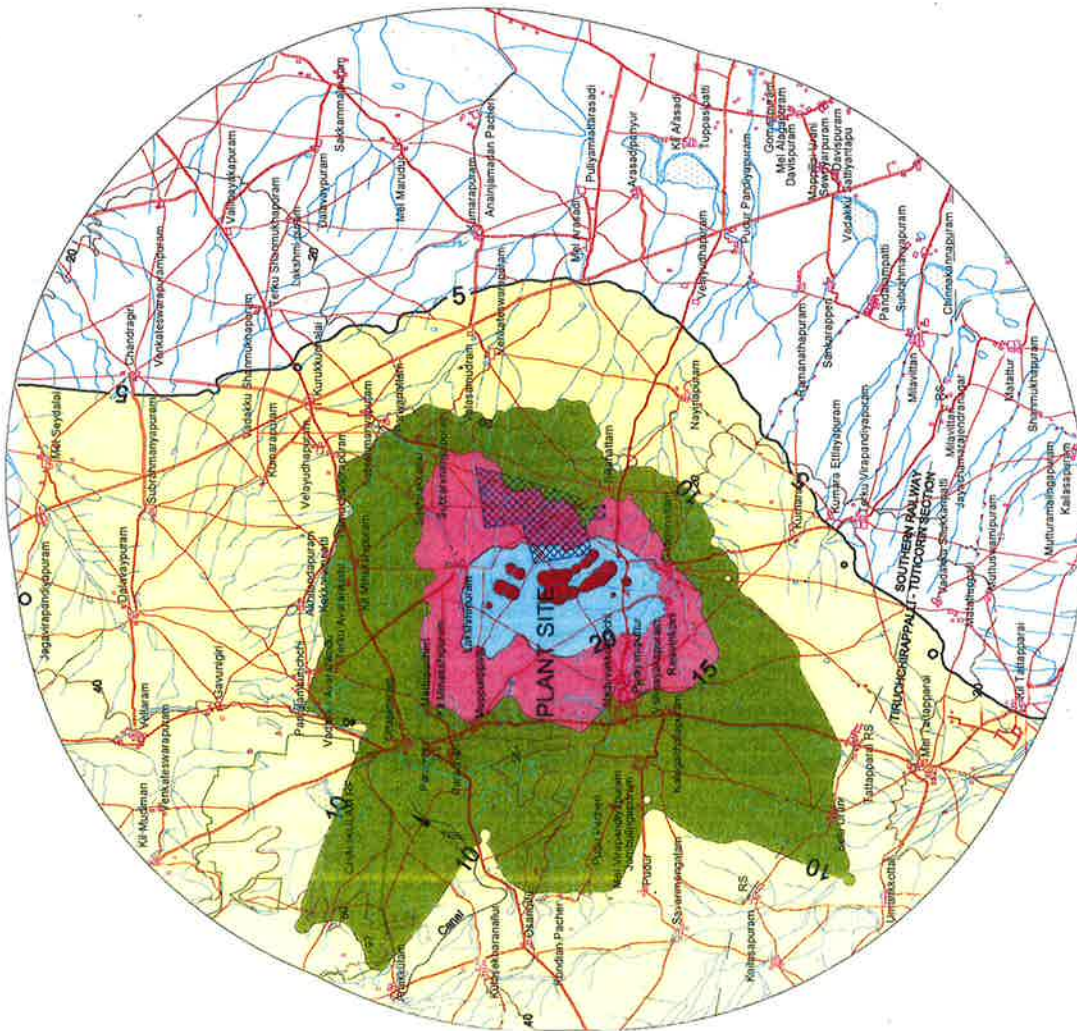
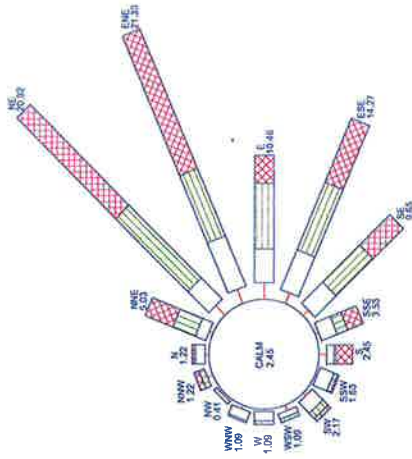
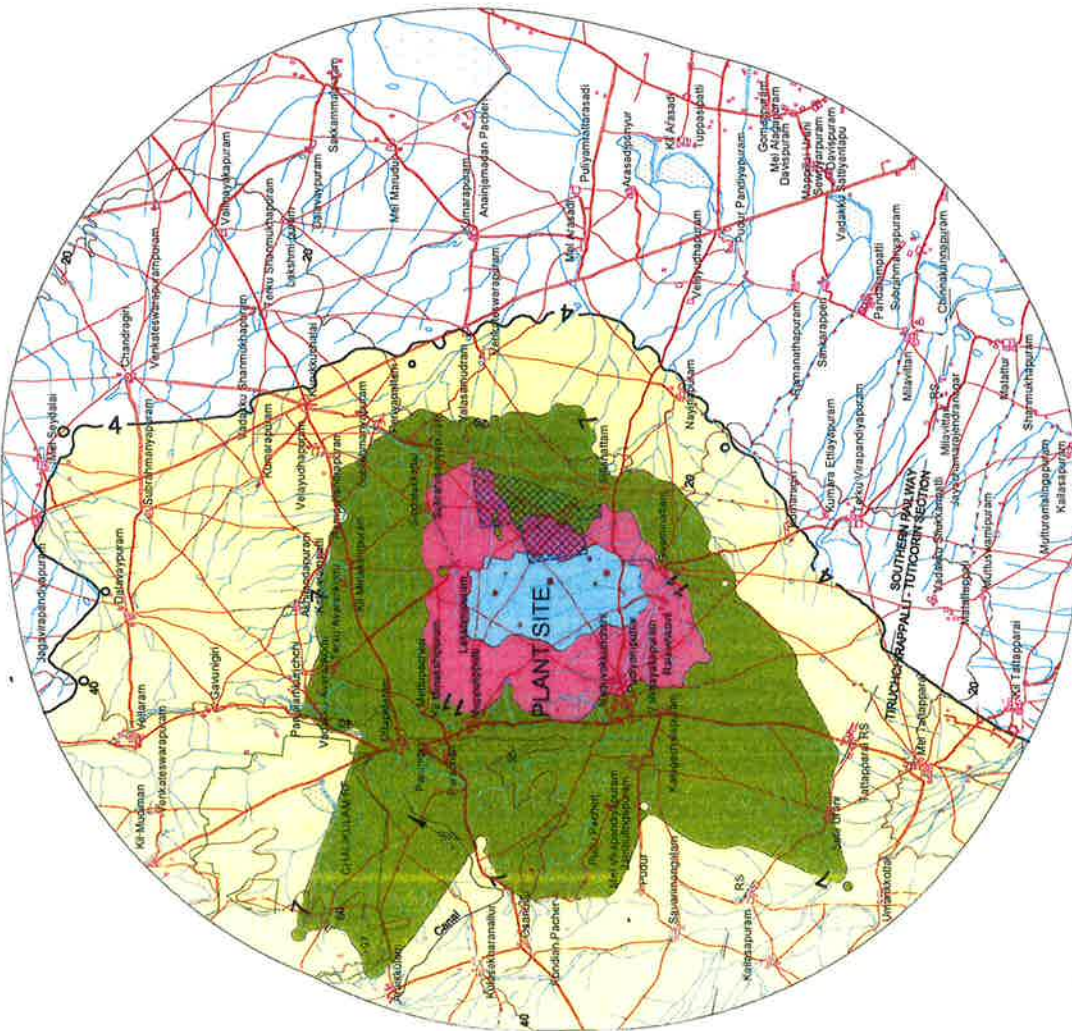


FIG - 4.2
PREDICTED GROUNDLEVEL CONCENTRATIONS
OF SULPHUR DIOXIDE (SO₂) FOR THE WORST CASE SCENARIO - B
DUE TO EMISSIONS FROM 1320 MW KUTPPL POWER PLANT
FUEL : BLEND COAL

CLIENT : KU THERMAL POWER PVT LTD
 PROJECT : 1320 MW COAL BASED POWER PLANT
 PREPARED BY
B.S. ENVI-TECH PVT. LTD., HYD.





WIND ROSE - MAY-JULY, 2015

ISOPLETH INTERVAL (ug/m3)



SCALE (M)



FIG - 4.3
PREDICTED GROUNDLEVEL CONCENTRATIONS
OF SULPHUR DIOXIDE (SO2) FOR THE WORST CASE SCENARIO - B
DUE TO EMISSIONS FROM 1320 MW KUTPPL POWER PLANT
FUEL : BLEND COAL

CLIENT : KU THERMAL POWER PVT LTD
 PROJECT : 1320 MW COAL BASED POWER PLANT
 PREPARED BY
B.S. ENVI-TECH PVT. LTD., HYD.



The emissions from the above industries are reflecting in the baseline monitoring studies carried out during the period May-July, 2015

The industries which are proposed/under implementation and yet to be commissioned within 10 km are:

- a) Ind Bharath Thermal Power plant – 1 X 150 MW - 0.1 km – W
- b) Coastal Energen - Thermal Power Plant –1 X 600 MW- 7.8 km – ENE
- c) Coastal Energen - Thermal Power Plant –2 X 800 MW -7.8 km – ENE

The additional emission in 10 km radius of the study area are from the subject power plant and above coal based thermal power plants. Cumulative Ground level concentrations are computed taking into consideration emissions from the subject power plant of 1320 MW and the above power plants located within 10 km radius. The emission details of the above power plant considered are given below:

EMISSION DETAILS OF ADJACENT POWER PLANTS

	1 X 150 MW Ind Bharat	1 X 600 MW Coastal Energen	2 X 800 MW Coastal Energen Pvt Ltd
No. Of units	1	1	2
No. Of stacks	1	1	1
Number of flues	1	2	2
Height of stack, m	130	275	275
Diameter of flue (m)	3.0	7	9
Temperature of flue gas (°C)	140	14	140
Velocity of flue gas (m/s)	22	25	25
Particulate matter at outlet of ESP (gm/sec/flue)	8.6	48.5	79
Sulphur dioxide emission (gm/sec/flue)	196	1208	1793
Oxides of Nitrogen (gm/sec/flue)	110	604	1180

***Source: EIA Reports of the power plants**



Considering the above emissions, the cumulative ground level concentrations are estimated for the following scenarios

4.2.1.8 CUMULATIVE GROUND LEVEL CONCENTRATIONS

Cumulative Ground level concentrations of PM10 SO₂ and NO_x were estimated to project the incremental increase of concentrations above baseline concentrations due to emissions from the above power plant. The following table shows the summary of the same

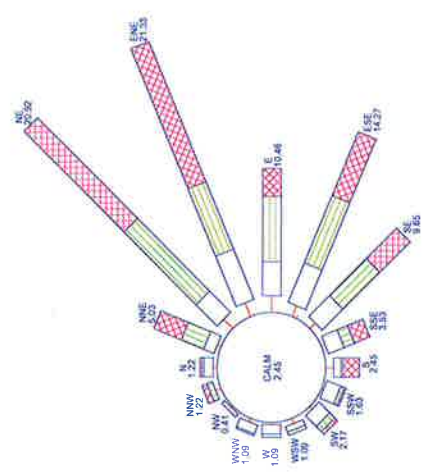
INCREMENTAL CUMULATIVE GROUND LEVEL CONCENTRATION, $\mu\text{g}/\text{m}^3$

	SOURCES CONSIDERED	PM	SO ₂	NO _x
Scenario - C	a. 1320 MW KUTPPL with Imported Coal b. Ind Bharath Thermal Power plant - 1 X 150 MW - 0.1 km - W c. Coastal Energen - Thermal Power Plant -1 X 600 MW 7.8 km - ENE d. Coastal Energen - Thermal Power Plant -2 X 800 MW 7.8 km - ENE	2.01	45.8	28.2
Scenario - D	a. 1320 MW KUTPPL with Blend Coal b. Ind Bharath Thermal Power plant - 3 X 150 MW - 0.1 km - W c. Coastal Energen - Thermal Power Plant -1 X 600 MW 7.8 km - ENE d. Coastal Energen - Thermal Power Plant -2 X 800 MW 7.8 km - ENE	2.12	47.36	31.4

Isopleths showing cumulative ground level concentrations for the worst case Scenario - D are shown in **Fig - 4.4 - 4.6**.

4.2.1.9 AIR POLLUTION CONTROL MEASURES

The power plant is a coal based power plant where imported coal or blended coal would be used as fuel. Particulate Matter, SO₂ and NO_x are the major pollutants emitted due to combustion of coal containing Sulphur content of 0.50 % (max).



WIND ROSE - MAY-JULY, 2015

SOURCES :

- ▲ Ind Bharath Thermal Power plant - 1 X 150 MW - 0.1 km - W
- ◆ Coastal Energen - Thermal Power Plant -1 X 600 MW 7.8 km - ENE
- ◆ Coastal Energen - Thermal Power Plant -2 X 800 MW 7.8 km - ENE

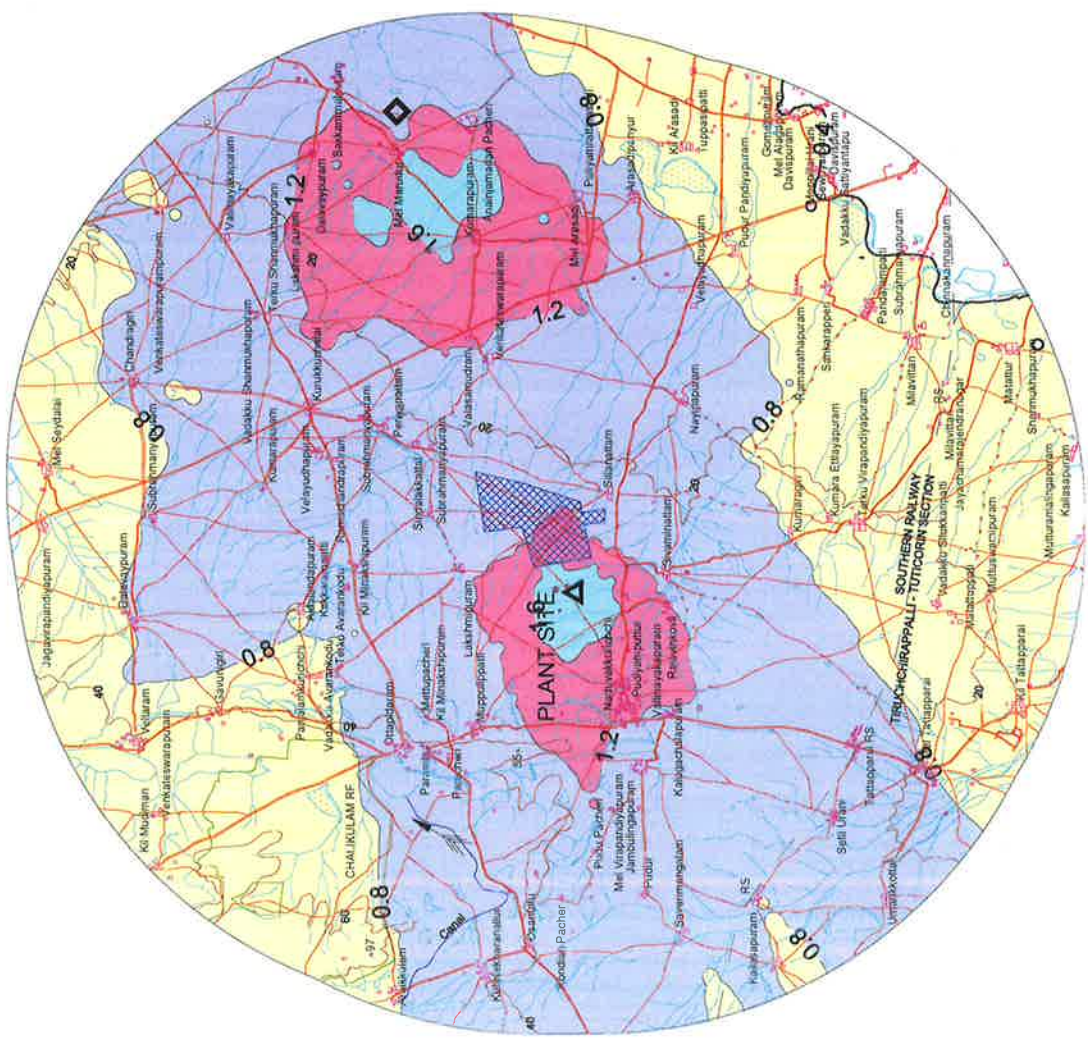
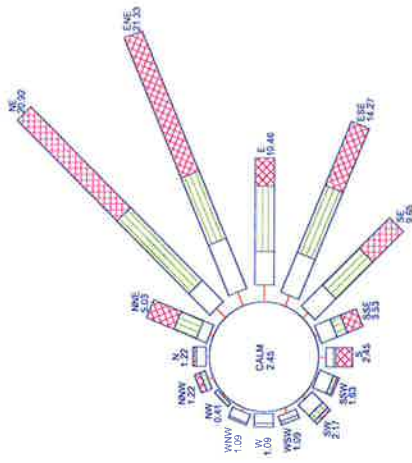


FIG - 4.4
PREDICTED CUMULATIVE GROUNDLEVEL CONCENTRATIONS
OF PARTICULATE MATTER - PM FOR THE WORST CASE SCENARIO - B
DUE TO EMISSIONS FROM PROPOSED POWER PLANTS
(Scenario - D)

CLIENT : KU THERMAL POWER PVT LTD
 PROJECT : 1320 MW COAL BASED POWER PLANT



PREPARED BY
B.S. ENVI-TECH PVT. LTD., HYD.



WIND ROSE - MAY-JULY, 2015

SOURCES :

- ▲ Ind Bharath Thermal Power plant - 1 X 150 MW - 0.1 km - W
- ◆ Coastal Energen - Thermal Power Plant -1 X 600 MW 7.8 km - ENE
- ◆ Coastal Energen - Thermal Power Plant -2 X 800 MW 7.8 km - ENE

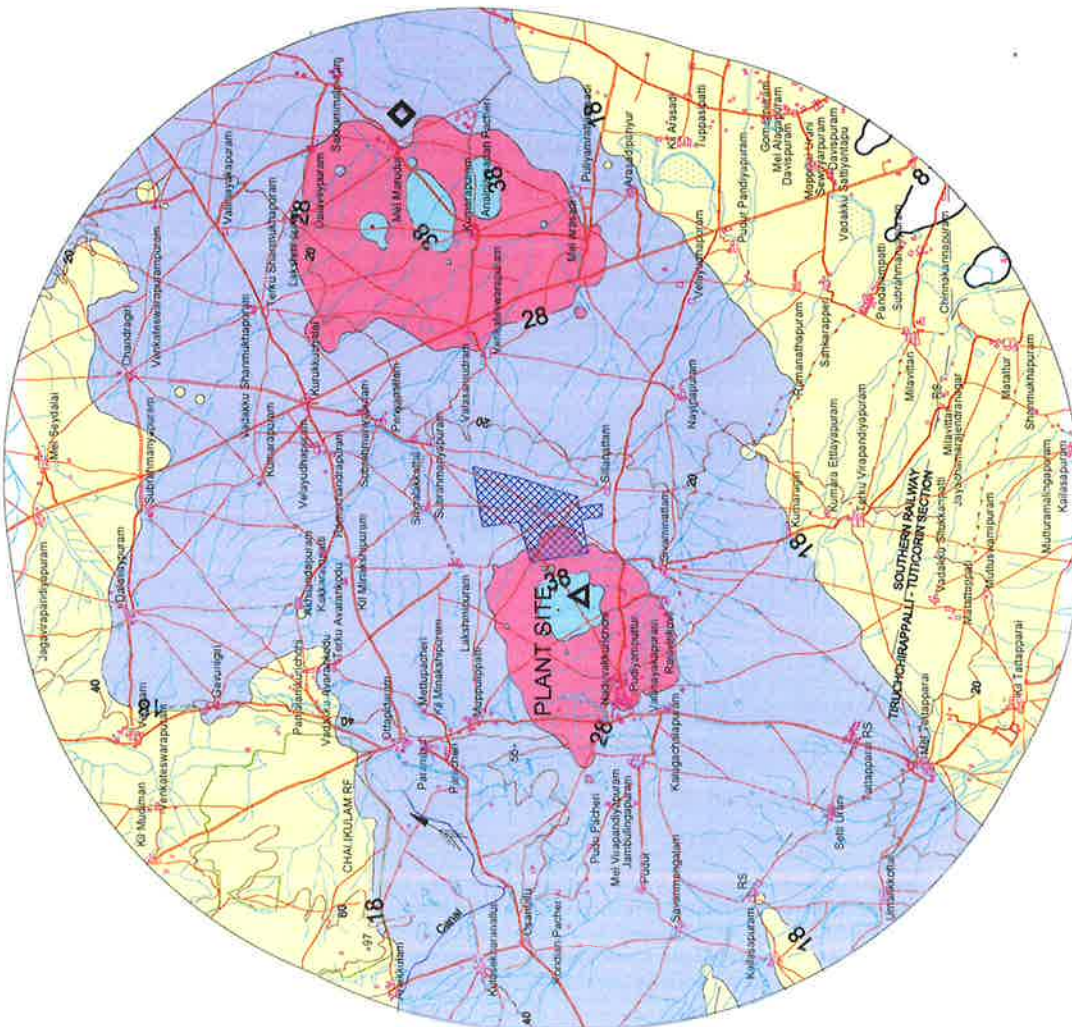
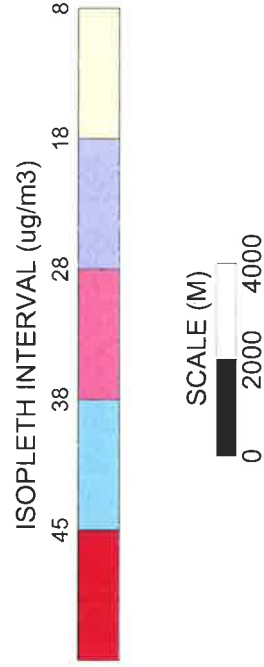


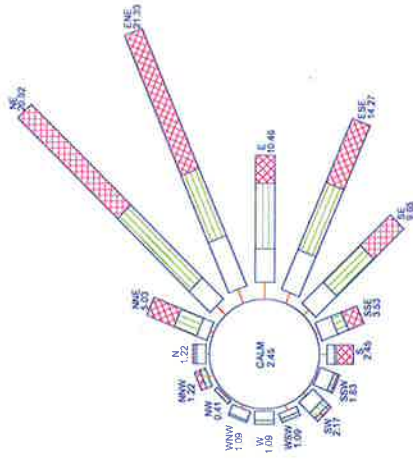
FIG - 4.5
PREDICTED CUMULATIVE GROUNDLEVEL CONCENTRATIONS
OF SULPHUR DIOXIDE FOR THE WORST CASE SCENARIO - B
DUE TO EMISSIONS FROM PROPOSED POWER PLANTS
(Scenario - D)

CLIENT : KU THERMAL POWER PVT LTD
 PROJECT : 1320 MW COAL BASED POWER PLANT



PREPARED BY

B.S. ENVI-TECH PVT. LTD., HYD.



WIND ROSE - MAY-JULY, 2015

SOURCES :

- ▲ Ind Bharath Thermal Power plant - 1 X 150 MW - 0.1 km - W
- ◆ Coastal Energen - Thermal Power Plant -1 X 600 MW 7.8 km - ENE
- ◆ Coastal Energen - Thermal Power Plant -2 X 800 MW 7.8 km - ENE

ISOPLETH INTERVAL (ug/m3)



SCALE (M)

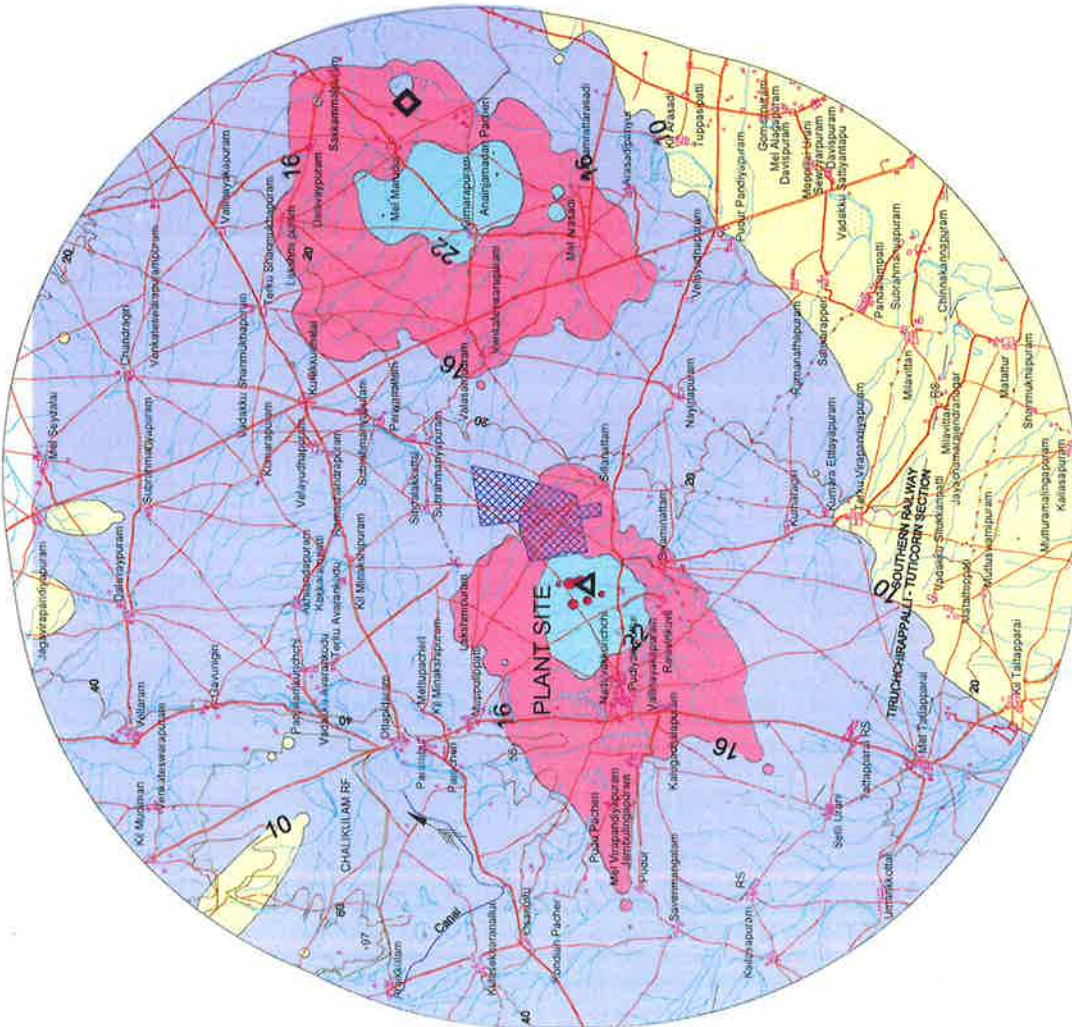


FIG - 4.6
PREDICTED CUMULATIVE GROUNDLEVEL CONCENTRATIONS
OF OXIDES OF NITROGEN FOR THE WORST CASE SCENARIO - B
DUE TO EMISSIONS FROM PROPOSED POWER PLANTS
(Scenario - D)

CLIENT : KU THERMAL POWER PVT LTD
 PROJECT : 1320 MW COAL BASED POWER PLANT



PREPARED BY

B.S. ENVI-TECH PVT. LTD., HYD.

In order to minimize fly ash emission to atmosphere, high efficiency Electrostatic Precipitators (ESP) (2 nos) will be installed. The Pollution control system will be designed to limit the particulate emission to less than 50 mg/Nm³. Therefore the impact due to particulate emission due to combustion of coal leading to rise of suspended particulate concentration in the ambient air will be minimal. The fly ash collected in the hoppers will be removed through dry collection system.

One bi-flue stack of 275 m height will be provided as per CPCB guidelines.

Dust extraction system of coal crusher and other equipment will be provided with Bag filters to minimize fugitive dust emission from Coal Handling Plant.

Combustion of coal will result in NO_x emission of about 650 mg/Nm³ from the stack of the proposed power plant. This will lead to increase of ambient NO_x level. Predicted NO_x level due to emission from the proposed power plant super imposed on the baseline concentrations showed the ground level concentrations to be well within the limits of NAAQ standards.

Low NO_x burners will be provided for the steam generators to minimize the emission of Nitrogen oxides from boilers.

4.2.1.10 FUGITIVE DUST CONTROL

For control of fugitive dust, water spray arrangement will be provided to spray water all-round the coal stockpiles to suppress the dust and to wet the coal while compacting to minimize the dust nuisance. A closed conveyor system will be implemented to minimize the dust nuisance. All transfer points will be provided with bag filters.

4.2.1.11 CLEAN DEVELOPMENT MECHANISM (CDM)

This project activity would bring about reduction in greenhouse gas (GHG) emission (primarily carbon dioxide - CO₂) by selecting Supercritical Technology for the Power Cycle of the power plant.



The Baseline Carbon Dioxide Emissions from Power Sector have been worked out by Central Electricity Authority (CEA) based on detailed information obtained from all the operating Power Stations in the country. Weighted average emission factor, simple operating margin (OM), build margin (BM) and combined margin (CM) of all southern regional grid for FY 2004-05 (not adjusted for inter-regional and cross-country electricity transfers), is 1 tonne CO₂ / MWh.

Power plant with supercritical technology would increase the plant efficiency by more than 1.0% as compared to those employing sub-critical technology. The projected power generation from the power plant at 85 % PLF is 9828720 MWh which corresponds to 9828720 tonnes per year of CO₂. Based on a baseline emission factor of 0.941 tonnes CO₂ / MWh, the total CO₂ generation from the proposed power plant would be 9248825 tonnes per year, which corresponds to reduction in emission of 579894 tonnes of CO₂ per year.

Benefits of CDM projects include investment in climate change mitigation projects in developing countries, transfer or diffusion of technology in the host countries, as well as improvement in the livelihood of communities through the creation of employment or increased economic activity.

However, KUTPPL does not propose to avail the CDM benefits.

4.2.2 NOISE ENVIRONMENT

During installation of the power plant, no significant impact is envisaged as most of the construction equipment produce noise level below 90 dB(A). The noise generated is expected to be intermittent and of short duration. Proper care will be taken during operation with respect to steam blowing operations to minimize the activity at night time so as to avoid inconvenience to the surrounding villages.

During operation, the major noise generating sources are:



Noise level (dB (A))

Steam turbines	90
Compressors	90
Coal crushers	85
Ash Slurry pumps	90
Boiler feed water pumps	90-102

All high noise making equipment will be provided with acoustic enclosures.

Prediction of anticipated noise levels resulting from operation of the power plant have been computed using point source model. A basic phenomenon of the model is the geometric attenuation of sound. Noise at a point generates spherical waves, which are propagated outward from the source through the air at a speed of 1,100 ft/sec, with the first wave making an ever-increasing sphere with time. As the wave spreads the intensity of noise diminishes as the fixed amount of energy is spread over an increasing surface area of the sphere.

The assumption of the model is based on point source relationship i.e. for every doubling of the distance the noise levels are decreased by 6 dB (A). Point source propagation is defined by the following equation:

$$Lp_2 = Lp_1 - 20 \log (r_2/r_1)$$

where Lp_1 and Lp_2 are sound pressure levels at points located at distances r_1 and r_2 , respectively, from the source.

Predictions carried are on as is basis, without taking into consideration any attenuation factors. Additional attenuation is expected, due to atmospheric effect or its interaction with objects in the transmission path.

Noise level at the plant boundary, calculated from the above equation, is expected to be less than 55 dB (A) without considering any attenuation factors. The development of greenbelt of 160 acres along the periphery of the power plant will further reduce the noise levels.



4.2.2.1 NOISE POLLUTION CONTROL MEASURES

All equipments in the power plant would be designed for noise levels not exceeding 90 dB(A). Proper encasement of noise generating sources will be done to control the noise levels. The proposed greenbelt development will further reduce the noise levels. With encasement of the noise generating sources and greenbelt, KUTPPL will comply with ambient noise standards.

The steam turbine generators would be provided with acoustic enclosures. The steam turbines would be located in a closed building which considerably reduces the noise outside the turbine hall.

All operations and maintenance personnel working near noise prone areas would be provided with earmuffs & earplugs. Stand alone noise proof cabins will be provided to operators.

A thick greenbelt in an area of 160 acres around the main plant area will be developed all around the boundary which acts as noise barrier.

In general the following methods are considered to control the noise pollution

- The use of complete or partial enclosures
- Introduction of control and monitoring rooms having good sound insulation properties for the benefit of operators.
- Proper plantation of trees depending on the wind velocity can reduce noise pollution on the surrounding area.
- Providing earmuffs and earplugs to the plant personnel and rotations of duties.

4.2.3 WATER ENVIRONMENT

The Air cooled condensate system will be adopted for the project to limit water usage. Makeup water requirement for the auxiliaries cooling and other makeup requirement is estimated to be about 260 m³/h(6.24MLD).

Power plant is based on Air cooled condensate system. Water consumption in the power plant is for DM Plant Feed Water to Boiler, DM Plant Regeneration, AC Ventilation System Makeup, Potable Water, Service Water and others. This requirement will be obtained from Desalination plant of South Ganga Water Technologies Private Limited.

Details of water balance is given below and shown in **Fig - 4.7**.

WATER BALANCE (m³/hr)

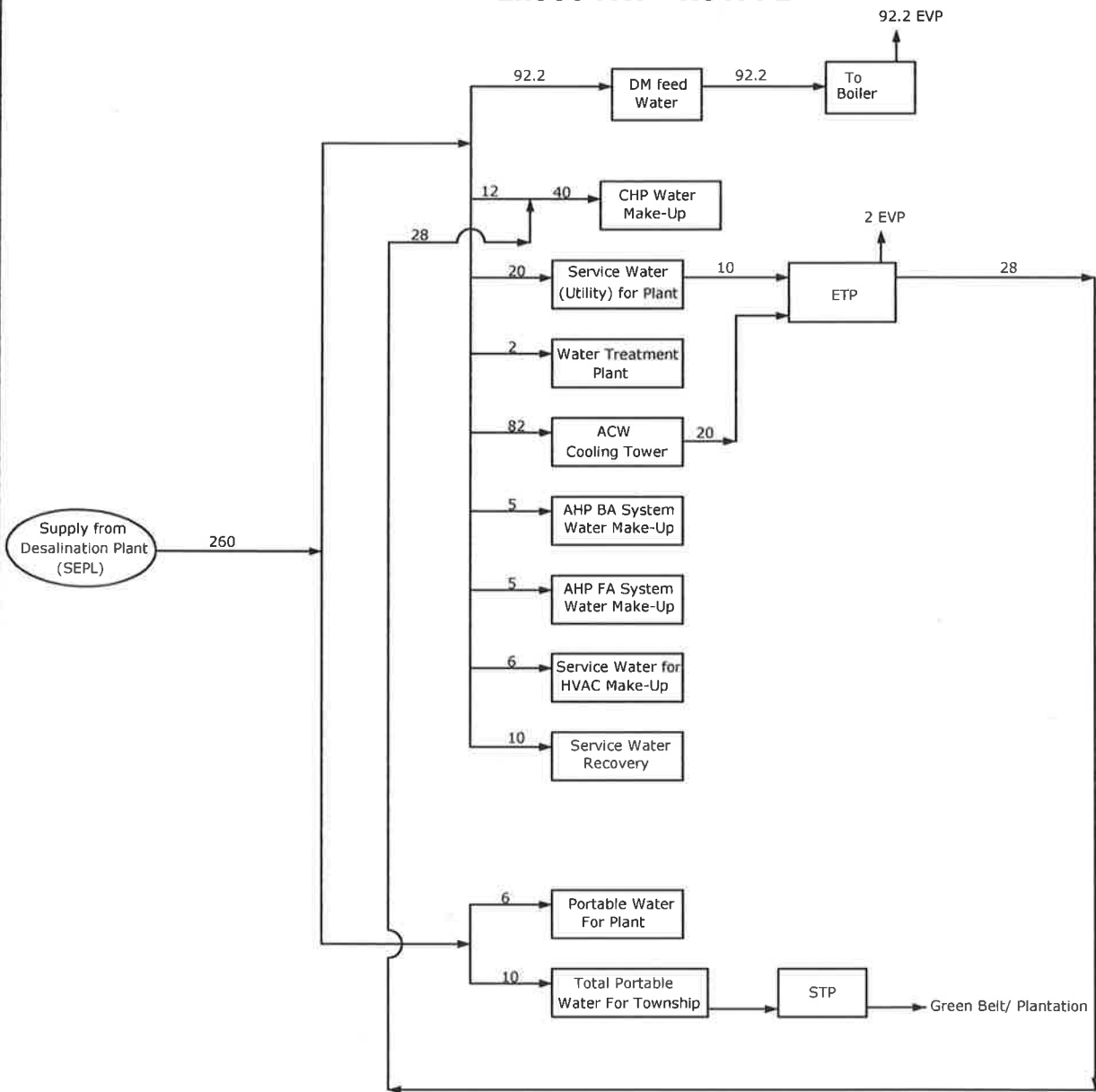
		Require- Ment	Usage (U) /Loss (L)	Waste Water
Cooling Water - Auxiliary cooling		102	82	20
Boiler	DM water to boiler	92	92	0
Coal Handling Plant		40	40	0
Service Water	Service water	20	10	10
	Service water for WTP and CW chlorination/chemical dosing	2	0	0
	Service water for HVAC make up	6	0	0
	AHP BA system water make-up	5	0	0
	AHP FA system water make-up	5	0	0
Domestic	Potable water for plant	6	0.6	5.4
	Total potable water for township	10	2	8
Total		288	226.6	43.4
Treated Wastewater utilization for coal Handling, dust suppression and greenbelt		(-) 28		
Fresh water requirement		260		

Source; KTUPPL

4.2.3.1 WASTEWATER GENERATION

The total wastewater generation from the plant is 43.4 m³/hr. Detail of wastewater generation from various areas is given below:

FIG - 4.7
WATER BALANCE, WASTEWATER TREATMENT AND UTILISATION
2x660 MW - KUTPPL



Note:- Values are in m³/hr

WASTEWATER GENERATION (m³/hr)

		Waste Water
Cooling Water - Auxiliary cooling tower blowdown		20
Service / Plant Utilities		10
Domestic	Plant	6.4
	Township	8
Total		43.4

4.2.3.2 WATER POLLUTION CONTROL MEASURES

During construction, provision for infrastructural services including water supply, sewage, drainage facilities and electrification will be made. The construction site would be provided with suitable toilet facilities for the workers to allow proper standards of hygiene and ensure minimum impact on the environment.

The site development activities like site clearing, leveling, earthwork excavation and infrastructural development like roads etc will lead to stagnation of water. This will result in unhygienic conditions leading to breeding of mosquitoes. Adequate arrangements to ensure proper drainage of water will be made. Proper sanitation facilities for the labor colony and the temporary staff quarters will be made. The waste water from construction activities would contain mostly suspended impurities. Adequate sedimentation ponds to channel the construction wastewater will be provided. The ponds will have a minimum of 2-3 hrs of hydraulic retention time. The clear supernatant will be discharged to seasonal stream.

4.2.3.3 WASTEWATER TREATMENT AND DISPOSAL

Plant service water (floor wash in oily area) will be treated for oil and grease removal and will be routed along with CT blowdown to Central monitoring Basin (CMB)

All the wastewater water streams except domestic wastewater will be routed to Central Monitoring Basin. Water from this is being fully utilized for greenbelt development.

Treated wastewater from the CMB totaling to 28 m³/hr will be recycled back to for use in coal handling plant for dust suppression and for greenbelt development Domestic waste water will be treated in Sewage Treatment plant and it will be used for greenbelt development.

WASTEWATER GENERATION (m³/hr)

Unit	Waste Water	Treatment	Recycle/disposal	
Cooling tower blowdown	20	Nil	To CMB	Recycle
Plant Utilities	10	Oil and Grease removal	To CMB	Recycle
Domestic – Plant & Colony	13.4	Sewage treatment plant	13.4 m ³ /hr used for greenbelt development	
Total	43.4			

4.2.3.4 FIRE PROTECTION SYSTEM

It is proposed to provide a full-fledged fire protection system namely hydrant system for all the areas of the power plant, high velocity water spray system for transformer, turbine lube oil tanks, medium velocity spray system for cable vault/gallery and portable fire extinguishers for all the buildings of the plant.

The source of water will be from the firewater storage tanks of adequate capacity. This water is utilized in case of fire within the plant. Therefore this requirement is not a consumptive requirement on daily basis.

4.2.3.5 AREA DRAINAGE STUDY

Surface water plays major role in irrigation when compared to the ground water source. There are around 96 small to medium in size tanks present with in the 10 Km radius of the project site. The total aerial extent of the tanks in the study area is around 8.54 Sq.Km, which accounts for 3% of the total area. Ottapidaram tank in the

village is the biggest tank. All the tanks in the study area are rain fed and water for irrigation from these tanks is available for 2 to 3 months only after the rains.

The structural features mostly control the drainage of the study area. Among the different drainage pattern the well-established drainage systems are parallel and sub-parallel. There is no major river with in 10 km radius of the project site. The drainages are seasonal and rainfed. The streams are flowing towards east.

The flow direction and flow accumulation of the study area clearly indicates the control of the structural features on the river system. The drainage water from the Project site flows towards south confluences with a stream at Rajavinkoil.

Drainage and Water bodies Map of the Project Site and its surroundings of 10 km radius is as shown in **Fig 4.8**

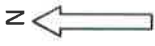
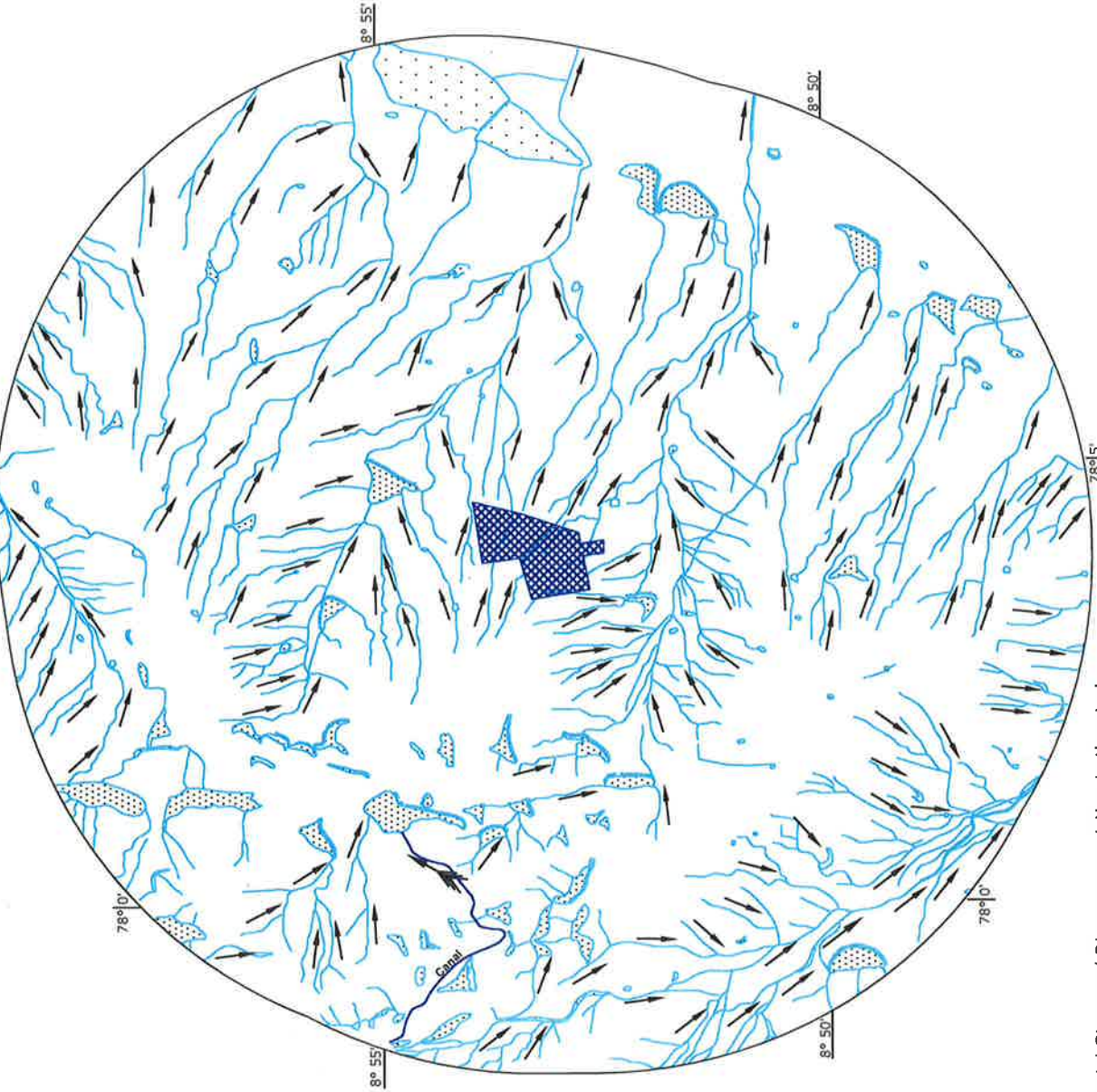
No perennial nallas are existing within the project site. No alteration of the surface drainage pattern of the area is proposed




4.2.3.6 STORM WATER MANAGEMENT & RAIN WATER HARVESTING

A detailed storm water management and rain water harvesting report has been prepared by M/s J V L Technologies, Hyderabad. Report of the same is enclosed as **Annexure – 4C**. Summary of the same is given below:

The historical data indicate that Thoothukudi district receives the lowest rainfall in TamilNadu. The arithmetic averages of rainfall of all stations under district between 2008 and 2013 reveals that the rainfall pattern in the district is very erratic with highest rainfall of 1076.9 mm received during 2008 and lowest rainfall of 410.8 mm received during 2013.

During the South-West monsoon season, the district recorded an average rainfall of 65.7 mm in 2008, which is 6.10% higher than



- LEGEND**
-  STREAMS / TANKS
 -  CANAL
 -  PROJECT SITE

REFER TO THIS MAP AS:- 1:50,000
 SHEET 58/L1&L5 FIRST EDITION
 Published under the direction of
 the Surveyor General of India - 1969

Index to
Survey of India Toposheets


58 G/16	58 K/4	58 K/8
58 H/12		58 L/5
58 H/14	58 L/2	SEA



FIG - 4.8

CLIENT: **M/s. KU THERMAL POWER PRIVATE LIMITED**

PROJECT: **PROPOSED 1320 MW (2x660 MW)
 COAL BASED THERMAL POWER PLANT**

Obbardaram & Silanabam Villages, Obbardaram Taluk, Tuticorin District, Tamil Nadu, India

TITLE: **DRAINAGE MAP**

PREPARED BY
 **B.S. ENVI-TECH (P) LTD.,**
 SECUNDERABAD

No Perennial Streams/ Rivers are existing in the study area
 All Streams are seasonal Streams.

normal rainfall and 13.8 mm in 2013, which is 62.60% less than normal rainfall.

During North-East monsoon season, the district recorded an average rainfall of 592.4 mm in 2008, which is 36.81% higher than normal rainfall and 301.6 mm in 2013, which is 30.35% less than normal rainfall.

During winter season, the district recorded an average rainfall of 323.9 mm in 2008, which is 30.08% higher than normal rainfall and 49.9 mm in 2013, which is 58.83% less than normal rainfall.

The annual average rainfall during 2008 is 1076.9 mm, which is 72.08% higher than normal rainfall and during 2013 it is 410.8 mm, which is 34.36% less than normal rainfall.

Based on the type of facility/development presented in the layout, the project site is sub-divided into three categories:

- 1) Area containing rain water and further utilized – rain falling in raw water pond, ash pond and off- site facilities like open containers etc. will not be available for harvesting. 0.28 MCM of rainfall annually will be collected in raw water pond that will get mixed with raw water and utilized, ash pond that will be pumped to the plant area for use in ash-transportation or recycled and other ponds and containers.
- 2) Area that may receive pollutants in plant area, off-site facilities like coal conveyor/rail yard etc. (pollutants may include settling of ash, particulate matter, sulphur dioxide etc.) – diverting to treatment units and recycle. The amount of rain water available from the plant area and other off- site facilities for treatment and recirculation will be 0.46 MCM per annum.
- 3) Area free from pollutants including township, open space outside plant area, green belt etc. - for rain water harvesting, usage and recharge. Rain water available from the balance area of the project site can be safely harvested and used for direct

ground water recharge which works out to 0.28 MCM per annum.

RAINWATER HARVESTING POTENTIAL

S.No.	Description	Area (sq km)	Run-off Coefficient	Annual Rainfall (m)	Annual Run-off (MCM)
1	Upper Catchment				
1.1	Agriculture/Fallow Land	1.10	0.3	0.626	0.21
1.2	Waste/Scrub Land	1.03	0.25	0.626	0.16
Total/Average		2.12	0.28	0.626	0.37
2	Project Site				
2.1	Areas containing rain water				
2.1.1	Area under raw water pond, ash pond and others containing rain water	0.50	0.9	0.626	0.28
2.2	Balance area from project site for Treatment				
2.2.1	Off-site facilities - coal storage, railway corridor	0.78	0.5	0.626	0.24
2.2.2	Plant area	0.50	0.7	0.626	0.22
2.3	Balance area from project site for Harvesting				
2.3.1	Area to be harvested from roof top of buildings	0.013	0.9	0.626	0.01
2.3.2	Greenbelt	0.64	0.25	0.626	0.10
2.3.3	Other BOP Facilities	0.46	0.6	0.626	0.17
Total/Average		2.893	0.63	0.63	1.02

4.2.3.7 ROOF TOP RAIN WATER HARVESTING

4.2.3.7.1 ADMINISTRATION & SECURITY BUILDINGS

Rain water from the roof tops of Administration and Security buildings can be harvested in a common pit connected through



drop pipes from roof tops and drains with a storage capacity of 135 m³ (with 20% additional capacity over 15 min peak rainfall) and the harvested water can be utilized for toilet flush, gardening etc.

4.2.3.7.2 ROOF TOP WATER HARVESTING DESIGN CAPACITY TOWNSHIP

Since the details of building types, roof areas, open area etc., are not available for the township area, an approximate area of 5% (6070.27 sq m) as roof, 60% as road network & pavements and open space (72843.3 sq m) and balance as green belt are considered for estimating rain water harvesting design volume in the township. Total design volume of water to retain at least 15 minute peak rainfall works out to 2367.41 m³. This can be diverted through drop pipes from the roofs and connecting storm water drains leading to an open well (having at least 2.00 m water column from the shallow weathered aquifer) which can be used as an alternate source for toilet flush, green belt etc., and an artificial ground water recharge structure.

4.2.3.7.3 BALANCE PROJECT AREA (EXCLUDING PLANT AREA)

The volume estimated from this area is 270000 m³ that can be recharged through rain water harvesting pits.

4.2.3.7.4 MANAGEMENT OF WATER HARVESTING SYSTEMS

A detailed storm water drainage network has been considered in the layout designing to collect rain water from roof tops and unpaved areas.

Storm water network considered in the layout is shown in **Fig - 4.9**

The rainwater collected by the storm water network will be routed to proposed rain water harvesting pits proposed in the project area for recharging the ground water.

The following maintenance measure will be followed for proper operation and maintenance of rain water harvesting systems helps to

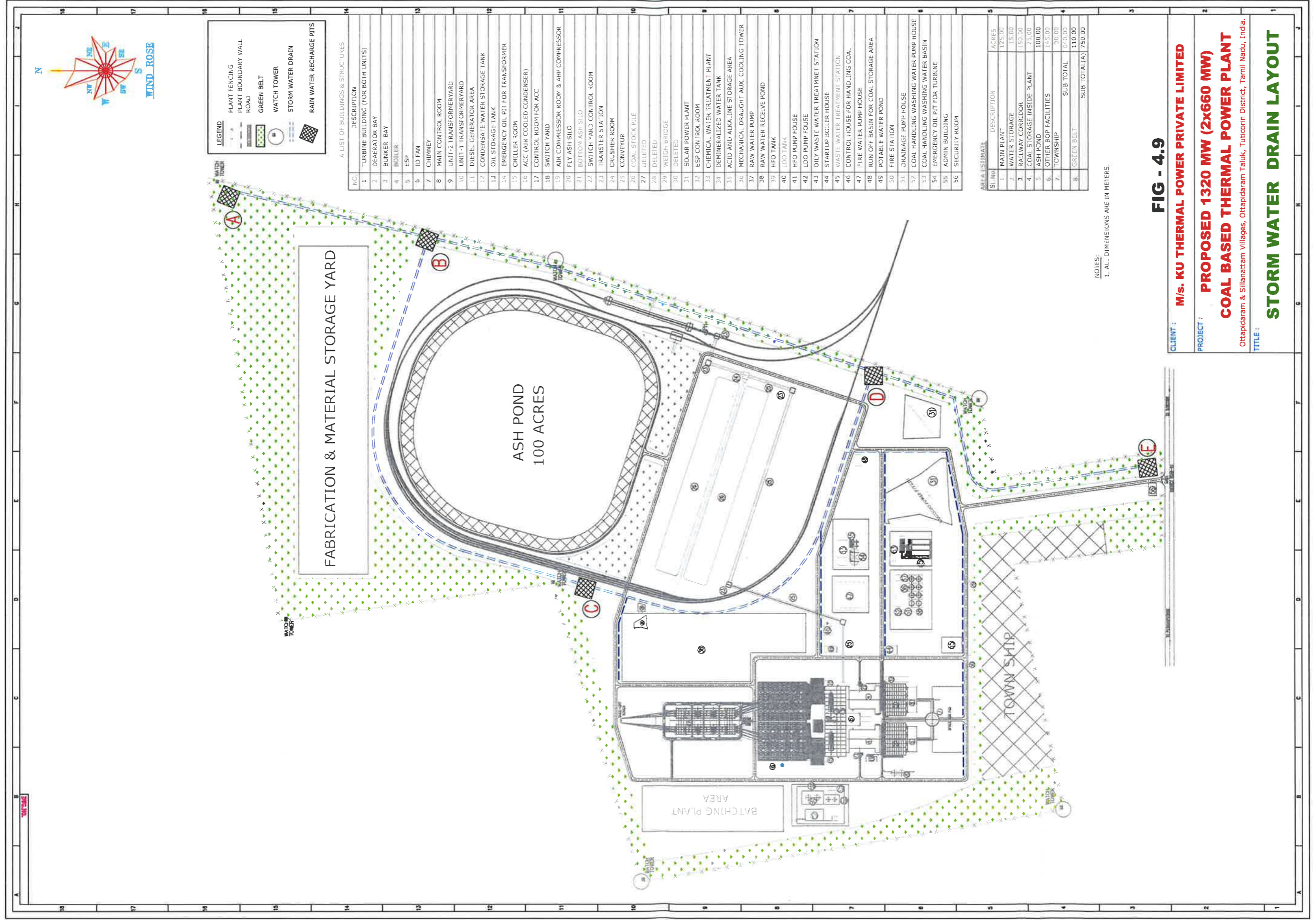


FIG - 4.9

CLIENT: M/s. KU THERMAL POWER PRIVATE LIMITED

PROJECT: PROPOSED 1320 MW (2x660 MW) COAL BASED THERMAL POWER PLANT
Ottapidaram & Sillanattam Villages, Ottapidaram Taluk, Tuticorin District, Tamil Nadu, India.

TITLE: STORM WATER DRAIN LAYOUT

protect water quality in several ways. Regular inspection and cleaning of catchment, gutters, filters and tanks reduce the likelihood of contamination.

- Water from other sources will not be allowed be mixed with that while diverting to the storage or recharge structure.
- Treatment of stored rain water only makes sense if it is done properly and if hygienic collection and use of the Water will ensure it does not suffer from re-contamination.
- Roof top or Recharge water should be silt free as far as possible and roof tops, silt traps and harvesting measures should be cleaned annually preferably before the onset of monsoon. The roof outlets on the terrace should be covered with a mesh to prevent entry of leaves or other solid waste into the system. The filter materials have to be either replaced or washed properly before the monsoon.
- The recharge water is guided through a pipe to the bottom of well or below the water level to avoid scouring of bottom and entrapment of air bubbles in the aquifer.
- The recharge structure will be made on a plot at the places of lower levels/elevations so that rain water may flow towards it under normal gravitation flow.

4.2.4 LAND ENVIRONMENT

4.2.4.1 LAND USE

The construction is expected to take about 44 months from the date of notice to proceed to the EPC contractor. After the completion of the power plant and other facilities, the temporarily modified landuse pattern will be changed to that of the permanent one. This will pave way for landscaping and development of the greenbelt in an area of 160 acres around the main plant area and around the ash pond area. This large scale plantation of trees and landscaping of the vacant

areas will improve the aesthetics of the landscape and provide visual comfort.

4.2.4.2 DIVERSION OF THE ROAD

Cart Track connecting Sillanattam and Lakshmipuram villages which is passing through the project site will be diverted along the project boundary.

4.2.5 GREENBELT DEVELOPMENT PLAN

An area of 160 acres of the project area will be developed under greenbelt to improve aesthetics, control of dust and noise pollution.

A curtain of trees covering a width of 50-100 m all around the power plant complex will be developed as shown in **Fig - 4.10**. The green belt design shall be as follows:

PRIMARY ZONE

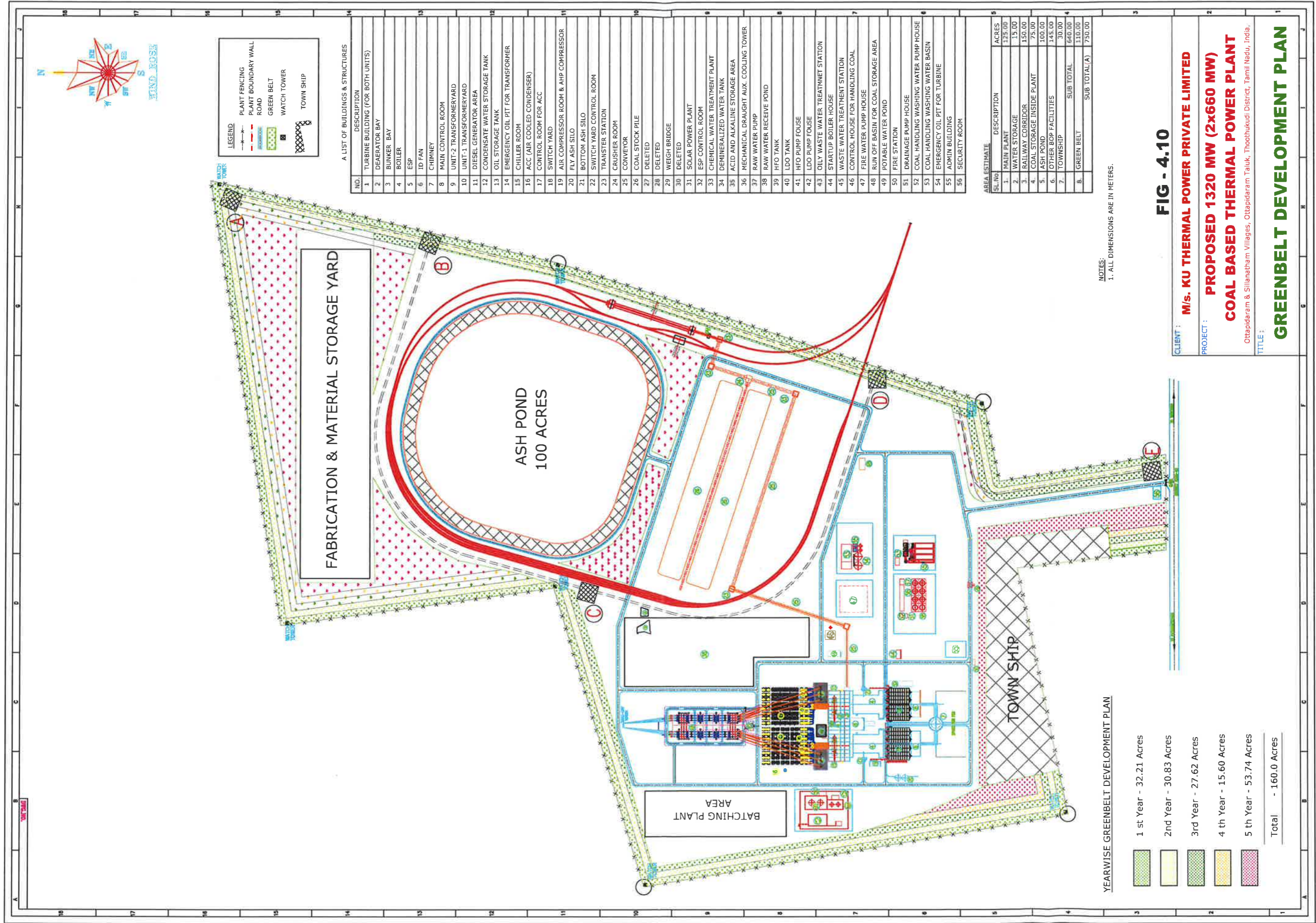
This zone will be the nearest one to the emission sources, where the ambient pollutant concentration is higher. The trees planted here shall have dense spreading canopy. The trees should be close-set with Spacing of 2-3m between trees and width of this zone will be 15 metres.

SECONDARY ZONE

Outer to the above primary zone, 15 metre width wide strip of land will be planted with trees which are moderately tolerant to the pollutants but are endowed with fast growing, dense foliage canopy.

CURTAIN ZONE

All along the boundary of power station complex, a 20 meter width land strip will be planted with trees which are tall in nature and evergreen in habit.



LEGEND

- PLANT FENCING
- PLANT BOUNDARY WALL
- ROAD
- GREEN BELT
- WATCH TOWER
- TOWN SHIP

A LIST OF BUILDINGS & STRUCTURES

NO.	DESCRIPTION
1	TURBINE BUILDING (FOR BOTH UNITS)
2	DEAERATOR BAY
3	BUNKER BAY
4	BOILER
5	ESP
6	ID FAN
7	CHIMNEY
8	MAIN CONTROL ROOM
9	UNIT-2 TRANSFORMERYARD
10	UNIT-1 TRANSFORMERYARD
11	DIESEL GENERATOR AREA
12	CONDENSATE WATER STORAGE TANK
13	OIL STORAGE TANK
14	EMERGENCY OIL PIT FOR TRANSFORMER
15	CHILLER ROOM
16	ACC (AIR COOLED CONDENSER)
17	CONTROL ROOM FOR ACC
18	SWITCH YARD
19	AIR COMPRESSOR ROOM & AHP COMPRESSOR
20	FLY ASH SILO
21	BOTTOM ASH SILO
22	SWITCH YARD CONTROL ROOM
23	TRANSFER STATION
24	CRUSHER ROOM
25	CONVEYOR
26	COAL STOCK PILE
27	DELETED
28	DELETED
29	WEIGH BRIDGE
30	DELETED
31	SOLAR POWER PLANT
32	ESP CONTROL ROOM
33	CHEMICAL WATER TREATMENT PLANT
34	DEMINERALIZED WATER TANK
35	ACID AND ALKALINE STORAGE AREA
36	MECHANICAL DRAUGHT AUX. COOLING TOWER
37	RAW WATER PUMP
38	RAW WATER RECEIVE POND
39	HFO TANK
40	LDO TANK
41	HFO PUMP HOUSE
42	LDO PUMP HOUSE
43	OILY WASTE WATER TREATMENT STATION
44	STARTUP BOILER HOUSE
45	WASTE WATER TREATMENT STATION
46	CONTROL HOUSE FOR HANDLING COAL
47	FIRE WATER PUMP HOUSE
48	RUN OFF BASIN FOR COAL STORAGE AREA
49	POTABLE WATER POND
50	FIRE STATION
51	DRAINAGE PUMP HOUSE
52	COAL HANDLING WASHING WATER PUMP HOUSE
53	COAL HANDLING WASHING WATER BASIN
54	EMERGENCY OIL PIT FOR TURBINE
55	ADMIN BUILDING
56	SECURITY ROOM

AREA ESTIMATE

S/NO	DESCRIPTION	ACRES
1.	MAIN PLANT	113.00
2.	WATER STORAGE	15.00
3.	RAILWAY CORRIDOR	150.00
4.	COAL STORAGE INSIDE PLANT	75.00
5.	ASH POND	100.00
6.	OTHER BOP FACILITIES	145.00
7.	TOWNSHIP	30.00
	SUB TOTAL	640.00
8.	GREEN BELT	110.00
	SUB TOTAL(A)	750.00

NOTES:
1. ALL DIMENSIONS ARE IN METERS.

FIG - 4.10

CLIENT : M/s. KU THERMAL POWER PRIVATE LIMITED
PROJECT : PROPOSED 1320 MW (2x660 MW) COAL BASED THERMAL POWER PLANT
 Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.
TITLE : GREENBELT DEVELOPMENT PLAN

YEARWISE GREENBELT DEVELOPMENT PLAN

1st Year - 32.21 Acres
2nd Year - 30.83 Acres
3rd Year - 27.62 Acres
4th Year - 15.60 Acres
5th Year - 53.74 Acres
Total - 160.0 Acres

This zone will act as a barrier and as far as possible check the pollutants from going to and contaminating other areas beyond the power plant premises. The spacing between the trees would be kept more than 1 metre.

KUTPPL will establish its own nursery with the help of forest department to develop the greenbelt. The density of greenbelt will be 1500 saplings/ha and will include native species only. Greenbelt development will be taken up from the construction stage itself.

4.2.5.1 PLANTATION SCHEDULE

It is proposed to plant 600 saplings/acre for development of the greenbelt within the plant site as per the schedule given below:

GREENBELT AREA

Years	area (acres)	No of saplings (@600 saplings/acre)
1 st	32.20	19320
2 nd	30.82	18492
3 rd	27.61	16566
4 th	15.56	9348
5 th	53.78	32268
TOTAL	160	95994

SPECIES PROPOSED FOR PLANTATION

The list of species proposed for greenbelt development will be as per CPCB guidelines.

4.2.6 SOLID WASTE GENERATION AND MANAGEMENT

4.2.6.1 ASH GENERATION

The major solid waste generation from the plant is ash in the form of fly ash and bottom ash. Fly ash will be collected and stored in silos in dry form for utilization by ash users. The unutilized ash will be disposed to ash pond by wet handling system. The clinker (bottom ash) collected at the bottom of the boiler will also be available to users

if required. Bottom ash which is not used will be sent to ash pond.

4.2.6.2 ASH MANAGEMENT PLAN

The main solid waste generated from the power plant is ash. Maximum ash generation from power plant is due to use of blend coal. Steam generating units are the main sources of the solid waste where coal is burnt. The following table shows the ash generation from the power plant.

ASH GENERATION (MTPA)

	100% Imported coal	Blend coal (70% Indian & 30% imported)
Coal consumption at full load (100%)	620.43 TPH	812.83 TPH
Ash content considered for design	5.52%	31.06%
Ash generated per hour in Tonnes	34.25	252.43
Ash generated per year in Million Tonnes @85%PLF	0.255	1.876
Fly Ash Generation (80% of total ash) million tonnes	0.204	1.50
Bottom ash (20% of total ash)	0.051	0.376

4.2.6.3 ASH HANDLING AND DISPOSAL SYSTEM

The broad parameters considered for design of ash handling and disposal given below:

- High Concentration Slurry disposal has been envisaged for disposal of ash from the Power Plant.
- Progressive utilization of Fly Ash as per the directive of MoEF has been taken into account while computing the quantities.

4.2.6.4 BOTTOM ASH HANDLING SYSTEM

The Bottom ash will be collected in water impounded, refractory

lined, double V-type bottom ash hopper having four (4) outlets. Each outlet will be connected to a clinker grinder and a jet pump. The bottom ash hopper will have capacity to store about 8 hours of bottom ash and economizer ash. It will also be capable of collecting ash from Economizer hoppers in slurry form. The ash from the hopper will be fed to the clinker grinders where it will be crushed to (-) 25mm size. The jet pumps located below the clinker grinders will convey the crushed ash clinkers using high pressure water to the ash slurry sump through piping. The outlets of the bottom ash hopper will be fitted with hydraulically operated (using air-water converter) gates. The ash slurry collected in the slurry sump will be pumped to the ash disposal area by slurry pumps through piping.

4.2.6.5 COARSE ASH HANDLING SYSTEM

Coarse Ash will be collected in Economizer Hoppers, Air Pre-heater Hoppers and Flue gas Duct Hoppers along the flue gas path and will then be conveyed to ash pond.

4.2.6.6 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.

4.2.6.7 VACUUM-CUM-PRESSURE TYPE 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. Once in eight (8) hours shift, the fly ash will be sequentially extracted from these hoppers by creating vacuum in the extraction piping circuit with the help of vacuum pumps. 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 conveying air compressors. There will be two ash transmitter vessels below each Buffer hopper, out of which one will be operating and the

other will be standby. A vent filter with fan will be mounted on the silo 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 in all hoppers will completely evacuated from the hoppers once in eight (8) hours shift.

4.2.6.8 HIGH CONCENTRATION SLURRY DISPOSAL (HCSD) SYSTEM FOR FLY ASH.

4.2.6.8.1 FLY ASH FROM MAIN SILO TO MIXING TANK

The fly ash collected in RCC silo shall be extracted through a pneumatic operated valve and a Rotary feeder provided with variable speed drive to control its discharge from silo. A solid flow meter shall be provided to measure the flow rate and help in regulating the feed rate through variable speed drive of Rotary feeder. The dry ash shall be mixed with water in Ash conditioner and then feed in to mixing tank. The mixing tank prepares the slurry by mixing the ash with water in rated proportion.

4.2.6.8.2 HIGH CONCENTRATION SLURRY DISPOSAL SYSTEM(HCSD)

The mixing tank outlet shall be connected to an individual HCSD Pumps. The high concentration slurry formed in mixing tank shall be disposed off to Ash pond through suitably sized seamless pipeline connected to each mixing tank by means of High Pressure Piston diaphragm Pump. Ash slurry shall be fed to high pressure pumps by centrifugal pumps (if required). The mixing tank shall be provided with necessary instruments to monitor and control the concentration of slurry. The discharge line shall be flushed using the high pressure pump.

This is environmentally friendly technology, which disposes of power plant fly ash efficiently and effectively. No water retaining structures are needed and the area required for disposal is about half that for lean phase systems.

For evacuation of bottom ash for the 25 years, Lean Phase Slurry System will be adopted. Evacuation of 50% of fly ash upto 4 years will be done through HCSD system

It is envisaged to have normal slurry disposal system sized for 100% generation of ash from the generating units. The bottom ash slurry and coarse ash slurry would be fed to common slurry pump house for onward transfer to the Ash Pond through hydrobins. Hydrobins are incorporated to separate and reuse excess water in the slurry.

4.2.6.9 ASH WATER SYSTEM

Necessary HP and LP water pumps, flushing water pumps and seal water pumps for slurry disposal pump gland sealing and other uses will be provided.

4.2.6.10 ASH POND

The possibility of groundwater contamination due to the leaching of metals from the ash pond was examined based on soil investigation study. The soil investigation carried out in the region indicates the co-efficient of permeability in the area is in the range of 10^{-6} to 10^{-5} cm per second, which indicates very poor drainability. The same will be reduced further to 10^{-9} cm per second, if required, by compaction. The dykes around the pond shall be constructed with proper compaction at maximum dry density. The co-efficient of permeability shall be much less than the natural deposits to further reduce the drainability.

Thus, the impact of the ash pond on the ground water will be insignificant. Further, the existing infiltration rates may reduce further due to the disposal of ash in the ash pond, which is likely to be caused due to the result of deposition of fly ash in the pore space of the topsoil, which will decrease its permeability. With the passage of time, more and more fly ash particles will get deposited in the pore spaces of the top soil making it essentially non-porous and impervious

and in view of the above, contamination through leaching is not envisaged.

Moreover, in high concentrate slurry, water content will be very less about 35-40% and there will not be pounding of the water in ash pond. There will not be any water left for leaching into ground water. However, liners will be provided to ash pond to prevent leaching of contaminants to groundwater. Hence, the impact on the ground water quality will be insignificant.

4.2.7 ASH UTILISATION

ASH GENERATION

The peak generation of ash due to use of coal in the proposed 1320 MW power plant is estimated to be about 1.876 MTPA (at 85 % PLF).

FLY ASH UTILIZATION

Maximum flyash generation from the plant is 6060 t/day. KUTPPL has tiedup with the following for offtake of flyash generated from the plant for the following quantities.

1. My Home Industries Limited – 0.35 MTPA as on today and 0.7 MTPA by 2018.
2. The Ramco Cements Limited – 0.50 MTPA.

KUTPPL has entered into MOU's with Cement Companies (**Enclosed as Annexure – 4 D**)

KUTPPL is exploring the possibility of exporting Flyash.

DISPOSAL OF UNUTILIZED ASH TO ASH POND

The unutilized ash comprising fly ash and bottom ash will be disposed to the ash dyke proposed in an area of 100 acres of land. The dyke will be initial height of 5 Meters and extension of height will be done using fly ash from the plant. **Details regarding the Ash pond design are furnished in Annexure – 2A.**

4.2.8 HAZARDOUS WASTE MANAGEMENT

The Company will store the hazardous waste like waste oil, lube oil in a designated area as per the practices approved by State Pollution Control Board and the statutory provisions.

Spent Oil / lubricating oil and batteries will be disposed to the authorized vendors as per the Hazardous Wastes (Management and Handling) Amendment Rules, 2011.

4.3 SOCIO ECONOMIC ENVIRONMENT

Socio Economic Status in the study area is found to be moderate with respect to livelihood, amenities etc.

The management will give preference to local people for recruitment in semi-skilled and unskilled categories. The direct and indirect employment potential of the proposed project is as follows:

REQUIREMENT OF MANPOWER

	Direct	Indirect
During Construction (Executives and Supervisory Staff)	125	-
During Construction (Manpower -Peak)	-	2000 (peak)
During Operation (unskilled & skilled)	450	-

Additional employment due to support services like security, greenbelt development, and township will be in the range of 50 people.

The power plant will help in developing the overall socio-economy of the area by providing the following benefits to the local population:

- Increase in secondary employment opportunities for providing infrastructural support services like housekeeping, security, plant maintenance etc.
- Improvement in communication, transport and medical facilities.
- Improvement in educational facilities.

4.3.1 IMPACT ON LIVELIHOOD

Primary survey was conducted in villages and views of respondents in focused group discussions have been obtained. Summary of the same are given below:

- ❖ Generation of additional economic activity is expected to create employment opportunities for the local population, will be either in Power plant itself or in downstream industries and commercial ventures and in service sector units that will be developed in an around the project area.
- ❖ At present economic activities in the project area are limited and concentrated to agriculture and allied activities only. Both skilled and unskilled manpower of the project area is expected to get employment opportunities due to the power plant.
- ❖ There is a need for skill up gradation or new skill acquisition training for youths of the area, which will be an added advantage.
- ❖ It is envisaged that in post project period due to presence of small and medium industries, lot of employees of the plant and industrial workers will be settled in the villages, this will open up trade or business opportunities for youth as well employment opportunities in the villages. Youth may open up grocery shops, medical shops. Saloons, PCOs, etc. and will earn handsomely. .
- ❖ At present the wage rate in the project area varies from Rs.200 to Male and Rs.150 to female for 8 hours labour work in agricultural activity. But in case of Non-Agricultural labour, the wage rate is in the rate of Rs. 300/- to Male and Rs. 200 /- Female. This is very low as compared to the market price of the area. No doubt this will increase after the constructed activities of the Power Plant starts in the area.
- ❖ At present the market in the project area is very much unorganized. This will be an organized one after the Power plant starts its operation. Improvement in living standards of the people of the area as well influx of huge number of workers and

employees will develop the market economy of the area to a significant extent. A variety of products will be available in the area. Also market opportunities will be developed for the local household products like milk and milk products, meat, vegetables, farm products etc.

- ❖ At present the Project area is devoid of adequate infrastructure and service facilities. There is lack of good quality of roads, communications and transport facilities, health, education and market facilities in the project area. People have poor access to improved health care facilities and depend on nearby cities, Tuthukodi, and Ramanthapuram. Similarly, the project area lack good quality public schools, where people are able to afford can admit their children for better education. Regarding availability of transport and communication facilities, the project area is entirely dependent on three wheelers that are not sufficient to meet the demands in the absence of bus facilities, people face lot of difficulty in commuting at the time of need. The setting up of the power plant and the implementation of CSR activities will create significant improvement in the socio economy of the area
 - Women, Children, handicapped etc., are considered as vulnerable in any community and needs special care in any operation. Once the power plant commissioned, the major impacts on this group of population as perceived by the community are:
 - More participation of women in economic activities
 - General outlook and awareness of women may increase
 - Women and other vulnerable groups may feel secure due to increased family income and improvement in social status.
 - Better educational, and health facilities may develop in post project period.
 - Increased group interaction with in women members and improvement in social status.

4.3.2 IMPACT DUE TO LAND ACQUISITION

Power Plant will be located in an area of about 750 acres Private Land. About 725 acres of private patta land had been procured

4.3.3 OCCUPATIONAL SAFETY & HEALTH MEASURES - CONSTRUCTION PHASE

A senior Environment and Safety Officer will be made in-charge of the Environment and Safety aspects during construction.

A senior Environment and Safety Officer belonging to the EPC contractor will coordinate the Safety and Environmental aspects in consultation with Company's Environment and Safety Officer.

Proper Sanitation, Dwelling and Drinking Water facilities will be provided to the workforce at site

A 24 Hr Medical Aid Room with qualified para-medical staff and fully equipped Ambulance will be made available at site

The Company will tie-up with Hospitals in Thoothukudi to provide timely medical help and treatment in case of medical emergency. In addition, proper co-ordination will be made with neighboring industries so as to ensure that emergency medical aid is extended in the least time.

Two fire tenders with trained personnel will be made available to handle any fire accident at site. The firefighting tenders will also be extended to other neighboring plants/ villages etc in coordination with District Authorities to ensure mutual help in case of fire.

The Company will provide regular training to its staff on Occupational Safety and Health both during construction and operation.

4.3.4 OCCUPATIONAL SAFETY & HEALTH MEASURES –OPERATIONAL PHASE

Occupational health and safety risks and mitigation measures during operation are:

- Heat
- Noise
- Dust
- Electrical hazards
- Fire and explosion hazards

Heat

Occupational exposure to heat occurs during operation and maintenance of combustion units, pipes, and related hot equipment. Prevention and control measures proposed to address heat exposure at thermal power plants include:

- ❖ Regular inspection and maintenance of pressure vessels and piping;
- ❖ Provision of adequate ventilation in work areas to reduce heat and humidity;
- ❖ Reducing the time required for work in elevated temperature environments and ensuring access to drinking water;
- ❖ Shielding surfaces where workers come in close contact with hot equipment, including generating equipment, pipes etc;
- ❖ Use of warning signs near high temperature surfaces and personal protective equipment (PPE) as appropriate, including insulated gloves and shoes.

Noise

Noise sources in combustion facilities include the turbine generators and auxiliaries; boilers and auxiliaries, such as pulverizers; diesel engines; fans and ductwork; pumps; compressors; condensers; precipitators, including rappers and plate vibrators; piping and valves; motors; transformers; circuit breakers; and cooling towers. proposed

measures to prevent, minimize, and control occupational noise exposures in thermal power plants include:

- ❖ Provision of sound-insulated control rooms with noise levels below 60 dBA
- ❖ Identify and mark high noise areas and require that personal noise protecting gear is used all the time when working in such high noise areas (typically areas with noise levels >85 dBA).

Dust

Dust is generated in handling solid fuels and solid wastes (e.g., ash). Dust may contain silica (associated with silicosis), arsenic (skin and lung cancer), coal dust (black lung), and other potentially harmful substances.

Proposed measures to prevent, minimize, and control occupational exposure to dust in thermal power plants include use of dust controls i.e at source and at personnel level to keep dust below applicable guidelines or wherever free silica levels in airborne dust exceed 1 percent;

Electrical Hazards

Energized equipment and power lines can pose electrical hazards for workers at thermal power plants. Proposed measures to prevent, minimize, and control electrical hazards at thermal power plants include:

- ❖ Consider installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization;
- ❖ Use of voltage sensors prior to and during workers' entrance into enclosures containing electrical components;
- ❖ Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximal to them;
- ❖ Provision of specialized electrical safety training to those workers working with or around exposed components of electric

circuits. This training should include, but not be limited to, training in basic electrical theory, proper safe work procedures, hazard awareness and identification, proper use of PPE, proper lockout/tagout procedures, first aid and proper rescue procedures.

Fire and Explosion Hazards

Storage, transfer, and use large quantities of coal; therefore, careful handling is necessary to mitigate fire and explosion risks. In particular, fire and explosion hazards increase as the particle size of coal is reduced. Particle sizes of coal that can fuel a propagating explosion occur within thermal dryers, cyclones, baghouses, pulverized-fuel systems, grinding mills, and other process or conveyance equipment.

4.3.5 OCCUPATIONAL HEALTH SURVEY

Occupational health checkup at the time of recruitment will be carried for all the employees for the following tests:

- Lung function test
- ECG
- Chest X-ray
- Blood analysis test
- Urine analysis test
- Audiometry
- Checking colour blindness
- Stool Analysis
- Sputum (Optional)

If any person who fails the above health checkup will not recruited. Like so, a baseline data on the health status of workmen in the Pre-recruitment stage will be established. The same will be repeated periodically to update and to take action accordingly.

KUTPPL will engage full time qualified doctor who is trained in occupational health. Health monitoring of the workers will be

conducted at periodic intervals and health records will be maintained. Awareness programme for workers due to likely adverse impact on their health due to working in non-conducive environment will be carried out and precautionary measures like use of personal equipment etc. will be provided. Review of impact of various health measures undertaken at intervals as per statutory norms will be conducted with a follow up plan of action wherever required.

The first aid box will be made available for immediate treatment. First aid training is imparted to the selected employees regularly. The list of first aid members is being displayed at strategic places. A full fledged health centre manned by a qualified Doctor will be in operation with start of construction to take care of any emergencies.

A full-fledged Health Centre with qualified doctor will be in operation with the start of construction to take care of any emergencies

CHAPTER - 5

ANALYSIS OF ALTERNATIVES (TECHNOLOGY & SITE)



CHAPTER - 5 : ANALYSIS OF ALTERNATIVES (TECHNOLOGY & SITE)

5.1 ANALYSIS OF ALTERNATIVE TECHNOLOGY

The selection of the proper steam generator technology is a critical step in the basic design of a new power project. The fuel to be fired and the steam cycle to be adopted dictates the type of steam generator needed to satisfy the requirements of the project.

5.1.1 ALTERNATIVES FOR BOILER TECHNOLOGY

The following are the general options for selection of boiler technology.

For easy to burn fuels, such as bituminous coals – suspension firing of the pulverized fuel in horizontal, wall-mounted burners is the configuration of choice.

For low volatile, low reactivity fuels, such as anthracite and petroleum cokes, the down – fired arch furnace is the choice adopted world-wide. Another option for difficult fuels, as well as for waste fuels, which cannot be properly burned with suspension firing, is the circulating fluidized bed (CFB) boiler. Also the flywheel of circulating solids in the CFB boiler allows a wide range of fuels to be fired in the same unit.

In the proposed project, coal will be the main fuel. Hence, pulverized super critical boilers are considered.

5.1.1 ALTERNATIVES FOR BOILER PARAMETERS

Two options, sub-critical and supercritical parameters were examined related to power generation of thermal power plants.

Super critical boilers possess high steam parameters and higher efficiency. The major benefit of adopting higher steam cycle is reduction in emissions of PM, CO₂, SO₂, and NO_x.

The principal advantages of supercritical steam cycles are:

- Reduced fuel costs due to improved thermal efficiency.
- CO₂ emissions reduced by about 15%, per unit of electricity generated, when compared with typical existing subcritical plant.
- Well-proven technology with excellent availability, comparable with that of existing subcritical plant.
- Very good part-load efficiencies, typically half the drop in efficiency experienced by subcritical plant costs comparable with subcritical technology and less than other clean coal technologies and
- Very low emissions of nitrogen oxides (NO_x), sulphur oxides (SO_x) and particulates achievable using modern flue gas clean-up equipment.

Hence, in view of the above, super critical parameters are considered for the proposed boiler configuration.

5.2 ANALYSIS OF ALTERNATIVE SITES FOR LOCATION OF POWER PLANT

Three (3) probable locations were assessed for site selection:

- Site-1: Veppalodai site, near veppalodai Village, Tuticorin district, Tamilnadu
- Site-2: Kayalpattinam site, near Kayalpattinam village, Tuticorin District, TN
- Site-3: Ottapidaram & Sillanattam village, Ottapidaram taluk, Tuticorin District, Tamilnadu

TABLE - 5.1
SITE SELECTION CRITERIA

S.NO	CRITERIA	SITE-1 (Veppalodai)	SITE-2 (Kayalpattinam)	SITE-3 (Ottapidaram & Sillanattam)
1	Nearest Town	Thoothukudi (19.0 km, S)	Thoothukudi (25 km, N)	Thoothukudi (10 km, SE)
2	Road Connectivity	SH-75 (2.3 KM, NW)	SH-17 (6.2 km, E)	NH-45B (3.0 km, E) SH-75 (2.8 km, N)
3	Rail Connectivity	Thoothukudi (19.1 km, S)	Kayalpattinam (2.0 km, S)	Tattaparai (6.7 km, SE)
4	Port	Thoothukudi (24.0 km, S)	Thoothukudi (25.0 km, N)	Thoothukudi (18.5 km, E)
5	Water Source	South Ganga Waters Technologies Private Ltd at Vellapatti (14.1 km, S)	South Ganga Waters Technologies Private Ltd at Vellapatti (31.0 km, N)	South Ganga Waters Technologies Private Ltd at Vellapatti (10.7 km, SE)
6	Coal Source (Domestic & Imported)	Indigenous coal fields and Imported coal from Indonesia	Indigenous coal fields and Imported coal from Indonesia	Indigenous coal fields and Imported coal from Indonesia
7	Protected areas as per Wildlife Protection Act, 1972 (National Parks, Wildlife Sanctuaries and Reserves)	Nil in 10 km radius	Nil in 10 km radius	Nil in 10 km radius
8	Reserved / Protected Forests (in 15 Km radius)	Nil	Nil	Nil
9	Religious, Archeological Monuments	Nil	Nearer to Srichendur	Nil
10	Defence Installations	Nil in 10 km	Nil in 10 km	Nil in 10 km
11	Land Profile	Barren land	Barren land	100% uncultivable waste land
12	Social Issues	Nil	Nil	Nil
13	Homestead oustees	Nil	Nil	Nil
14	Forest land	Nil	Nil	Nil

Source; Final EIA report of M/s Vimta Labs Ltd



SELECTION OF THE SITE

After evaluation of the above 3 sites, the site near Ottapidaram & Sillanattam villages in Ottapidaram taluk, Thoothukudi district has been identified for the development of the project due to the following advantages

- Site is a dry land with no irrigation facilities as per revenue records.
- Availability of required plain land
- Proximate to Thoothukudi Port
- Nearest national high way (NH-45B) is at about 3.0 km from the selected site
- Nearest railway Station (Tattaparai) is at about 6.7 km
- Desalinated water availability from South Ganga Waters Technology Private Ltd located at 10.7 km from the site
- No National Parks, Wildlife Sanctuaries in 10 km radius
- No human settlements, habitations or forests in the Project area
- Suitability for laying railway siding for transportation of coal from Thoothukudi port
- Power evacuation to nearby PGCIL substation

The location of alternative sites considered for the proposed power plant are shown in **Fig - 5.1**.

FIG - 5.1
ALTERNATE SITES CONSIDERED FOR THE PROPOSED POWER PLANT



Source; Final EIA report of M/s Vimta Labs Ltd

CHAPTER - 6

ENVIRONMENTAL MONITORING PROGRAMME



CHAPTER - 6 : ENVIRONMENTAL MONITORING PROGRAM

6.1 ENVIRONMENTAL MONITORING PROGRAM

Monitoring of various environmental parameters will be carried out on a regular basis to ascertain the following:

- State of pollution within the plant and in its vicinity;
- Generate data for predictive or corrective purpose in respect of pollution;
- Examine the efficiency of Pollution Control Systems installed in the Power Station; and
- To monitor the environmental impacts

The characteristics of plant/treated effluent, which would be ultimately disposed off, will be maintained to meet the requirements of the TNPCB Minimum National Standards for Thermal Power plant as Central Pollution Control Board/MoEF&CC.

The various items to be monitored are stack emission, ambient air quality, liquid effluent quality and noise levels. Post Project monitoring programme to be undertaken by the plant authorities for various environmental components is detailed below:

A Meteorology

An automatic continuous recording meteorological station will be installed within the plant premises for a proper measurement and record of meteorological parameters on hourly basis. In addition, minimum and maximum temperatures, atmospheric pressure and rainfall will be measured daily.

B Ambient Air Quality

To determine the extent to which the proposed thermal power plant contributes to pollution in the area, a network of AAQ ground level monitoring stations are proposed.



Continuous monitoring of PM10 & PM2.5, SO₂ and NO_x concentrations from the stack would be carried out using online emission monitoring system for proper control of the pollutants.

Periodic monitoring (monthly) of stack emissions by Stack Monitoring Kit would also be undertaken for counter checking the results of continuous monitoring. The stack monitoring data will be utilised to keep a check on the performance of pollution control equipment

Ambient air quality would be monitored twice a week for Particulate Matter (PM₁₀ and PM_{2.5}), SO₂, NO_x, and CO 24-hourly samples of ambient air quality at five locations outside plant premises and one station at the plant shall be carried out. In addition CO monitoring at each location shall be carried out twice a week.

C Water Quality

Treated wastewater quality of the wastewater at the outlet of the Common Monitoring Basin.

D Noise Environment

Noise will be monitored for day-and-night-time at plant area and nearby villages once in six months.

E Occupational Health

Health checks, especially for diseases of eye, ear and chest for all plant personnel will be carried out as per statutory requirement

The proposed post-operational monitoring programme is presented in **Table - 6.1.**

The power plant will be based on super critical technology and will be equipped with pollution control and monitoring systems. These measures will help in minimizing the impact on the environment due to the operation of the power plant.



TABLE - 6.1
MONITORING PROGRAMME

Discipline	Locations	Parameter	Frequency
Meteorology (Met station)	One	Max. and Min. Temp, Rain fall, Relative Humidity, Atm.Pressure, Wind speed and direction	Continuous using auto weather station
Ambient Air Quality	Three	PM10 & PM2.5, SO ₂ , NO _x , and CO	Continuous Ambient air quality stations connected to TNPCB web site
Stack Emissions	Each Unit	PM, SO ₂ , NO _x Particle Size	Continuous online stack emission monitoring connected to TNPCB web site
Waste water	Plant Wastewater (Central Monitoring Basin)	pH, Temp, Conductivity, Total suspended & dissolved solids, Chemical Oxygen Demand (COD), Bio-Chemical Oxygen Demand (BOD) & Dissolved Oxygen (DO), Oil & Grease, Phenolic Compounds, Sulphates, Chlorides, Fluorides, Phosphates.	Daily
		Iron & Heavy Metals (Hg, Cd, Cr, Pb, Zn, As, Cu)	Quarterly
Soil Quality	Four locations around ash pond and close to air quality monitoring stations	Physico-chemical parameters, Organic content and heavy metals	Once in a year
Surface water quality	Minimum two locations (to be finalized in consultation with State Pollution Control Board)	pH, Temp, Conductivity, TSS & TDS, BOD & DO, MPN Coliform.	Monthly
		Iron & Heavy Metals (Hg, Cd, Cr, Pb, Zn, As, Cu)	Quarterly
Ground Water Quality	Four locations around Ash pond (to be finalized in consultation with State Pollution Control Board)	pH, TSS, TDS, Fluoride and Boron	Monthly
		Heavy Metals	Quarterly
Noise	Plant Area and Near by villages	Day-and Night time noise Levels	6 monthly
Ash quality	Two samples	For all Heavy metals	Monthly
Coal quality	Four samples		
Health Check up	All Plant personnel	Diseases of Eye, Ear and Chest	Yearly

6.2 BUDGET FOR IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT PLAN

A budget of Rs 418 Crores is earmarked for implementing the Environmental Management Plan for project:

BUDGET FOR IMPLEMENTATION OF EMP

Sr. No	Description of Item	Cost (Rs in Crores)	Recurring Cost (Rs in Crores)
1	Electrostatic Precipitators	170	8.5
2	Ash pond dyke	100	5
3	Effluent Treatment Plant (ETP) and	50	2.5
4	Dust Suppression System	40	2
5	Control of Fire & Explosion Hazards	20	1
6	Noise abatement	20	1
7	Environmental Lab Equipment and on line Monitoring equipment	10	0.5
8	Green Belt	8	0.4
	Total	418	20.9

GREEN ENDOWMENT FUND

As part of CSR activities, KUTPPL has earmarked an amount of Rs 125 Lakhs as part of CSR budget. This amount will be utilized for waste land development into plantation



CHAPTER - 7

ADDITIONAL STUDIES



CHAPTER - 7: ADDITIONAL STUDIES

7.1 PUBLIC CONSULTATION

Public Consultation was conducted on 24.7.2014. The proceedings are enclosed as **Annexure - 7A**. Revised detailed response and Action plan with budgetary provisions for issues raised in PH are enclosed as **Annexure - 7 B**

7.1.1 JUSTIFICATION FOR PUBLIC HEARING VENUE

Public Hearing(PH) Venue was fixed by District Collector. It is normal practice at Thoothukudi to conduct all public hearing at District collectorate office.

TNPCB published Name and address of the project, Project Details, Date&Time, Venue, Contact Person on its web site at link <http://www.tnpcb.gov.in/publichearing.htm> inviting Responses to be e-mailed to tnpcb@md3.vsnl.net.in to the contact person in writing on or before the public hearing date.

The public hearing done so far during last one year at Office of the District Collector, Sangukoodam, Korampallam, Thoothukudi in the last one year including the subject project are

- M/s. Modern Building Materials Private Limited, Melamaruthur Village, Ottapidaram Taluk, Thoothukudi district.
- Formation of Flood Carrier Canal from Kannadian Channel to drought prone areas of Santhankulam, Thisaiyanvillai by interlinking Tamiraparani Karumeniyar and Nambiyar Rivers in Tirunelveli and Thoothukudi districts of Tamil Nadu.

7.2 RISK ASSESSMENT AND AN APPROACH TO EMERGENCY PREPAREDNESS PLAN

7.2.1 Introduction

Hazard analysis involves the identification and quantification of the various hazards (unsafe conditions) that exist in the proposed power



plant. On the other hand, risk analysis deals with the recognition and computation of risks, the equipment in the plant and personnel are prone to, due to accidents resulting from the hazards present in the plant.

Risk analysis follows an extensive hazard analysis. It involves the identification and assessment of risks the neighboring populations are exposed to as a result of hazards present. This requires a thorough knowledge of failure probability, credible accident scenario, vulnerability of population etc. Much of this information is difficult to get or generate. Consequently, the risk analysis is often confined to maximum credible accident studies.

In the sections below, the identification of various hazards, probable risks in the proposed power plant, maximum credible accident analysis, consequence analysis are addressed which gives a broad identification of risks involved in the plant. The Disaster Management Plan (DMP) has been presented based on the risk estimation for fuel storage only since there is no hazardous chemical storage in the power plant in view of the electro chlorination plant proposed to be installed.

7.2.2 Approach to the Study

Risk involves the occurrence or potential occurrence of some accidents consisting of an event or sequence of events. The risk assessment study covers the following:

- Identification of potential hazard areas;
- Identification of representative failure cases;
- Visualization of the resulting scenarios in terms of fire (thermal radiation) and explosion;
- Assess the overall damage potential of the identified hazardous events and the impact zones from the accidental scenarios;
- Assess the overall suitability of the site from hazard minimization and disaster mitigation point of view;
- Furnish specific recommendations on the minimization of the worst accident possibilities; and

- Preparation of broad disaster management plan (DMP), on-site and off-site Emergency Plan, which includes Occupational and Health Safety Plan.
- Check calls on random periodicity through dummy tests and responses.

7.3 Hazard Identification

Identification of hazards in the proposed power plant is of primary significance in the analysis, quantification and cost effective control of accidents involving chemicals and process. A classical definition of hazard states that hazard is in fact the characteristic of system/plant/process that presents potential for an accident. Hence, all the components of a system/plant/process need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident. The following two methods for hazard identification have been employed in the study:

- Identification of major hazardous units based on Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 of Government of India (GOI Rules, 1989); and
- Identification of hazardous units and segments of plants and storage units based on relative ranking technique, viz. Fire-Explosion and Toxicity Index (FE&TI).

7.3.1 Classification of Major Hazardous Units

Hazardous substances may be classified into three main classes namely flammable substances, unstable substances and toxic substances. The ratings for a large number of chemicals based on flammability, reactivity and toxicity have been given in NFPA Codes 49 and 345 M. The major hazardous materials to be stored, transported, handled and utilized within the facility have been summarized in the **Table-7.1**. The fuel storage details and properties are given in **Table-7.2** and **Table-7.3** respectively.

TABLE-7.1
HAZARDOUS MATERIALS STORED,
TRANSPORTED AND HANDLED

Materials	Hazardous Properties
LDO	UN 1203. Dangerous Goods class 3 - Flammable Liquid
HFO	Dangerous Goods class 3 - Flammable Liquid

TABLE-7.2
CATEGORY WISE SCHEDULE OF STORAGE TANKS

Sr. No.	Material	No. of Tanks	Design Capacity (KL)	Classification
1	LDO	1	500 (each)	Non-dangerous Petroleum
2	HFO	2	1000(each)	Non-dangerous Petroleum

TABLE-7.3
PROPERTIES OF FUELS USED IN THE PLANT

Chemical	Codes/Label	TLV	FBP	MP	FP	UEL	LEL
			°C			%	
HFO	Flammable	5 mg/m ³	350	-26	66	6.0	0.5
LDO	Flammable	5 mg/m ³	400	-	32 - 96	7.5	0.6

TLV : Threshold Limit Value

MP : Melting Point

UEL : Upper Explosive Limit

FBP : Final Boiling Point

FP : Flash Point

LEL : Lower Explosive Limit

7.3.1.1 Identification of Major Hazard Installations Based on GOI Rules, 1989

Following accidents in the chemical industry in India over a few decades, a specific legislation covering major hazard activities has been enforced by Govt. of India in 1989 in conjunction with Environment Protection Act, 1986. This is referred here as GOI Rules 1989. For the purpose of identifying major hazard installations the rules employ certain criteria based on toxic, flammable and explosive properties of chemicals.

A systematic analysis of the fuels/chemicals and their quantities of storage has been carried out, to determine threshold quantities as notified by GOI Rules, 1989 and the applicable rules are identified. Applicability of storage rules are summarized in **Table-7.4**.

TABLE-7.4
APPLICABILITY OF GOI RULES TO FUEL/CHEMICAL STORAGE

Sr. No.	Chemical/ Fuel	Listed in Schedule	Total Quantity (KL)	Threshold Quantity (T) for Application of Rules	
				5,7-9,13-15	10-12
1	LDO	3 (1)	1x500	25 MT	200 MT
2	HFO	3 (1)	2x1000	25 MT	200 MT

7.4 Hazard Assessment and Evaluation

7.4.1 Methodology

An assessment of the conceptual design is conducted for the purpose of identifying and examining hazards related to feed stock materials, major process components, utility and support systems, environmental factors, proposed operations, facilities, and safeguards.

7.4.2 Preliminary Hazard Analysis (PHA)

A preliminary hazard analysis is carried out initially to identify the major hazards associated with storages and the processes of the plant. This is followed by consequence analysis to quantify these hazards. Finally, the vulnerable zones are plotted for which risk reducing measures are deduced and implemented.

Preliminary hazard analysis for fuel storage area and whole plant is given in **Table-7.5** and **Table-7.6**.

TABLE-7.5
PRELIMINARY HAZARD ANALYSIS FOR STORAGE AREAS

Unit	Capacity	Hazard Identified
LDO	1 x 500 KL	Fire/Explosion
HFO	2 x 1000 KL	Fire/Explosion

TABLE-7.6
PRELIMINARY HAZARD ANALYSIS FOR THE WHOLE PLANT IN
GENERAL

PHA Category	Description of Plausible Hazard	Recommendation	Provision
Environmental factors	If there is any leakage and eventuality of source of ignition.		All electrical fittings and cables are provided as per the specified standards. All motor starters are flame proof.
Environmental factors	Highly inflammable nature of the liquid fuels may cause fire hazard in the storage facility.	A well designed fire protection including foam, dry powder, and CO ₂ extinguisher should be provided.	Fire extinguisher of small size and big size are provided at all potential fire hazard places. In addition to the above, fire hydrant network is also provided.

7.4.3 Fire Explosion and Toxicity Index (FE&TI) Approach

Fire, Explosion and Toxicity Indexing (FE & TI) is a rapid ranking method for identifying the degree of hazard. The application of FE & TI would help to make a quick assessment of the nature and quantification of the hazard in these areas. However, this does not provide precise information.

The degree of hazard potential is identified based on the numerical value of F&EI as per the criteria given below:



F&EI Range	Degree of Hazard
0-60	Light
61-96	Moderate
97-127	Intermediate
128-158	Heavy
159-up	Severe

By comparing the indices F&EI and TI, the unit in question is classified into one of the following three categories established for the purpose (Table-7.7).

TABLE-7.7
FIRE EXPLOSION AND TOXICITY INDEX

Category	Fire and Explosion Index (F&EI)	Toxicity Index (TI)
I	F&EI < 65	TI < 6
II	65 < or = F&EI < 95	6 < or = TI < 10
III	F&EI > or = 95	TI > or = 10

Certain basic minimum preventive and protective measures are recommended for the three hazard categories.

7.4.3.1 Results of FE and TI for Storage/Process Units

Based on the GOI Rules 1989, the hazardous fuels used by the proposed power plant were identified. Fire and Explosion are the likely hazards, which may occur due to the fuel storage. Hence, Fire and Explosion index has been calculated for in plant storage. Estimates of FE&TI are given in Table-7.8.

TABLE-7.8
FIRE EXPLOSION AND TOXICITY INDEX

Sr. No.	Chemical/ Fuel	Total Capacity (KL)	F&EI	Category	TI	Category
1	LDO	1 x 500	1.1	Light	Nil	-
2	HFO	2 x 1000	3.1	Light	Nil	-

7.4.4 CONCLUSION

Results of FE&TI analysis show that the storage of LDO and HFO falls into Light category of fire and explosion index with a Nil toxicity index.

7.4.5 MAXIMUM CREDIBLE ACCIDENT ANALYSIS (MCAA)

Hazardous substances may be released as a result of failures or catastrophes, causing possible damage to the surrounding area. This section deals with the question of how the consequences of the release of such substances and the damage to the surrounding area can be determined by means of models. Major hazards posed by flammable storage can be identified taking recourse to MCA analysis. MCA analysis encompasses certain techniques to identify the hazards and calculate the consequent effects in terms of damage distances of heat radiation, toxic releases, vapour cloud explosion, etc. A host of probable or potential accidents of the major units in the complex arising due to use, storage and handling of the hazardous materials are examined to establish their credibility. Depending upon the effective hazardous attributes and their impact on the event, the maximum effect on the surrounding environment and the respective damage caused can be assessed. The reason and purpose of consequence analysis are many folds like:

- Part of Risk Assessment;
- Plant Layout/Code Requirements;
- Protection of other plants;
- Protection of the public;
- Emergency Planning; and
- Design Criteria.

The results of consequence analysis are useful for getting information about all known and unknown effects that are of importance when some failure scenario occurs in the plant and also to get information as how to deal with the possible catastrophic events. It also gives the workers in the plant and people living in the vicinity of the area, an understanding of their personal situation.



Selected Failure Cases

The purpose of this listing is to examine consequences of such failure individually or in combination. It will be seen from the list that a vast range of failure cases have been identified. The frequency of occurrence of failure also varies widely.

7.4.5.1 DAMAGE CRITERIA

The fuel storage and unloading at the storage facility may lead to fire and explosion hazards. The damage criteria due to an accidental release of any hydrocarbon arise from fire and explosion. The vapors of these fuels are not toxic and hence no effects of toxicity are expected.

Tank fire would occur if the radiation intensity is high on the peripheral surface of the tank leading to increase in internal tank pressure. Pool fire would occur when fuels collected in the dyke due to leakage gets ignited.

FIRE DAMAGE

A flammable liquid in a pool will burn with a large turbulent diffusion flame. This releases heat based on the heat of combustion and the burning rate of the liquid. A part of the heat is radiated while the rest is converted away by rising hot air and combustion products. The radiations can heat the contents of a nearby storage or process unit to above its ignition temperature and thus result in a spread of fire.

The radiations can also cause severe burns or fatalities of workers or fire fighters located within a certain distance. Hence, it will be important to know beforehand the damage potential of a flammable liquid pool likely to be created due to leakage or catastrophic failure of a storage or process vessel. This will help to decide the location of other storage/process vessels, decide the type of protective clothing the workers/fire fighters' need, the duration of time for which they can be in the zone, the fire extinguishing measures needed and the protection methods needed for the nearby storage/process vessels.

The damage effect on equipment and people due to thermal radiation intensity is given in **Table-7.9**.

TABLE-7.9
DAMAGE DUE TO INCIDENT RADIATION INTENSITIES

Sr. No.	Incident Radiation (kW/m ²)	Type of Damage Intensity	
		Damage to Equipment	Damage to People
1	37.5	Damage to process equipment	100% lethality in 1 min. 1% lethality in 10 sec.
2	25.0	Minimum energy required to ignite wood at indefinitely long exposure without a flame	50% Lethality in 1 min. Significant injury in 10 sec.
3	19.0	Maximum thermal radiation intensity allowed on thermally unprotected adjoining	
4	12.5	Minimum energy to ignite with a flame; melts plastic tubing	1% lethality in 1 min.
5	4.5		Causes pain if duration is longer than 20 sec, however blistering is un-likely (First degree burns)
6	1.6	—	Causes no discomfort on long exposures

Source: Techniques for Assessing Industrial Hazards by World Bank

The effect of incident radiation intensity and exposure time on lethality is given in **Table-7.10**.

TABLE-7.10
RADIATION EXPOSURE AND LETHALITY

Radiation Intensity	Exposure Time	Lethality (%)	Degree of Burns
1.6	—	0	No Discomfort even
4.5	20	0	1 st
4.5	50	0	1 st
8.0	20	0	1 st
8.0	50	<1	3 rd
8.0	60	<1	3 rd
12.0	20	<1	2 nd
12.0	50	8	3 rd
12.5	Inst	10	--
25.0	inst	50	--
37.5	inst	100	--

7.4.6 SCENARIOS CONSIDERED FOR MCA ANALYSIS

7.4.6.1 FUEL STORAGE

The details of storages in the proposed power plant are given in Table-7.2 above. In case of fuel released in the area catching fire, a steady state fire will occur. Failures in pipeline may occur due to corrosion and mechanical defect. Failure of pipeline due to external interference is not considered as this area is licensed area and all the work within this area is closely supervised with trained personnel.

7.4.6.2 MODELING SCENARIOS

Based on the storage and consumption of various fuels the following failure scenarios for the proposed power plant have been identified for MCA analysis and the scenarios are discussed in **Table-7.11**. The fuel properties considered in modeling are given in **Table-7.12**.

TABLE-7.11
SCENARIOS CONSIDERED FOR MCA ANALYSIS

Sr. No.	Fuel/Chemical	Total Quantity	Scenarios considered
1	Failure of LDO tank	1 x 500 KL	Pool fire
2	Failure of two HFO	2 x 1000 KL	Pool fire

TABLE-7.12
PROPERTIES OF FUELS CONSIDERED FOR MODELING

Sr. No.	Fuel	Molecular weight (kg/kg mol)	Boiling Point (°C)	Density (kg/m ³)
1	LDO	114.24	400	840
2	HFO	135.0	350	900

7.4.7 POOL FIRE MODELS USED FOR MCA ANALYSIS

Heat Radiation program 'RADN' has been used to estimate the steady state radiation effect from storage of fuel at different distances. The model is based on the equations compiled from various literatures by Prof.J.P.Gupta, Department of Chemical Engineering, IIT Kanpur.

7.4.8 RESULTS AND DISCUSSION

The results of MCA analysis are tabulated indicating the distances for various damages identified by the damage criteria, as explained earlier. Calculations are done for radiation intensities levels of 37.5, 25, 12.5, 4.5 and 1.6-kW/m², which are presented in **Table-7.13** for different scenarios. The distances computed for various scenarios are from the center of the pool fire.

TABLE-7.13
OCCURRENCE OF VARIOUS RADIATION INTENSITIES- POOL FIRE

Radiation and Effect	Radiation Intensities (kW/m ²)/Distances (m)					
	37.5	25.0	19.0	12.5	4.5	1.6
Failure of LDO tank	12.9	16.2	19.0	24.1	43.2	77.9
Failure of HFO tank	55.1	69.4	81.0	103.2	184.7	333.

- Pool Fire Due to Failure of LDO Storage Tanks (**Figure-7.1**)

The maximum capacity of storage of LDO will be 1x500 KL. The most credible failure is the rupture of the largest pipe connecting to the storage tank. As the worst case, it is assumed that the entire contents leak out into the dyke forming a pool, which may catch fire on finding a source of ignition.

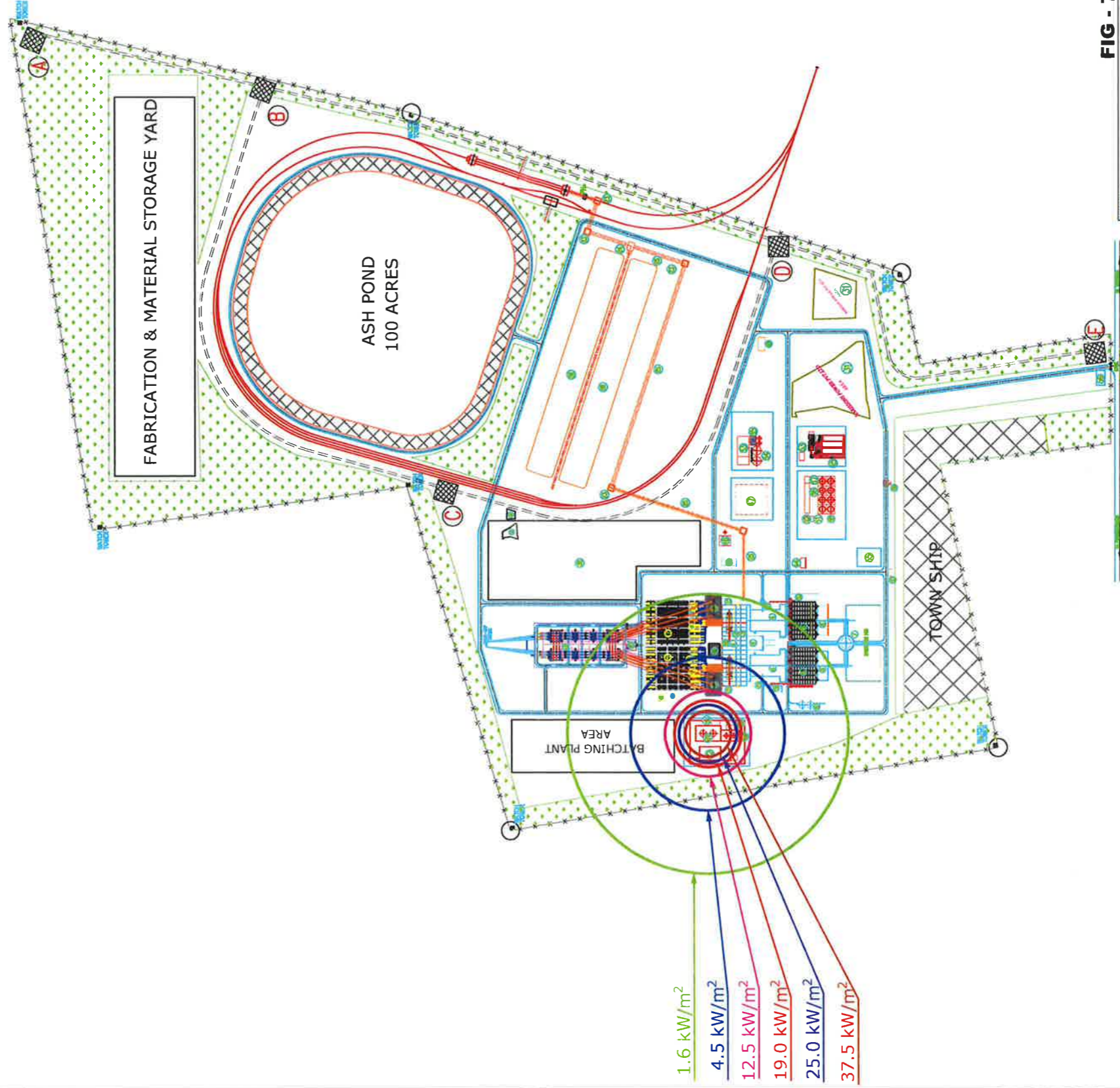


FIG - 7.1

CLIENT : **M/S. KU THERMAL POWER PRIVATE LIMITED (KUTPPL)**
 PROJECT : **PROPOSED 1320 MW (2x660 MW) COAL BASED THERMAL POWER PLANT**
Ottapidaram & Sillanabham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.
 TITLE : **POOL FIRE DUE TO FAILURE OF LDO STORAGE TANK**

A perusal of the above table clearly indicates that 37.5 kW/m² (100% lethality) occurs within the radius of the pool which is computed at 12.9 m tank on pool fire. This vulnerable zone will damage all fuel storage equipment falling within the pool radius.

Similarly, the threshold limit for first degree burns is 1.6 kW/m², this vulnerable zone in which the thermal fluxes above the threshold limit for first degree is restricted to 77.9 m in case tank on pool fire.

- Pool Fire Due to Failure of HFO Storage Tanks (**Fig - 7.2**)

The capacity of storage of HFO will be 2x1000 KL. The most credible failure is the rupture of the largest pipe connecting the storage tank. As the worst case, it is assumed that the entire contents leak out into the dyke forming a pool, which may catch fire on finding a source of ignition.

The radiation intensities have been computed using software based pool fire model and the results are tabulated in **Table 7.14**.

A perusal of the above table clearly indicates that 37.5 kW/m² (100% lethality) occurs within the radius of the pool which is computed at 55.1 m in case of HFO tanks on pool fire. This vulnerable zone will damage all fuel storage equipment falling within the pool radius.

7.4.9 COAL HANDLING PLANT - DUST EXPLOSION

Coal dust when dispersed in air and ignited would explode. Crusher house and conveyor systems are most susceptible to this hazard. To be explosive, the dust mixture should have:

- Particles dispersed in the air with minimum size (typical figure is 400 microns);
- Dust concentrations must be reasonably uniform; and
- Minimum explosive concentration for coal dust (33% volatiles) is 50 gm/m³.



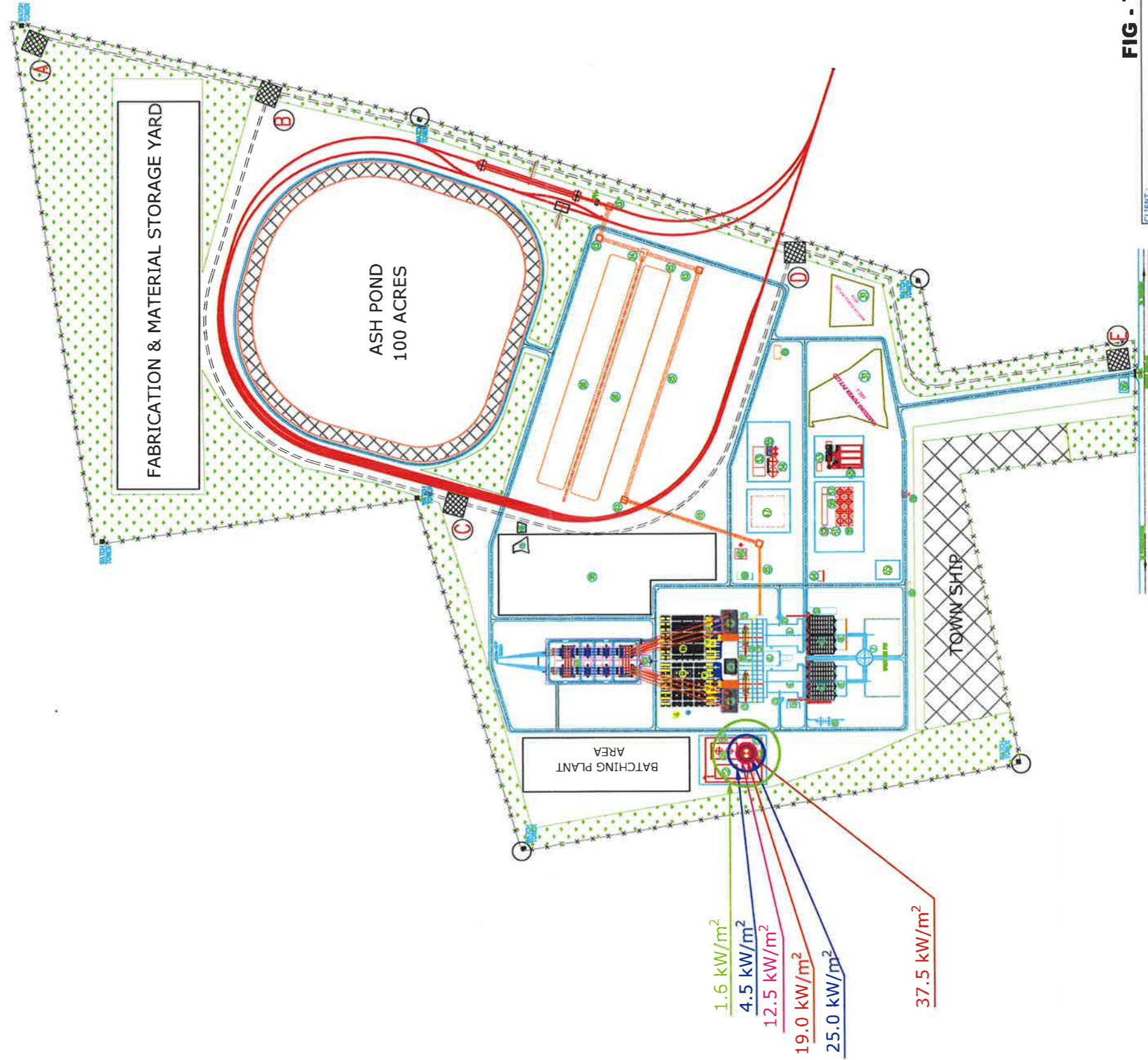
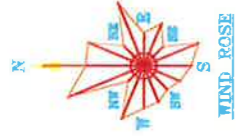


FIG - 7.2

CLIENT: **M/S. KU THERMAL POWER PRIVATE LIMITED (KUTPPL)**
PROJECT: **PROPOSED 1320 MW (2x660 MW) COAL BASED THERMAL POWER PLANT**
TITLE: **POOL FIRE DUE TO FAILURE OF HFO STORAGE TANK**

Ottapidaram & Sillanatham Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu, India.

Failure of dust extraction and suppression systems may lead to abnormal conditions and may increase the concentration of coal dust to the explosive limits. Sources of ignition present are incandescent bulbs with the glasses of bulkhead fittings missing, electric equipment and cables, friction, spontaneous combustion in accumulated dust. Dust explosions may occur without any warnings with Maximum Explosion Pressure upto 6.4 bars. Another dangerous characteristic of dust explosions is that it sets off secondary explosions after the occurrence of the initial dust explosion. Many a times the secondary explosions are more damaging than primary ones. The dust explosions are powerful enough to destroy structures, kill or injure people and set dangerous fires likely to damage a large portion of the Coal Handling Plant including collapse of its steel structure which may cripple the life line of the power plant.

Stockpile areas will be provided with automatic garden type sprinklers for dust suppression as well as to reduce spontaneous ignition of the coal stockpiles. Necessary water distribution network for drinking and service water with pumps, piping, tanks, valves etc will be provided for distributing water at all transfer points, crusher house, control rooms etc. A centralized control room with microprocessor based control system (PLC) has been envisaged for operation of the coal handling plant. Except for locally controlled equipment like traveling tripper, dust extraction/ dust suppression / ventilation equipment, sump pumps, water distribution system etc., all other in-line equipment will be controlled from the central control room but will have provision for local control as well. All necessary interlocks, control panels, MCC's, mimic diagrams etc. will be provided for safe and reliable operation of the coal handling plant.

7.4.9.1 CONTROL MEASURES FOR COAL YARDS

The total quantity of coal will be stored in separate stack piles, with proper drains around to collect washouts during monsoon season.

Water sprinkling system will be installed on stocks of coal in required scales to prevent spontaneous combustion and consequent fire hazards.



The stock geometry will be adopted to maintain minimum exposure of stock pile areas towards predominant wind direction.

7.4.10 IDENTIFICATION OF HAZARDS

The various hazards associated, with the plant process apart from fuel storage have been identified and are outlined in **Table-7.14**

Table-7.14
HAZARD ANALYSIS FOR PROCESS IN POWER PLANT

Sr. No.	Blocks/Areas	Hazards Identified
1	Coal storage in open yard	Fire, Spontaneous Combustion
2	Coal Handling Plant including Bunker area	Fire and/or Dust Explosions
3	Boilers	Fire (mainly near oil burners), Steam Explosions, Fuel Explosions
4	Steam Turbine Generator Buildings	Fires in - a) Lube oil system b) Cable galleries c) Short circuits in i) Control rooms ii) Switch-gears Explosion due to leakage of Hydrogen and fire following it.
5	Switch-yard Control Room	Fire in cable galleries and Switch-gear/Control Room
6	LDO Tank Farms HFO Tank Farm	Fire

7.4.11 HAZARDOUS EVENTS WITH GREATEST CONTRIBUTION TO FATALITY RISK

The hazardous event scenarios likely to make the greatest contribution to the risk of potential fatalities are summarized in **Table-7.15**. 'Onsite facility' refers to the operating site, whereas 'offsite facility' refers to transport and handling systems, which are away from the operating site.

TABLE-7.15

HAZARDOUS EVENTS CONTRIBUTING TO ON-SITE FACILITY RISK

Hazardous Event	Risk Rank	Consequences of Interest
Onsite vehicle impact on personnel	3	Potential for single fatalities, onsite impact only
Entrapment/struck by Machinery	3	Potential for single fatalities, onsite impact only
Fall from heights	3	Potential for single fatalities, onsite impact only
Electrocution	3	Potential for single fatalities, onsite impact only
Storage tank rupture	3	Potential for single fatalities, onsite impact only

7.4.12 RISK ASSESSMENT SUMMARY

The preliminary risk assessment has been completed for the proposed power plant and associated facilities and the broad conclusions are as follows:

- There will be no significant community impacts or environmental damage consequences; and
- The hazardous event scenarios and risks in general at this facility can be adequately managed to acceptable levels by performing the recommended safety studies as part of detailed design, applying recommended control strategies and implementing a Safety Management System.

7.4.13 RISK REDUCTION OPPORTUNITIES

The following opportunities will be considered as a potential means of reducing identified risks during the detailed design phase:

- Buildings and plant structures designed for cyclone and seismic events (where appropriate), to prevent structural collapse and integrity of weather (water) proofing for storage of dangerous goods;



- Provision for adequate water capacity to supply fire protection systems and critical process water;
- Isolate people from load carrying/mechanical handling systems, vehicle traffic and storage and stacking locations;
- Installation of fit-for-purpose access ways and fall protection systems to facilitate safe access to fixed and mobile plant;
- Provision and integrity of process tanks, waste holding tanks and bunded areas as per relevant standards;
- Containment of hazardous materials;
- Security of facility to prevent unauthorized access to plant, introduction of prohibited items, and control of onsite traffic; and
- Development of emergency response management systems commensurate with site specific hazards and risks (fire, explosion, rescue and first aid).

7.5 DISASTER MANAGEMENT PLAN

7.5.1 DISASTERS

A disaster is a catastrophic situation in which suddenly, people are plunged into helplessness and suffering and, as a result, need protection, clothing, shelter, medical and social care and other necessities of life.

Disasters can be divided into two main groups. In the first, are disasters resulting from natural phenomena like earthquakes, volcanic eruptions, storm surges, cyclones, tropical storms, floods, avalanches, landslides, forest fires. The second group includes disastrous events occasioned by man, or by man's impact upon the environment. Examples are armed conflict, industrial accidents, radiation accidents, factory fires, explosions and escape of toxic gases or chemical substances, river pollution, mining or other structural collapses, air, sea, rail and road transport accidents which can reach catastrophic dimensions in terms of human loss.

There can be no set criteria for assessing the gravity of a disaster in the abstract since this depends to a large extent on the physical, economic and social environment in which it occurs. What would be consider a

major disaster in a developing country, ill-equipped to cope with the problems involved, may not mean more than a temporary emergency elsewhere. However, all disasters bring in their wake similar consequences that call for immediate action, whether at the local, national or international level, for the rescue and relief of the victims. This includes the search for the dead and injured, medical and social care, removal of the debris, the provision of temporary shelter for the homeless, food, clothing and medical supplies, and the rapid re-establishment of essential services.

7.5.2 OBJECTIVES OF DISASTER MANAGEMENT PLAN

The Disaster Management Plan is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of the Disaster Management Plan, it should be widely circulated and personnel trained through rehearsals/drills.

The Disaster Management Plan should reflect the probable consequential severalties of the undesired event due to deteriorating conditions or through 'Knock on' effects. Further the management should be able to demonstrate that their assessment of the consequences uses good supporting evidence and is based on currently available and reliable information, incident data from internal and external sources and if necessary the reports of out side agencies.

To tackle the consequences of a major emergency inside the plant or in the immediate vicinity of the plant, a Disaster Management Plan has to be formulated and this planned emergency document is called "Disaster Management Plan".

The objective of the Industrial Disaster Management Plan is to make use of the combined resources of the plant and the outside services to achieve the following:

- Effect the rescue and medical treatment of casualties;
- Safeguard other people;
- Minimize damage to property and the 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 area; and
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the Emergency.

In effect, it is to optimize operational efficiency to rescue, rehabilitate and render medical help and to restore normalcy.

7.5.3 TSUNAMI

Upto December 2004, Tsunami was a little known phenomenon in India, but the Indian Ocean Tsunami of 26th December 2004 affecting the coastal areas of Tamil Nadu and Pondicherry, changed the scenario.

7.5.3.1 TSUNAMI CHARACTERISTICS

a) TSUNAMI DEFINITION

Tsunami (soo-NAH-mee) is a Japanese word meaning harbour wave. A tsunami is a series of waves with a long wavelength and period (time between crests). Time between crests of waves can vary from a few minutes to over an hour. Tsunamis are often incorrectly called tidal waves; they have no relation to the daily ocean tides.

Tsunamis can occur at any time of day or night.

b) CAUSES OF TSUNAMI

Tsunamis are generated by any large, impulsive displacement of the sea bed.

Earthquakes generate tsunamis by vertical movement of the sea floor. However if the sea floor movement is horizontal, a tsunami is not generated. Generally earthquakes of $M > 6.5$ on Richter scale cause Tsunami.



Tsunamis are also triggered by landslides into or under the water surface, and can be generated by volcanic activity and meteorite impacts.

c) SPEED OF TSUNAMI

Tsunami velocity is dependent on the depth of water through which it travels. The velocity is governed by the following equation

$$V = \sqrt{g h}$$

where, V is the velocity of Tsunami in m/sec

g is the gravitational force in m/sec^2

h is the depth of water in m

Tsunamis travel approximately at a velocity of 700 kmph in 4000 m depth of sea water, but in 10 m of water depth the velocity drops to about 36 kmph. For example, the tsunami from Sumatra coastal earthquake travelled to Tamil Nadu coast in about two hours.

Even on shore, Tsunami's speed could be 35 - 40 km/h, much faster than a person can run.

d) SIZE OF TSUNAMI

Tsunamis range in size from centimeters to over 30 m height. Most tsunamis are less than 3 m in height.

A large tsunami can flood land up to 1.5 km from the coast.

In deep water (greater than 200 m), tsunamis are rarely over 1m high and will not be noticed by ships due to their long period (time between crests).

As tsunamis propagate into shallow water, the wave height can increase by over 10 times.

Tsunami heights can vary greatly along a coast. The waves are amplified by certain shoreline and bathymetric (sea floor) features.



The force of some tsunamis is enormous. Large rocks weighing several tonnes along with boats and other debris can be moved hundreds of feet inland by tsunami wave activity. Homes and other buildings are destroyed. All this material and water move with great force and can kill or injure people.

7.5.3.2 FREQUENCY OF OCCURRENCE

- a) On the average, there are two tsunamis per year in the Pacific Ocean which cause damage.
 Approximately every 15 years a destructive tsunami occurs in Pacific.
- b) Frequency of Tsunami in India

The details of Tsunami in India are given below:

Date	Occurrences
April 12, 1762	Earth quake in the Bay of Bengal generated tsunami wave of 1.8 m in coastal Bangladesh
August 19, 1868	Earthquake Mw 7.5 in the Bay of Bengal. Tsunami wave run-up level at Port Blair, Andaman Island 4.0 m.
December 31, 1881	Earthquake of magnitude Ms 7.9 in the Bay of Bengal, reported tsunami runup level of 0.76m at Car Nicobar, 0.3m at Dublat , 0.3 m at Nagapattinam and 1.22 m at Port Blair in Andaman Island
1883	Karakatau, volcanic explosion in Indonesia. 1.5 m tsunami at Chennai, 0.6 m at Nagapattinam.
1884	Earthquake in the western part of the Bay of Bengal. Tsunamis at Port Blair & mouth of Hoogly River
26-Jun-1941	Earthquake of magnitude MW 8.1 in the Andaman Sea at 12.90 N,92.5o E. Tsunamis on the east coast of India with amplitudes from 0.75 to 1.25 m. Some damage from East Coast was reported.
27-Nov-1945	Mekran Earthquake (Magnitude Ms 8.3). 12 to 15 M wave height in Ormara, 13 m at Pasni, and 1.37 m at Karachi (Pakistan). In Gulf off Cambay of Gujarat wave heights of 11.0 m was estimated, and 2 m at Mumbai, where boats were taken away from their moorings.

Date	Occurrences
26-Dec-2004	An earthquake of rear Magnitude (MW9.3) generated giant tsunami waves in North Indian Ocean. Tsunami made extensive damage to many coastal areas of Indonesia, India, Malaysia, Maldives, Sri Lanka and Thailand. A transoceanic tsunami, observed over areas beyond the Ocean limit of origin. More than 2,00,000 people lost their lives in above countries which is a record.

Source: National Disaster Management Division, Ministry of Home Affairs, Government of India, January, 2006

7.5.3.3 TSUNAMI IN SHORES

Normally, a tsunami appears as a rapidly advancing or receding tide. In some cases, a bore (wall of water) or series of breaking waves may form.

Sometimes a tsunami causes water near the shore to recede by 0.5 - 2.0 km, exposing the ocean floor, and then the wave crest comes with a high speed.

Tsunamis can travel up rivers and streams that lead to the sea.

7.5.3.4 TSUNAMI VS WIND-GENERATED WAVE

Wind-generated waves usually have periods (time between crests) of 5 to 20 seconds. Tsunami periods are usually between 5 minutes and an hour.

Wind-generated waves break as they shoal and lose energy offshore. Tsunamis act more like a flooding wave.

7.5.4 TSUNAMI EMERGENCY MANAGEMENT PLAN FOR PLANT

7.5.4.1 TRAINING

- a. The operation and Maintenance Personnel of the power plant will be trained properly to handle the situation smoothly without any panic.



For training the personnel, the services of relevant body like Disaster Management cell etc., will be utilized. A detailed manual will be prepared and handed over to all plant personnel, which will be the basis of the periodical training programs.

b. Educating the community

Community near to power plant will be educated about Tsunami. People around the power plant will be advised to move to an elevated place or away from the sea shore.

c. Conduct awareness program

Tsunami awareness program will be conducted among employees and other nearby villagers regularly. Mock drills will also conduct at regular intervals, for teaching the employees how to face the consequences.

d. Maintenance of History Register

A history register will be maintained for recording events to facilitate improved awareness.

e. Exhibit in Notice Board

A board showing Do's and Don'ts during Tsunami will be exhibited in a visible location for informing to all concerned

f. Discussion with family members

Employees will be advised to discuss with their family members periodically to have more awareness about Tsunami

7.5.4.2 SAFETY MEASURES ON RECEIPT OF TSUNAMI WARNING

Safe shut down of the plant is the main task once Tsunami warning is received. On receipt of Tsunami warning the following action will be taken:



- Inform load dispatch centre for shut down of the plant
- Trip the turbo generator
- Open start up vent of the boiler
- Cut off fuel supply to boiler
- Switch on D.C. Emergency oil pump
- Switch on D.C. lighting
- Blow the siren for evacuation of the Personnel
- Switch of the A.C. Power supply
- Protect equipments from damage (Depending upon the time availability)

7.5.4.3 ENSURE RAPID RETURN TO NORMALCY

After the threat is over, our main focus will be to restore normalcy in the plant, which will involve the following:

- Obtain confirmation from District Administration / Regional Disaster Management Cell
- Thorough checking of equipments. Check the equipments for healthiness
- Inspect the cable gallery
- Clean the cables, ends and terminations
- Meger it for its IR value
- Inform load dispatch centre regarding restarting of the plant
- Establish start up power supply
- Start the system sequentially
- Put the T.G. set on turning gear
- Light up the boiler
- Roll the turbine as per start up procedure
- Synchronize the unit with grid after getting proper clearance from L.D center
- Raise the load as per loading curve
- Normalize the plant operation.

7.5.5 EMERGENCIES

7.5.5.1 GENERAL, INDUSTRIAL, EMERGENCIES

The emergencies that could be envisaged in the plant and fuel storage are as follows:

- A situation of fire at the Hydrogen Plant;
- A situation of fire at the tank farm of all storages;
- Slow isolated fires;
- Fast spreading fires;
- Structural failures;
- Contamination of food/water; and
- Sabotage/Social disorder.

7.5.5.2 SPECIFIC EMERGENCIES ANTICIPATED

FIRE AND EXPLOSION

Fire consequences can be disastrous, since they involve huge quantities of fuel either stored or in dynamic inventory in pipe lines or in nearby areas. Preliminary hazard analysis has provided a basis for consequence estimation. Estimation can be made by using various pool fire, tank fire consequence calculations. During the study of Risk Assessment, the nature of damages is worked out and probability of occurrence of such hazards is also drawn up.

7.5.6 EMERGENCY ORGANIZATION

It is recommended to setup an Emergency Organization. A senior executive who has control over the affairs of the plant should lead the Emergency Organization. He shall be designated as Site Controller. General Manager [O & M] shall be designated as the Incident Controller. In the case of stores, utilities, open areas, which are not under the control of the Production Heads, Senior Executive responsible for maintenance of utilities would be designated as Incident Controller. All the Incident Controllers would be reporting to the Site Controller.



Each Incident Controller, for himself, organizes a team responsible for controlling the incidence with the personnel under his control. Shift In-charge would be the reporting officer, who would bring the incidence to the notice of the Incidence Controller and Site Controller.

Emergency Co-ordinators would be appointed who would undertake the responsibilities like fire fighting, rescue, rehabilitation, transport and provide essential and support services. For this purposes, Security In-charge, Personnel Department, Essential services personnel would be engaged. All these personnel would be designated as Key personnel.

In each shift, electrical supervisor, electrical fitters, pump house in-charge, and other maintenance staff would be drafted for emergency operations. In the event of power or communication system failure, some of staff members in the office/plant offices would be drafted and their services would be utilized as messengers for quick passing of communications. All these personnel would be declared as essential personnel.

7.5.6.1 EMERGENCY COMMUNICATION

Whoever notices an emergency situation such as fire, growth of fire, leakage etc would inform his immediate superior and Emergency Control Center. A place nearer to the Gate House Complex shall be identified as Emergency Control Center. The person on duty in the Emergency Control Center would appraise the Site Controller. Site Controller verifies the situation from the Incident Controller of that area or the Shift In-charge and takes a decision about an impending On Site Emergency. This would be communicated to all the Incident Controllers, Emergency Co-ordinators. Simultaneously, the emergency warning system would be activated on the instructions of the Site Controller.

7.5.7 EMERGENCY RESPONSIBILITIES

The responsibilities of the key personnel are appended below:



7.5.7.1 SITE CONTROLLER

On receiving information about emergency, site controller would rush to Emergency Control Center (ECC) and take charge of ECC and the situation. His responsibilities would be as indicated below:

- Assesses the magnitude of the situation on the advice of Incident Controller and decides;
- Whether the affected area needs to be evacuated;
- Whether personnel who are at assembly points need to be evacuated;
- Declares Emergency and orders for operation of emergency siren;
- Organizes announcement by public address system about location of emergency;
- Assesses which areas are likely to be affected, or need to be evacuated or are to be alerted;
- Maintains a continuous review of possible development and assesses the situation in consultation with Incident Controller and other Key Personnel as to whether shutting down the plant or any section of the plant is required and if evacuation of persons is required;
- Directs personnel for rescue, rehabilitation, transport, fire, brigade, medical and other designated mutual support systems locally available, for meeting emergencies;
- Controls evacuation of affected areas, if the situation is likely to go out of control or effects are likely to go beyond the premises of the factory, informs the District Emergency Authority, Police, Hospital and seeks their intervention and help;
- Informs Inspector of Factories, Deputy Chief Inspector of Factories, TNPCB and other statutory authorities;
- Gives a public statement if necessary;
- Keeps record of chronological events and prepares an investigation report and preserves evidence; and
- On completion of On Site Emergency and restoration of normalcy, declares all clear and orders for all clear warning.

7.5.7.2 INCIDENT CONTROLLER

- Assembles the incident control team;
- Directs operations within the affected areas with the priorities for safety to personnel minimize damage to the plant, property and environment and minimize the loss of materials;

- Directs the shutting down and evacuation of plant and areas likely to be adversely affected by the emergency;
- Ensures that key personnel help is sought;
- Provides advice and information to the Fire and Security Officer and the Local Fire Services as and when they arrive;
- Ensures that all non-essential workers/staff of the affected areas are evacuated to the appropriate assembly points, and the areas are searched for casualties;
- Has regard to the need for preservation of evidence so as to facilitate any inquiry into the causes and circumstances, which caused or escalated the emergency;
- Co-ordinates with emergency services at the site;
- Keeps in touch with the team and advises them regarding the method of control to be used; and
- Keeps the Site Controller of Emergency informed of the progress being made.

7.5.7.3 EMERGENCY COORDINATOR - RESCUE, FIRE FIGHTING

- On knowing about emergency, rushes to ECC;
- Helps the Incident Controller in containment of the emergency;
- Ensure fire pumps are in operating condition and instructs pump house operator to ready for any emergency with standby arrangement;
- Guides the fire fighting crew i.e. firemen, trained plant personnel and security staff;
- Organizes shifting the fire fighting facilities to the emergency site, if required;
- Takes guidance of the Incident Controller for fire fighting as well as assesses the requirements of outside help;
- Arranges to control the traffic at the gate and the incident area;
- Directs the security staff to the incident site to take part in the emergency operations under his guidance and supervision;
- Evacuates the people in the plant or in the nearby areas as advised by Site Controller;
- Searches for casualties and arranges proper aid for them;
- Assembles search and evacuation team;

- Arranges for safety equipment for the members of this team;
- Decides which paths the evacuated workers should follow; and
- Maintains law and order in the area, and if necessary seeks the help of police.

7.5.7.4 EMERGENCY COORDINATOR-MEDICAL, MUTUAL AID, REHABILITATION, TRANSPORT AND COMMUNICATION

- In the event of failure of electric supply and thereby internal telephone, sets up communication point and establishes contact with the ECC;
- Organizes medical treatment to the injured and if necessary will shift the injured to nearby hospitals;
- Mobilizes extra medical help from outside, if necessary;
- Keeps a list of qualified first aid providers for the plant and seeks their assistance;
- Maintains first aid and medical emergency requirements;
- Makes sure that all safety equipment is made available to the emergency team;
- Assists Site Controller with necessary data to coordinate the emergency activities;
- Assists Site Controller in updating emergency plan, organizing mock drills, verification of inventory of emergency facilities and furnishing report to Site Controller;
- Maintains liaison with Civil Administration;
- Ensures availability of canteen facilities and maintenance of rehabilitation center.
- Liaises with Site Controller/Incident Controller;
- Ensures transportation facility;
- Ensures availability of necessary cash for rescue/rehabilitation and emergency expenditure;
- Controls rehabilitation of affected areas on discontinuation of emergency; and
- Makes available diesel/petrol for transport vehicles engaged in emergency operation.

7.5.7.5 EMERGENCY COORDINATOR - ESSENTIAL SERVICES

- Assists Site Controller and Incident Controller;
- Maintains essential services like Diesel Generator, Water, Fire Water, Compressed Air/Instrument Air, power supply for lighting;
- Plans alternate facilities in the event of power failure, to maintain essential services such as lighting, etc;
- Organizes separate electrical connections for all utilities and emergency services so that in the event of emergency or fires, essential services and utilities are not affected;
- Gives necessary instructions regarding emergency electrical supply, isolation of certain sections etc. to shift in-charge and electricians; and
- Ensures availability of adequate quantities of protective equipment and other emergency materials, spares etc.

7.5.7.6 GENERAL RESPONSIBILITIES OF EMPLOYEES DURING AN EMERGENCY

During an emergency, which becomes more enhanced and pronounced when an emergency warning is raised, the workers who are in-charge of process equipment should adopt safe and emergency shut down and attend to any prescribed duty as essential employee. If no such responsibility is assigned, he should adopt a safe course to assembly point and await instructions. He should not resort to spreading panic. On the other hand, he must assist emergency personnel towards meeting the objectives of DMP.

7.5.8 EMERGENCY FACILITIES

7.5.8.1 EMERGENCY CONTROL CENTER (ECC)

The following information and equipment are to be provided at the Emergency Control Center (ECC).

- Intercom, telephone;
- P and T telephone;
- Self-contained breathing apparatus;



- Fire suit/gas tight goggles/gloves/helmets;
- Hand tools, wind direction/velocities indications;
- Public address megaphone, hand bell, telephone directories (internal, P&T);
- Plant layout, site plan;
- Emergency lamp/torch light/batteries;
- Plan indicating locations of hazard inventories, plant control room, sources of safety equipment, work road plan, assembly points, rescue location vulnerable zones, escape routes;
- Hazard chart;
- Emergency shut-down procedures;
- Nominal roll of employees;
- List of key personnel, list of essential employees, list of Emergency Coordinators;
- Duties of key personnel;
- Address with telephone numbers and key personnel, emergency coordinator, essential employees; and
- Important address and telephone numbers including Government agencies, neighboring industries and sources of help, outside experts, fuel fact sheets and population details around the factory.

7.5.8.2 ASSEMBLY POINT

Number of assembly points, depending upon the plant location, would be identified wherein employees who are not directly connected with the disaster management would be assembled for safety and rescue. Emergency breathing apparatus, minimum facilities like water etc. would be organized

In view of the size of plant, different locations would be ear marked as assembly points. Depending upon the location of hazard, the assembly points are to be used

7.5.8.3 FIRE FIGHTING FACILITIES

First Aid and Fire fighting equipment suitable for emergency should be maintained in each section in the plant. This would be as per statutory



requirements. However, fire hydrant line covering major areas would be laid. It would be maintained as 6 kg/cm² pressure. Fire alarms would be located in the bulk storage areas. Fire officer will be the commanding officer of fire fighting services.

7.5.8.4 LOCATION OF WIND SOCK

Wind socks shall be installed at appropriate places in the plant to indicate direction of wind for emergency escape.

7.5.8.5 EMERGENCY MEDICAL FACILITIES

Stretchers, gas masks and general first aid materials for dealing with chemical burns, fire burns etc would be maintained in the medical center as well as in the emergency control room. Medical superintendent of the medical center will be the head of the casualty services ward. Private medical practitioners help would also be sought. Government hospital would be approached for emergency help.

Apart from plant first aid facilities, external facilities would be augmented. Names of Medical Personnel, Medical facilities in the area would be prepared and updated. Necessary specific medicines for emergency treatment of Patient's Burns would be maintained.

Breathing apparatus and other emergency medical equipment would be provided and maintained. Also, the help of nearby industries would be taken on mutual support basis.

7.5.8.6 AMBULANCE

Availability of an ambulance with driver in all the shifts would be ensured to transport injured or affected persons. Number of persons would be trained in first aid so that, in every shift first aid personnel would be available.

7.5.9 EMERGENCY ACTIONS

7.5.9.1 EMERGENCY WARNING

The emergency would be communicated both to the personnel inside the plant and the people outside. An emergency warning system shall be established for this purpose.

7.5.9.2 EMERGENCY SHUTDOWN

There are number of facilities, which can be provided to help deal with hazardous conditions, when a tank is on fire. The suggested arrangements are:

1. Stop feed;
2. Dilute contents;
3. Remove heat;
4. Deluge with water; and
5. Transfer contents.

Whether a given method is appropriate depends on the particular case.

7.5.9.3 EVACUATION OF PERSONNEL

There could be a number of persons in the storage area and other areas in the vicinity. The area would have adequate number of exits, staircases. In the event of an emergency, unconnected personnel have to escape to assembly point. Operators have to take emergency shutdown procedure and escape. Time Office shall maintain a copy of deployment of employees in each shift, at ECC. If necessary, persons can be evacuated by rescue teams.

7.5.9.4 ALL CLEAR SIGNAL

Also, at the end of an emergency, after discussing with Incident Controllers and Emergency Co-ordinators, the Site Controller orders an all clear signal. When it becomes essential, the Site Controller communicates to the District Emergency Authority, Police, and Fire

Service personnel regarding help required or development of the situation into an Off-Site Emergency.

7.5.10 GENERAL

7.5.10.1 EMPLOYEE INFORMATION

During an emergency, employees would be warned by raising siren in specific pattern. Employees would be given training of escape routes and taking shelter. Employees would be provided with information related to fire hazards, antidotes and first aid measures. Those who would be designated as key personnel and essential employees should be given training for emergency response.

7.5.10.2 PUBLIC INFORMATION AND WARNING

The industrial disaster effects related to this plant may mostly be confined to the plant area. The detailed risk analysis has indicated that the pool fire effects would not be felt outside. However, as an abundant precaution, the information related to fuels in use would be furnished to District Emergency Authority for necessary dissemination to general public and for any use during an off site emergency. Plants of this size and nature have been in existence in our country for a long time.

7.5.10.3 CO-ORDINATION WITH LOCAL AUTHORITIES

Keeping in view of the nature of emergency, two levels of coordination are proposed. In the case of an On Site Emergency, resources within the organization would be mobilized and in the event extreme emergency local authorities help would be sought.

In the event of an emergency developing into an off site emergency, local authority and District Emergency Authority (normally the Collector) would be appraised and under his supervision, the Off Site Disaster Management Plan would be exercised. For this purpose, the facilities that are available locally, i.e. medical, transport, personnel, rescue accommodation, voluntary organizations etc. would be mustered.

Necessary rehearsals and training in the form of mock drills would be organized.

7.5.10.4 MUTUAL AID

Mutual aid in the form of technical personnel, runners, helpers, special protective equipment, transport vehicles, communication facility etc would be sought from the neighboring industries.

7.5.10.5 MOCK DRILLS

Emergency preparedness is an important part of planning in Industrial Disaster Management. Personnel would be trained suitably and prepared mentally and physically in emergency response through carefully planned, simulated procedures. Similarly, the key personnel and essential personnel would be trained in the operations.

7.5.10.6 IMPORTANT INFORMATION

Once the plant goes on stream, important information such as names and addresses of key personnel, essential employees, medical personnel outside the plant, transporters address, and address of those connected with Off Site Emergency such as Police, Local Authorities, Fire Services, District Emergency Authority would be prepared and maintained. The on-site emergency organization chart for various emergencies is shown in **Figure-7.3**.

7.6 OFF-SITE EMERGENCY PREPAREDNESS PLAN

The task of preparing the Off-Site Emergency Plan lies with the District Collector; however the off-site plan will be prepared with the help of the local district authorities. The proposed plan will be based on the following guidelines.

7.6.1 INTRODUCTION

Off-site emergency plan would follow the on-site emergency plan. When the consequences of an emergency situation go beyond the plant



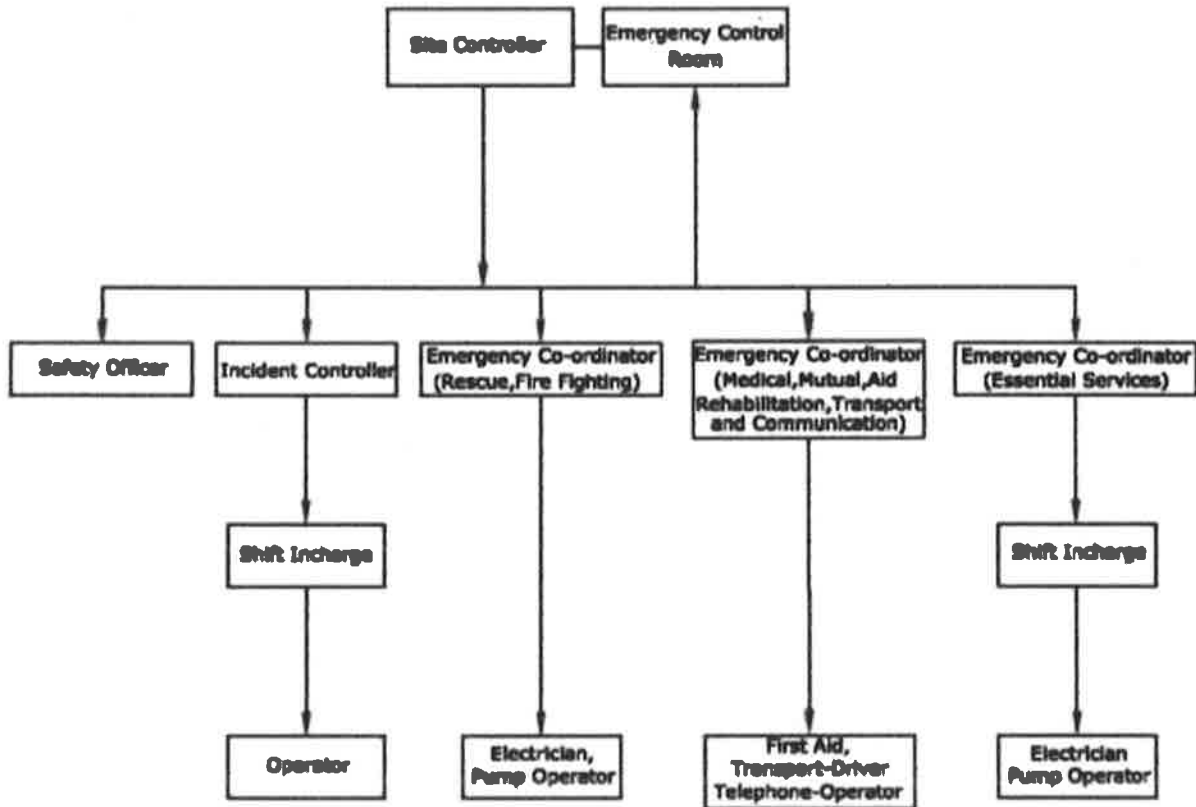
boundaries, it becomes an off-site emergency. Off-site emergency is essentially the responsibility of the public administration. However, the plant management will provide the public administration with the technical information relating to the nature, quantum and probable consequences on the neighboring population.

The off-site plan in detail will be based on those events, which are most likely to occur, but other less likely events, which have severe consequence, will also be considered. Incidents which have very severe consequences yet have a small probability of occurrence would also be considered during the preparation of the plan. However, the key feature of a good off-site emergency plan is flexibility in its application to emergencies other than those specifically included in the formation of the plan.

The roles of the various parties who will be involved in the implementation of an off- site plan are described below. Depending on local arrangements, the responsibility for the off-site plan would either rest with the plant management or with the local authority. Either way, the plan would identify an emergency co-ordinating officer, who would take the overall command of the off-site activities. As with the on-site plan, an emergency control center would be setup within which the emergency coordinating officer can operate.

An early decision will be required in many cases on the advice to be given to people living "within range" of the accident - in particular whether they should be evacuated or told to go indoors. In the latter case, the decision can regularly be reviewed in the event of an escalation of the incident. Consideration of evacuation may include the following factors:

FIGURE-7.3
ON-SITE EMERGENCY ORGANIZATION CHART



- In the case of a major fire but without explosion risk (e.g. an oil storage tank), only houses close to the fire are likely to need evacuation, although a severe smoke hazard may require this to be reviewed periodically; and
- If a fire is escalating and in turn threatening a store of hazardous material, it might be necessary to evacuate people nearby, but only if there is time; if insufficient time exists, people should be advised to stay indoors and shield themselves from the fire. This latter case particularly applies if the installation at risk could produce a fireball with very severe thermal radiation effects.

Although the plan will have sufficient flexibility built in to cover the consequences of the range of accidents identified for the on-site plan, it will cover in some detail the handling of the emergency to a particular distance from each major hazard works.

7.6.2 ASPECTS PROPOSED TO BE CONSIDERED IN THE OFF-SITE EMERGENCY PLAN

The main aspects, which should be included in the emergency plan are:

- **Organization**

Detail of command structure, warning systems, implementation procedures, emergency control centers.

Names and appointments of incident controller, site main controller, their deputies and other key personnel.

- **Communications**

Identification of personnel involved, communication center, call signs, network, list of telephone numbers.

- **Specialized Knowledge**

Details of specialist bodies, firms and people upon whom it may be necessary to call e.g. those with specialized fuel knowledge, laboratories.

- **Voluntary Organizations**

Details of organizers, telephone numbers, resources etc.

- **Fuel Information**

Details of the hazardous substances stored and a summary of the risk associated with them.

- **Meteorological Information**

Arrangements for obtaining details of weather forecasts and weather conditions prevailing at that time.

- **Humanitarian Arrangements**

Transport, evacuation centers, emergency feeding, treatment of injured, first aid, ambulances and temporary mortuaries.



- **Public Information**

Arrangements for:

- (a) Dealing with the media press office;
- (b) Informing relatives, etc.

- **Assessment of Emergency Plan**

Arrangements for:

- (a) Collecting information on the causes of the emergency;
- (b) Reviewing the efficiency and effectiveness of all aspects of the emergency plan.

7.6.3 ROLE OF THE EMERGENCY CO-ORDINATING OFFICER

The various emergency services would be co-ordinated by an Emergency Coordinating Officer (ECO), who will be designated by the district collector. The ECO would liaison closely with the site main controller. Again depending on local arrangements, for very severe incidents with major or prolonged off-site consequences, the external control would be passed to a senior local authority administrator or even an administrator appointed by the central or state government. The ECO will be equipped with address and phone numbers of important agencies.

7.6.4 ROLE OF THE LOCAL AUTHORITY

The duty to prepare the off-site plan lies with the local authorities. The Emergency Planning Officer (EPO) appointed should carry out his duty in preparing for a whole range of different emergencies within the local authority area. The EPO should liaison with the plant, to obtain the information to provide the basis for the plan. This liaison should ensure that the plan is continually kept upto date.

It will be the responsibility of the EPO to ensure that all those organizations which will be involved off site in handling the emergency, know of their role and are able to accept it by having for example, sufficient staff and appropriate equipment to cover their particular responsibilities. Rehearsals for off-site plans should be organized by the EPO.



7.6.5 ROLE OF POLICE

Formal duties of the police during an emergency include protecting life and property and controlling traffic movements.

Their functions should include controlling bystanders, evacuating the public, identifying the dead and dealing with casualties, and informing relatives of death or injury.

7.6.6 ROLE OF FIRE AUTHORITIES

The control of a fire should be normally the responsibility of the senior fire brigade officer who would take over the handling of the fire from the site incident controller on arrival at the site. The senior fire brigade officer should also have a similar responsibility for other events, such as explosions. Fire authorities in the region should be apprised about the location of all stores of flammable materials, water and foam supply points, and fire-fighting equipment. They should be involved in onsite emergency rehearsals both as participants and, on occasion, as observers of exercises involving only site personnel.

7.6.7 ROLE OF HEALTH AUTHORITIES

Health authorities, including doctors, surgeons, hospitals, ambulances, and so on, should have a vital part to play following a major accident, and they should form an integral part of the emergency plan.

For major fires, injuries should be the result of the effects of thermal radiation to a varying degree, and the knowledge and experience to handle this in all but extreme cases may be generally available in most hospitals.

Major off-site incidents are likely to require medical equipment and facilities additional to those available locally, and a medical "mutual aid" scheme should exist to enable the assistance of neighboring authorities to be obtained in the event of an emergency.

7.6.8 ROLE OF GOVERNMENT SAFETY AUTHORITY

This will be the factory inspectorate available in the region. Inspectors are likely to satisfy themselves that the organization responsible for producing the off-site plan has made adequate arrangements for handling emergencies of all types including major emergencies. They may wish to see well documented procedures and evidence of exercise undertaken to test the plan.

In the event of an accident, local arrangements regarding the role of the factory inspector will apply. These may vary from keeping a watching brief to a close involvement in advising on operations.

The action plan suggested for control of the off-site emergencies is given in **Table- 7.16**.

TABLE-7.16
OFF-SITE ACTION PLAN

S. No.	Action required to be taken to mitigate disaster by aid giving agency	Responsible agencies for taking action	Equipments/material facilities required at site to mitigate emergency
A1	Arrangements for evacuation/rescue of persons from zone of influence to predetermined camps	Police Department	Self Breathing apparatus with spare cylinder Chemical gas mask with spare canister Vehicle with PA system Transportation for evacuation of people
2	Caution to public by announcement		
3	Traffic and Mob control by cordoning of the area		
4	Law & order		
5	Request to railway authority for keeping the nearest by railway gate open & to stop the up & down trains at the		

S. No.	Action required to be taken to mitigate disaster by aid giving agency	Responsible agencies for taking action	Equipments/material facilities required at site to mitigate emergency
	nearest railway station		
B1	Control of fire	District Fire Brigade	Self breathing apparatus with spare cylinders Foam/water fire tenders Gas mask with spare canisters Lime water Neck to toe complete asbestos suit, PVC hand gloves, gumboots, safety goggles Mobile scrubbing system along with suction arrangement.
1	Scrubbing of the flashed off gas cloud with water curtain		
2	To rescue trapped persons		
3	If fire is big, keep surrounding area cool by spraying water		
4	Communication to TNEB to continue or cut off electric supply		
5	Communication to water supply department for supplying water		
C1	Medical facilities for affected persons (first aid and treatment)	Hospital and public health	Ambulance with onboard resuscitation unit, first aid, stretchers
D1	Identification of concentration of gas in zone of influence	Pollution control board	Gas detector
E1	Removal of debris and damaged structures	Municipal corporation	Provide bulldozers Provide cranes Provide traffic police at site
F1	Monitor the incoming and outgoing transports	Transport department	Provide emergency shifting vehicles at site Provide stock of fuel for vehicles
2	Arrange emergency shifting of affected persons and non-affected person to specified area		
3	Arrange diesel/petrol for needed vehicles		
G1	Give all information related to	Meteorological Department	Provide wind direction and velocity

S. No.	Action required to be taken to mitigate disaster by aid giving agency	Responsible agencies for taking action	Equipments/material facilities required at site to mitigate emergency
	meteorological aspects for safe handling of affected area for living beings		instruments with temperature measure Mobile van for meteorological parameter measurements
2	Forecast if any important weather change		
H1	Representatives of all departments are in the local crisis group; therefore they are expected to render services available with them. Since it is a group of experts with authority, the mitigating measures can be implemented speedily. The representatives from locals are also there so that communication with local people is easy and quick.	Local Crises Group	Must have all resources at hand, specially disaster management plan and its implementation method. All relevant information related to hazardous industry are generally available with crisis group Newspaper editor is a part of the group so that right and timely media release can be done
2	The district emergency or disaster control officer is the president and he is used to mock drill etc. so action can be taken in right direction in time		
II	Collector is the President of District Crisis Group therefore all district infrastructure facilities are diverted to affected zone	District Crisis group	All necessary facilities available at district can be made available at affected zone Control of law and order situation
2	All other functions as		

S. No.	Action required to be taken to mitigate disaster by aid giving agency	Responsible agencies for taking action	Equipments/material facilities required at site to mitigate emergency
	mentioned for local crisis group		

Sources	Diseases	Preventive measures		
		Engineering Control	Medical Measures	Legislation
BTG, ESP, Ash handling, Coal handling & Ash pond areas	Heat stress Noise induced hearing loss Back pain Fall from height Burn injuries Scaled Cuts Fracture Sprain Strain Cataract Low back pain Lack of sleep Anxiety Peptic ulcer Hypertension Heart diseases Electrocution Dust allergy	Design building Ventilation Illumination Work space Work ways House keeping Enclosure machines Enclosure of human beings Fall arrestor for work at height Statistical monitoring Mechanization Use of PPEs Research Air & Water Quality Monitoring Environmental monitoring	Pre -employment medical exam. Pre- placement medical exam. Periodic medical exam:- <ul style="list-style-type: none"> • Clinical exam • Audiometric noise • Spirintus lung function test • ECG test • Blood checkup: • Sugar • CBC • Urine test • Stool test Effective primary health care: <ul style="list-style-type: none"> • Dispensary • Medicine • Injury repair • Oxygen • Ambulance room 	Factory Act Minimum Wages Act. ESI Act Welfare Act
	Brain tumor Cardiac arrhythmia Burns	S Dust level S Noise level S Heat S Illustration	<ul style="list-style-type: none"> • Wound repair • Nebulizer • Immunization • Dressing/bandage • Operation Beds • Ambulance • Drinking water • Hazard specific 	

Sources	Diseases	Preventive measures		
		Engineering Control	Medical Measures	Legislation
			test:- • Pot room- fluoride test, urine stress. • Audiometric test • Urine cytology • Chest x-ray • USG mode • Kidney • Ureter & bladder • Skin and dermatitis • Stool and hygiene test • Skin and dermatitis • Vision testing	

7.6.9 SAFETY PLAN

Safety of both men and materials during construction and operation phases is of concern. Safety plan shall be prepared and implemented in the proposed power plant. The preparedness of an industry for the occurrence of possible disasters is known as emergency plan. The disaster in the plant is possible due to collapse of structures and fire/explosion etc

Keeping in view the safety requirement during construction, operation and maintenance phases, the power plant would formulate safety policy with the following regulations:

- To allocate sufficient resources to maintain safe and healthy conditions of work;
- 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 used in their work which are known to be potentially hazardous to health or safety;
- To keep all operations and methods of work under regular review for making necessary changes from the point of view of safety in the light of experience and upto date knowledge;
- To provide appropriate facilities for first aid and prompt treatment of injuries and illness at work;
- To provide appropriate instruction, training, retraining and supervision to employees in health and safety, first aid and to ensure that adequate publicity is given to these matters;
- To ensure proper implementation of fire prevention methods and an appropriate fire fighting service together with training facilities for personnel involved in this service;
- To organize collection, analysis and presentation of data on accident, sickness and incident involving people injury or 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 separate safety rules for each type of occupation/processes involved in a plant; and
- To ensure regular safety inspection by a competent person at suitable intervals of all buildings, equipments, work places and operations.

7.6.10 SAFETY ORGANIZATION

- **Construction and Erection Phase**

A qualified and experienced safety officer shall be appointed. The responsibilities of the safety officer include identification of the hazardous conditions and unsafe acts of workers and advice on corrective actions, conduct safety audit, organize training programs and



provide professional expert advice on various issues related to occupational safety and health. He is also responsible to ensure compliance of Safety Rules/ Statutory Provisions. In addition to employment of safety officer by KUTPPL, every contractor, who employs more than 250 workers, shall also employ one safety officer to ensure safety of the worker, in accordance with the conditions of contract.

- **Operation and Maintenance Phase**

When the construction is completed the posting of safety officers shall be in accordance with the requirement of Factories Act and their duties and responsibilities shall be as defined thereof.

7.6.11 SAFETY CIRCLE

In order to fully develop the capabilities of the employees in identification of hazardous processes and improving safety and health, safety circles would be constituted in each area of work. The circle would consist of 5-6 employees from that area. The circle normally shall meet for about an hour every week.

7.6.12 SAFETY TRAINING

A full-fledged training center shall be set up at the plant. Safety training shall be provided by the Safety Officers with the assistance of faculty members called from Professional Safety Institutions and Universities. In addition to regular employees, limited contractor labors shall also be provided safety training. To create safety awareness safety films shall be shown to workers and leaflets shall be distributed. Some precautions and remedial measures proposed to be adopted to prevent fires are:

- Compartmentation of cable galleries, use of proper sealing techniques of cable passages and crevices in all directions would help in localizing and identifying the area of occurrence of fire as well as ensure effective automatic and manual fire fighting operations;
- Spread of fire in horizontal direction would be checked by providing fire stops for cable shafts;



- Reliable and dependable type of fire detection system with proper zoning and interlocks for alarms are effective protection methods for conveyor galleries;
- Housekeeping of high standard helps in eliminating the causes of fire and regular fire watching system strengthens fire prevention and fire fighting; and
- Proper fire watching by all concerned would be ensured

7.6.13 HEALTH AND SAFETY MONITORING PLAN

The health of all employees shall be monitored once in a year for early detection of any ailment due to exposure to heat and noise.

7.7 SOCIAL IMPACT ASSESSMENT

The project will result in providing employment and subsequent increase in the income levels.

7.8 R&R ACTION PLAN -LAND ACQUISITION

KUTPPL has acquired 725 acres of the project area of out of 750 acres. As the present site considered for the proposed project is partly single crop agricultural land and waste land covering no habitat, no displacement of population is involved.

7.9 INFRASTRUCTURE FACILITIES FOR WORKERS (CONSTRUCTION & OPERATION)

KUTPPL will provide the following infrastructure facilities for the workers during construction and operation

- Septic tanks with soak pits will be provided at construction camp
- Water for the construction labour will be supplied
- Fuel for cooking will be supplied
- A dispensary with all necessary medicines will be provided
- Rest room with all facilities will be provided.
- Canteen facility at subsidy prices will be provided



CHAPTER - 8

PROJECT BENEFITS



CHAPTER - 8 : PROJECT BENEFITS

8.1 PROJECT BENEFITS

Implementation of the Power plant will result in the following benefits:

- a. Temporary employment for people from the neighboring villages during construction phase.
- b. Permanent employment
- c. Indirect employment arising out of a big infrastructural project like transport requirements, catering, ancillary industries, material handling, trading and other associated services.
- d. Community development activities such as training of local unemployed youth in various skills, personality development, development of self help groups for women, providing drinking water facility, strengthening of rural roads, rain water harvesting etc
- e. Improved health care facilities in nearby villages.
- f. Development of roads in the area.
- g. Improvement of infrastructure as well upliftment of social structure in the area.
- h. Provide benefits for the locals in two phases i.e. during construction phase as well as during operational stage.

8.2 CONSTRUCTION PHASE

8.2.1 EMPLOYMENT

The major benefit due to the proposed project will be in the area of generating temporary employment for substantial number of personnel. The construction phase of power plant is expected to span over 44 months. Approximately 2000 persons would be required for the construction work, most of whom would be unskilled workers, although the power plant construction needs a large number of skilled personnel as well. These construction workers will be taken from the study area and the nearby villages to the extent possible. Hence, the



proposed project will benefit locals to some extent in addition to CSR activities proposed by KUTPPL.

8.2.2 COMMUNITY SERVICES

KUTPPL will employ local people to the extent possible in order to reduce the need for additional infrastructure. In addition, KUTPPL will develop necessary infrastructure like accommodation, water supply, sewerage, medical facility, etc. for catering to the needs of the project personnel and their families. It is proposed to develop township for employees within the plant site. The local people will be indirectly benefited by these developments.

8.2.3 TRANSPORTATION

KUTPPL will be laying paved road around the project area as part of diversion of existing cart track so that all surrounding villages can avail better and faster connectivity between them.

8.3 OPERATIONAL PHASE

The man power requirements for the operational phase of the power project shall be about 575 persons.

Preference will be given to the persons from whom lands have been acquired based on the suitability i.e for skilled and unskilled jobs. On fulfilling this, balance employment will be given to locals based on suitability

In addition to the direct employment mentioned above, there will be indirect employment of local people by utilizing their expertise in different areas like horticulture, site clearing (for power plant construction), etc. Also, due to secondary development in the study area, employment opportunities will be generated. About 575 people are expected to get employment.



8.4 PROPOSED CSR ACTIVITIES

CSR activities will be taken up to fulfill the basic requirement of the people in the area. The basic requirement of the community needs will be strengthened by extending health care; educational facilities will be improved, providing drinking water to the villages, building/strengthening of existing roads in the area.

The proposed project will create opportunities for indirect employment which will help in improving the socio economic status of the region. Social welfare activities are taken up on a large scale.

M/s. KUTPPL proposes to implement various CSR activities in the areas like Infrastructure Development, Education, Medical Facilities, Sanitation, Community Development and Awareness Programmes, skill development training, livelihood, women empowerment in an around the project area. CSR Policy of KUTPPL is enclosed as **Fig-8.1**

8.4.1 BUDGET FOR COMMUNITY DEVELOPMENTAL ACTIVITIES

Need based assessment has been carried out to list out various needs of the villagers as part of the Community Development Plan in the area. An amount of Rs. 20.25 crores is earmarked for the implementation various developmental activities in area. Summary of CSR Budget for various focused areas is given below :

TABLE - 8.1
SUMMARY OF CSR BUDGET FOR VARIOUS FOCUSED AREAS

S.No	Description	Rupees in Lakhs					Total
		1st Year	2nd year	3rd year	4th year	5th year	
I	Infrastructure	152.00	177.00	232.00	242.00	217.00	1020.00
II	Livelihood And Training	102.00	102.00	102.00	100.00	100.00	506.00
III	Health	65.00	65.00	55.00	55.00	55.00	295.00
IV	Education	33.00	33.00	33.00	33.00	32.00	164.00
V	Sports	8.00	8.00	8.00	8.00	8.00	40.00
	Total	360	385	430	438	412	2025





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VISION DOCUMENT

Corporate Social Responsibility Policy

Our CSR Policy focuses on addressing social, environmental and economic needs of the society.

We align our CSR strategy to ;

- ❖ build a relationship of trust with society through proactive participation in society and trustworthy actions.
- ❖ direct Programmes towards achieving one or more of the following –
 - EDUCATION
 - HEALTH
 - LIVELIHOOD
 - SKILL DEVELOPMENT
 - INFRASTRUCTUE
 - SPORTS etc.,
- ❖ develop the required capability and self-reliance of beneficiaries at the grass roots, in the local area, in the belief that these are prerequisites for social and economic development;
- ❖ engage in affirmative action interventions such as skill building and vocational training, to enhance employability and generate livelihoods for persons from disadvantaged sections of society;
- ❖ pursue CSR Programmes primarily in areas that fall within the economic vicinity of the Company's operations to enable close supervision and ensure maximum development impact;
- ❖ carry out CSR Programmes in relevant local areas to fulfil commitments arising from requests by government/regulatory authorities and administrative bodies in the local area



S. R. Samdeep.
Director

The year wise and item wise breakup of budget is given in **Table-8.2**.

Additionally an amount of Rs. 1.5 crores per year will be earmarked towards the recurring expenditure during the operation phase of the power plant in the area.

8.5 SPECIAL FOCUS OF CSR

8.5.1 WASTE LAND DEVELOPMENT

Based on the primary socio economic study and the data collected from the secondary sources, the following area are identified as fallow lands.

DETAILS OF FALLOW LAND

	Area (Ha)
Sindalakottai	6.39
Periyanattham	103.36
Naduvakkurichi	309.62
Lakshmipuram	0.02
Sub-Total	419.39
Ottapidaram	5
Kalugachalapuram	1.36
Sub-total	845.14
Grand Total	1264.53

KUTPPL after detailed study will identify Government land for development. An amount of Rs 100 Lakhs as part of CSR budget has been allotted for the same.

8.5.2 KIDNEY PROBLEMS IN THE AREA

Base on the primary data collected from 15 villages there was no single Kidney problem case was observed. According to the Govt. hospital medical records given by the Ottapidaram Taluk also, confirms this.



TABLE - 8.2
YEAR WISE BUDGET ALLOCATION FOR CSR ACTIVITIES

S.No	Description	Rupees in Lakhs					Total
		1st Year	2nd year	3rd year	4th year	5th year	
I	INFRASTRUCTURE						
	1. Provision of drinking water facility for 15 Villages in the Study Area	35.00	35.00	35.00	45.00	45.00	195.00
	2. Repair / construction of new roads , Side drains etc.,	50.00	50.00	50.00	50.00	50.00	250.00
	3. Providing/upgradation of infrastructure facilities in schools and Play Grounds	15.00	15.00	15.00	15.00	15.00	75.00
	4. Construction of Individual toilets	10.00	10.00	10.00	10.00	10.00	50.00
	5. Providing water for existing community toilets and sanitation.	3.00	3.00	3.00	3.00	3.00	15.00
	6. Construction of Bus shelters	-	-	10.00	10.00	10.00	30.00
	7. Construction of Community Centers	-	-	45.00	45.00	45.00	135.00
	8. Providing Road facility from Kurukuchali to Subrymanyapuram, Periyannatham, Sindalkattai	-	25.00	25.00	25.00		75.00
	9. avenue plantation for villages	4	4.00	4.00	4.00	4.00	20.00
	10. rainwater harvesting	5	5.00	5.00	5.00	5.00	25.00
	11. Repairs/Renovation of Anganwadi centers	10.00	10.00	10.00	10.00	10.00	50.00
	12. Waste Land Development	20.00	20.00	20.00	20.00	20.00	100.00
II	LIVELIHOOD AND TRAINING						
	Training in Employability Skills						
	1. Driving	4.00	4.00	4.00	2.00	2.00	16.00
	2. Hospitality Services	5	5.00	5.00	5.00	5.00	25.00
	3. Security Guards	2.00	2.00	2.00	2.00	2.00	10.00
	4. Construction training program.	5.00	5.00	5.00	5.00	5.00	25.00
	5. Bore well repairs	3.00	3.00	3.00	3.00	3.00	15.00
	6. Women Empowerment Cell - Conducting Training Programs for upliftment of women and to generate self employment skills	10.00	10.00	10.00	10.00	10.00	50.00
	7. Farmers Development Fund	15.00	15.00	15.00	15.00	15.00	75.00
	8. Setting up a model agricultural farm and providing seeds to the farmers	15.00	15.00	15.00	15.00	15.00	75.00
	9. Support/Aid for setting up of Household fruit processing small unit	8.00	8.00	8.00	8.00	8.00	40.00
	10. Fishermen Development Fund	25.00	25.00	25.00	25.00	25.00	125.00
	11. Financial help to the existing Self Help groups in all the villages	10.00	10.00	10.00	10.00	10.00	50.00
III	HEALTH						
	1. Conducting of medical camps	15.00	15.00	15.00	15.00	15.00	75.00
	2. Providing Ambulance with paramedical staff	15.00	15.00	5.00	5.00	5.00	45.00
	3. Financial aid for operation at Hospitals	25.00	25.00	25.00	25.00	25.00	125.00
	4. Providing medical care to T.B. Patients for the affected villages	10.00	10.00	10.00	10.00	10.00	50.00
IV	EDUCATION						0.00
	1. Provision of scholarships for class toppers	5.00	5.00	5.00	5.00	4.00	24.00
	2. Distribution of Books and Stationery	8.00	8.00	8.00	8.00	8.00	40.00
	3. Distribution of School Uniforms	5.00	5.00	5.00	5.00	5.00	25.00
	4. Cultural Activities	5.00	5.00	5.00	5.00	5.00	25.00
	5. Celebrations at Schools	5.00	5.00	5.00	5.00	5.00	25.00
	6. Providing Teaching Assistance/External Experts for Schools	5.00	5.00	5.00	5.00	5.00	25.00
V	SPORTS						
	1. Training and Encouraging Sports activities	4.00	4.00	4.00	4.00	4.00	20.00
	2. Sponsorship for best Sportsmen for further training	4.00	4.00	4.00	4.00	4.00	20.00
	Total	360.00	385.00	430.00	438.00	412.00	2025.00

However, as per issue raised during PH, it is proposed to install mineral water plants in 15 villages located around 5 km radius of the plant phase wise covering five villages in each year.

An amount of Rs 195 lakhs has been budgeted as part of CSR activity for the same

8.5.3 CSR FOR FISHERMEN COMMUNITY

There are no Fishermen community/villages within 10 km radius of the project site

Two villages of Fishermen are located beyond 10 km radius towards Eastern direction on the coast of Bay of Bengal.

The villages are

1. Thiruvaikulam

- ⊕ Thiruvikulam is having 1743 House Holds, with 7325 Total population with 3758 Males and 3567 females. Sex ratio is 949 females for every 1000 males.

2. Ino-nagar

- ⊕ Ino-nagar is a part/ward of Tuticorin Municipality

A group discussions was conducted with the fishing community people to know their needs and problems.

No effect of their livelihood due to the project is foreseen as they are located beyond impact zone of 10 km radius and there is no abstraction of sea water or discharge of treated waste water into sea.

KUTPPL has earmarked an amount of Rs 125 Lakhs as fishermen fund to meet the following needs expressed by Fishermen during FGD. This fund is spread over 5 years.

- Training in modern fishing techniques such as GPS and Eco-sounder



- Subsidy and loan for procuring modern fishing equipment like fishing gear and Craft
- Providing Ice cutting machines.
- Vehicles for transporting fish catch to the market place
- Training on value addition
- Training to fisher women for additional revenue
- Training in hygienic handling of fish and providing necessary infrastructure
- Training and demonstration for alternative livelihoods opportunities for men and Women.
- New fish seed bank
- Concrete platform for fish handling and dry fish making
Providing ice box, crates, fish tubs

8.5.4 PRE TREATMENT FOR TUBERCULOSIS (TB)

Based on the primary data collected from Ottapidaram Taluk, 75 TB Cases are reported:

Adult - Male -37- Female- 33
Child - Male-4 - Female-1
Total-75

The information collected through household survey indicated that TB cases are mainly from persons involved in Sheep farming

KU will extend all the support as part of CSR activity to the TB prone individuals by extending support to the patient hospitalized for pretreatment evaluation and treatment initiation.

All cost will be borne by KUTPPL for Pretreatment evaluation which includes a thorough clinical evaluation, CXR and relevant hematological (complete blood count, blood sugar, liver function tests) and biochemical tests (blood urea, S. Creatinine, TSH, urine examination).

Patients identified/prone for TB will be provided regular treatment



An amount of Rs 50 Lakhs will be spent for TB treatment/pre treatment

8.6 MONITORING MECHANISM FOR CSR ACTIVITIES

The KUTPPL will form a CSR cell for implementing CSR activities. Local Panchayat heads of the Villages will be involved to monitor implementation of the listed activities of CSR

KUTPPL will receive periodic reports from the CSR Cell endorsed by Village Panchayat Heads on annual basis.

The nearest government institute will be engaged for conducting annual social audit once in a year.



CHAPTER - 9

ENVIRONMENTAL COST BENEFIT ANALYSIS



CHAPTER – 9: ENVIRONMENTAL COST BENEFIT ANALYSIS

Not applicable as it is not recommended at the Scoping stage.

CHAPTER - 10

ENVIRONMENTAL MANAGEMENT CELL



CHAPTER - 10 : ENVIRONMENTAL MANAGEMENT CELL

10.1 ENVIRONMENTAL CELL

In order to maintain the environmental quality within the standards, regular monitoring of various environmental components is necessary.

The power plant will be supervised and controlled by a General Manager supported by adequate team of technically and statutorily qualified personnel apart from the operating staff of skilled, semi-skilled, unskilled and other categories.

Environment Management will be the responsibility of the Environment Management cell headed by the Manager (Environment) and comprising of Environmental Engineer, safety officer, chemists, etc. The Manager (Environment) will report to the Plant General Manager.

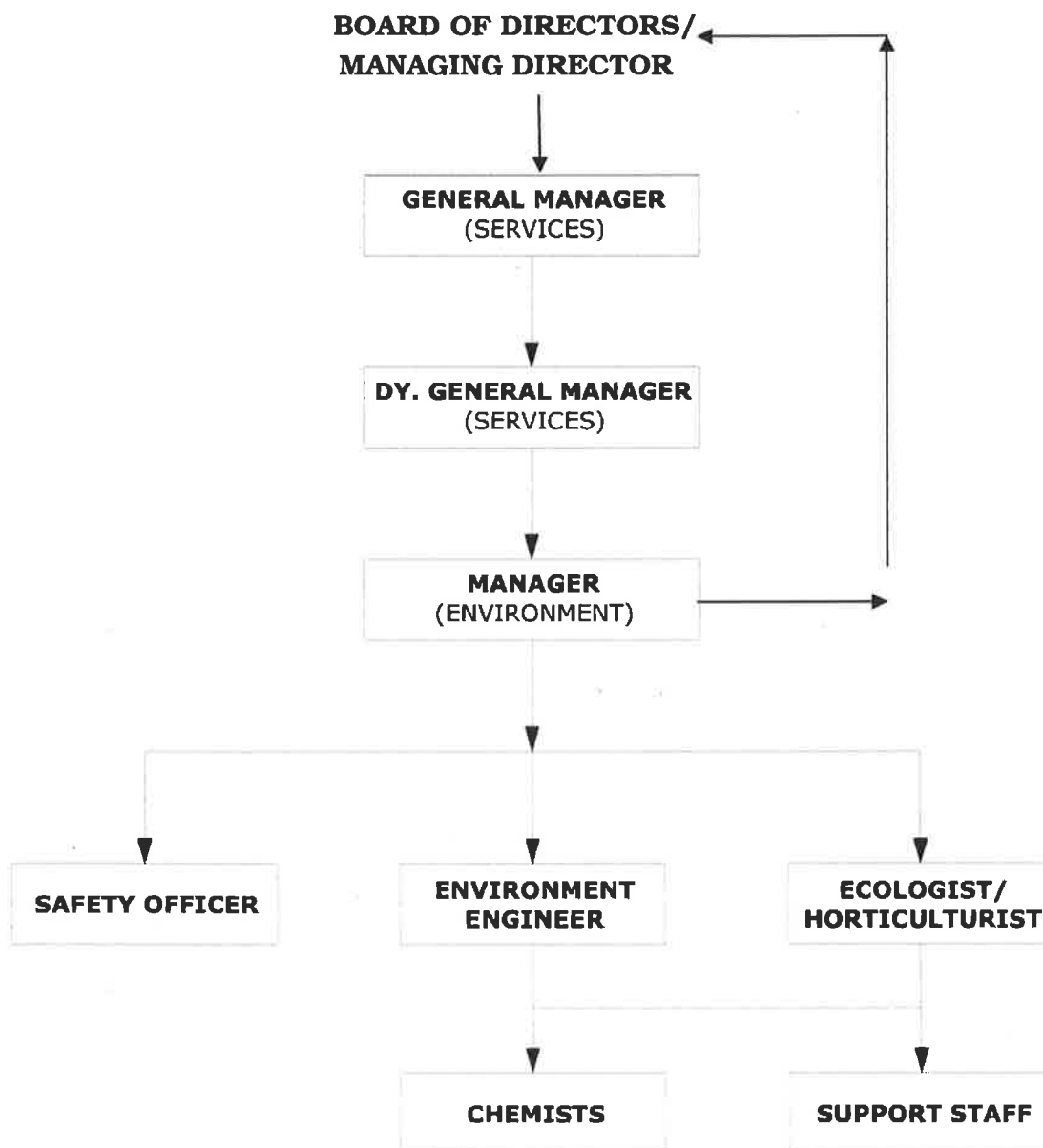
The Manager-Environment will be responsible for environment management activities in the power plant. To facilitate effective environment management, KUTPPL will create a department consisting of officers from various disciplines to co-ordinate the activities concerned with the management and implementation of the environmental control measures.

Basically, this department will supervise the monitoring of environmental pollution levels viz. ambient air quality, water and effluent quality, noise level either departmentally or by appointing external agencies wherever necessary.

In case the monitored results of environmental pollution are found to exceed the allowable limits, the Environmental Management Cell will suggest remedial action and get these suggestions implemented through the concerned authorities.

The Environmental Management Cell will also co-ordinate all the related activities such as collection of statistics of health of workers and population of the region, afforestation and green belt development. Organization structure of the Environmental Management cell is shown in **Fig-10.1**.

Fig - 10.1
Organization structure of the Environmental Management cell



10.2 ENVIRONMENT POLICY

KUTPPL Environment Policy to conserve and protect Environment. is enclosed as **Fig – 10.2**.

The procedure to identify the non-compliances is as given below:

Internal Audit : Periodic Internal Audits will be done to identify the non-compliances as part of Integrated Management System

The Responsibility of Auditors is given below:

(a) Internal Audit In-charge: Responsible for:

- ◆ Implementation of this procedure and he is Administrator for the “On - Line Audit Module”
- ◆ Review for final closing of Audit Report in absence of Management Representative.
- ◆ Provide information/reports on the results of audit for Management review.

(b) Internal Auditors: Responsible for:

- ◆ Conducting the auditing in the assigned auditee area/function as per schedule.
- ◆ Preparation of audit report on observations made during audits and entering mutually agreed target date in Audit report for closure of NC.
- ◆ Recommending for closure of NCs after verification of the effectiveness of corrective action taken and preventive action taken /planned by auditee and entering the follow up remarks in audit report.

Auditor’s findings are classified as Non-Conformance (NC) or Compliance & findings categorized as follows:



KU THERMAL POWER PRIVATE LIMITED

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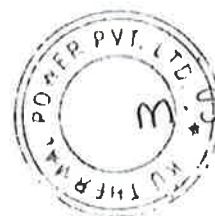
VISION DOCUMENT

ENVIRONMENT POLICY

We are committed to a programme of management, continuous improvement and reporting of our direct and indirect impacts, which marks our contribution to improving the world in which we live.

Towards this We ;

- ☞ Strive to preserve and uphold natural resources and reduce the environmental impact
- ☞ Aim towards sustainable development
- ☞ Safeguard an abundantly green Earth through creating awareness on sustainability
- ☞ Adopt principle of **Reduce, Reuse, Recycle, Renew and Respect.**
- ☞ Provide adequate training, information and instruction on quality activities, environmental protection, workplace safety and health hazards
- ☞ Provide all necessary resources for the protection of people and assets
- ☞ Ensure that the requirements of environmental, legal and other requirements are complied with
- ☞ Continuously improve Environment performance through measurable objectives and targets
- ☞ Periodically review the policy so that it remains relevant, and communicating it to all concerned
- ☞ Adopt the best practises for sustainable development
- ☞ Improve environmental and quality performance through conservation of natural resources, waste minimisation and prevention of pollution
- ☞ Design and develop products & processes for minimal environmental impact
- ☞ Promote environmental, health & safety awareness among the employees, contractors, users and transporters



M. S. R. Samdeep.
Director

“Major”- Non-conformity will be given for the **absence** of the system & repetition of the particular case of “Minor” Non-conformity in one particular area under scope of audit.

“Minor”- Non-conformity will be given for some minor **deviation** from the requirements of standard or procedures.

“Compliance”- Those findings which indicate neither any deviation nor any non- conformance are classified as “Compliance”.

Auditee implements the corrective actions & preventive action against the Non-Conformities and follows up with the same Auditor to close the NCs

In the case of non-availability of the same auditor, non-conformity can be closed by any other qualified auditor on verifying the effectiveness of corrective action taken and preventive action taken /planned by auditee

Audit reports is finally closed only after the review of the same by MR / Internal Audit In-charge

The hierarchical system /Administrative order to deal with the environmental issues for ensuring compliance with the environmental clearance conditions is given below: **FIG - 10.1**

The non-compliances /violations of environmental norms along with compliance status will be reported to the Board of Directors through Manager (Environment).

CHAPTER - 11

SUMMARY & CONCLUSIONS



CHAPTER – 11 : SUMMARY & CONCLUSIONS

11.1 INTRODUCTION

M/s. KU THERMAL POWER PRIVATE LIMITED (KUTPPL) proposes to setup 2x660 MW (1320 MW) Coal Based Thermal Power Plant at Ottapidaram & Sillanattam villages, Ottapidaram Taluk, Thoothukudi District in Tamil Nadu State. This project is being setup as a part of the power generation augmentation program of Government of Tamil nadu.

The proposed project of 1320 MW capacity is categorized as Category - A project as per Environmental Impact Assessment (EIA) Notification SO 1533, of 14-09-2006 which necessitates obtaining the Environmental Clearance from Ministry of Environment and Forests & Climate Change (MoEF&CC).

As per the requirement of EIA notification, KUTPPL had submitted the necessary application to MoEF&CC for approval of Terms of Reference (TOR). The Terms of Reference was approved by MoEF&CC for carrying out the EIA study vide letter No. J- 13012/115/2011-IA-II (T) dated 28-12-2011

The Data format for Draft EIA report was prepared by M/s. Vimta Labs, based on site specific baseline data collected during the period October to December 2011.

The project has been presented before MoEF&CC for validity extension of TOR for the proposed thermal power plant which was considered by the Expert Appraisal Committee meeting held during 5th – 6th December 2013 and the validity period of Terms of Reference extended for one year i.e. till 27-12 2014.. The TOR extension for the project has been extended for one more year i.e; till 27-12- 2015 vide letter no: J-13012/115/2011- IA.II (T), dated 15-1-2015.

The Public Hearing was conducted on 25 -7-2014 by Tamil Nadu State Pollution Control Board.



Final EIA report incorporating the details of the Public Consultation was prepared and submitted to Ministry in March 2015. The proposal was discussed in the Expert Appraisal Committee meet on 29th April 2015. During the discussions, the committee observed that the baseline data was collected in the period October to December 2011, which is monsoon season in Tamilnadu. The Committee, hence advised the proponent to collect fresh data in the period May to July 2015 and submit the revised Final EIA report along with few more clarifications. The Ministry also advised the proponent to advertise in local newspapers about the fresh baseline data and the Revised EIA report

Accordingly, the Fresh data was collected from May to July 2015, and the Revised Final EIA was prepared using the new data, and also addressing the clarifications by MoEF&CC minutes of 34th meeting of the re-constituted Expert Appraisal Committee on Environmental Impact Assessment of Thermal Power & Coal Mining projects held on 29th - 30th April, 2015.

The subject report is Revised Final EIA Report incorporating fresh baseline data and replies to the clarifications raised by MoEF&CC.

11.2 PLANT CAPACITY, COST AND IMPLEMENTATION SCHEDULE

PROJECT SCHEDULE

S.NO	Unit No.	Unit capacity	Year of commissioning	Project Cost Rs crores
1.	Unit #1	660 MW	Unit #1 :40 months from Notice to proceed (NTP) to Zero date	6600
2.	Unit #2	660 MW	Unit #2 : 44 months from Zero date	
Total		1320 MW		

11.3 TECHNOLOGY SELECTION & IMPLEMENTATION

The proposed 1320 MW coal fired power plant will be a base load station comprising two (2) Pulverized Coal Fired Steam generating



units operating with supercritical-steam-conditions (supercritical technology) and its Auxiliaries and two (2) Steam Turbine Generators & its Auxiliaries. The proposed units will employ supercritical steam conditions of 259 kg/cm² & 565 °C and will have higher efficiency resulting in reduced emission of greenhouse gases.

11.4 PROJECT SITE AND ITS ENVIRONS

The site is located near Ottapidaram & Sillanattam Villages of Ottapidaram Taluk in Thoothukudi District of Tamilnadu with an average msl of about 31 m.

Study area is 10 km radius around the project boundary and is part of Survey of India Toposheet No. 58/L/1 (Scale: 1:50000).

Nearest railway line connecting Kovilpatti Jn. – Thoothukudi Melur RS of Southern Railway line is at a distance of 6.2 km in project Southern direction.

Thoothukudi is major town at a distance of 10.5 km in SE direction.

The National Highway (NH- 45B) connecting Madurai – Thoothukudi is located at about 3.1 km in Eastern direction, The nearest railway station is Tattaparai located at 6.7 km in SE direction.

Nearest Settlements from the project site are:

- Sillanattam – 0.2 km – SE
- Sivaminattam – 1.4 km - SW
- Lakshmipuram – 1.0 km – NW
- Subrahmanyapuram – 1.3 km – N
- Venkateswarapuram – 2.3 km - E

The Project site consists of two Solar Power Plants of 1 MW each.

The project site is at about 12.3 km, NNE from Malattar river, 13.2 km, ENE from Kallar river and 14.0 km, SSE from Korampallam river

The nearest airport is Thoothukudi at 18.5 km in SSW direction.



The Nearest Reserved / Protected Forest is chalikulam RF located at a distance of 5.2 km in West North West direction. There are no wild life sanctuaries, national parks, elephant/tiger reserves within 10km radius of the study area.

The nearest Marine Sanctuaries (Islands of Gulf of Mannar) are beyond 10.0 km and they are:

- Kosavari Tivu – 15.0 km – ESE
- Van Tivu (Church Island) - 14.3 km - ESE

There are no ecological sensitive locations, archaeological monuments, places of tourist interests and defence installations within 10 km radius. The industries located within 10 km radius as per the information obtained from TNPCB are:

1. M/s. Sesa Sterlite Ltd, SIPCOT
2. M/s. Ind-Bharath Thermal Power Ltd, Saminathan.
3. M/s. V.V. Titanium Pigments Pvt Ltd, SIPCOT.
4. M/s. Sesa Sterlite Ltd (Power Plant), Meelavittan.
5. M/s. Ind-Bharath Power Gencom Ltd, Keelaarasadi.
6. M/s. Kalpaga Chemicals Ltd, Silanatham.

11.5 SITE SELECTION

KUTPPL has evaluated the following sites from techno-economic feasibility and environmental aspects:

- Site-1: Veppalodai site, near veppalodai Village, Tuticorin district, Tamilnadu
- Site-2: Kayalpattinam site, near Kayalpattinam village, Tuticorin District, TN
- Site-3: Ottapidaram & Sillanattam village, Ottapidaram taluk, Tuticorin District, Tamilnadu

After evaluation of the above 3 sites, the site near Ottapidarm & Sillanattam villages in Ottapidaram taluk, Thoothukudi district has been identified for the development of the due to the following reasons.



The Ottapidaram & Sillanattam has the following advantages:

- Site is a dry land with no irrigation facilities as per revenue records.
- Availability of required plain land
- Proximate to Thoothukudi Port
- Nearest national high way (NH-45B) is at about 3.0 km from the selected site
- Nearest railway Station (Tattapari) is at about 6.7 km
- Desalinated water availability from South Ganga Waters Technology Private Ltd located at 10.7 km from the site
- No National Parks, Wildlife Sanctuaries in 10 km radius
- No human settlements, habitations or forests in the Project area
- Suitability for laying railway siding for transportation of coal from Thoothukudi port
- No R&R issues involved in the project
- Power evacuation to nearby PGCIL substation

11.6 REQUIREMENT OF THE PROJECT

Water

The project is based on air cooled condensate system, due to which, the water consumption for the plant is very less. After taking other consumptive water needs into account, the total water requirement is estimated to be 260 m³/hr. COC considered for auxiliary cooling is 5. This requirement will be obtained from Desalination plant of South Ganga Water Technologies Private Limited (SGWTPL).

SGWTPL is operating Desalination plant located at 10.7. The capacity of the plant is about 3MLD (presently). South Ganga obtained CRZ Environmental clearance up to 10MLD capacity. SGWTPL will supply desalinated water to the proposed KUTPPL. The water requirement per day will be 6.24MLD.

Water supply agreement signed between KUTPPL & SGWTPL Ganga Waters Technologies Private Limited.



Coal

The proposed power plant will be operated as Independent Power Plant (IPP). The project will be implemented with super-critical technology.

The project will be using Imported coal or blended coal having ratio of 70 % Indigenous coal and 30 % Imported coal supported by the secondary fuel oil (LDO) for start-up and Heavy Oil for flame stabilization at low loads.

The estimated coal requirement of the plant based on coal quality is given below

ANNUAL COAL REQUIREMENT

Fuel		2x660 MW (1320 MW)
Imported Coal (100%)	TPH	620.43
	TPD	14891
	MTPA	4.62@ 85 % PLF
or		
Blend Coal (70% indigenous coal and 30% imported coal)	TPH	812.51
	TPD	19500
	MTPA	6.05 @ 85 % PLF

MTPA – million tonnes per annum, TPH -Tonnes Per Hour, TPD-Tons per day

Source : KUTPPL

Coal transportation

The coal imported from Indonesia as well as the Indigenous coal will be shipped into Thoothukudi Port. Coal received at Thoothukudi Port will be transported to the project site by rail through proposed railway siding. In case of any delay in rail siding, the Coal will be transported by road.

Power Evacuation

The power generated will be stepped up to 400kV and will be evacuated to the 400kV line bays to the grid. The nearest pooling station(400/765kV) is at Ettayapuram which is at a distance of 40Km from site.



Manpower

The total manpower of power plant during operation period is estimated to be 450 persons. Preference will be given to local persons from neighboring villages.

Township

Township will be constructed for the employees of the power plant in 30 acres. The township will include the residential quarters for all the employees, guest house, recreation and health facilities. About 350 employees will be accommodated in township.

11.7 ENVIRONMENTAL IMPACT ASSESSMENT STUDY

Baseline Status

The baseline environmental quality represents the background scenario of various environmental components in the study area.

The Draft EIA report was prepared based on site specific baseline data collected during the period October to December 2011, by M/s Vimta Labs. During EAC, MoEF appraisal meeting, the committee observed that the baseline data was collected in the period October to December 2011, which is rainy season in Tamilnadu. The Committee, hence advised to collect fresh data during non-monsoon and submit the revised Final EIA report.

Fresh baseline data was collected during the period May to July, 2015 (study period) and presented in this chapter.

Meteorology

Predominant Wind direction during the period was from NE-ENE-E-ESE-SE sector accounting to about 79.02% of the total time. Wind speeds during this period were varying between 1-15 kmph. The winds of less than 1.7 kmph were treated as calm, about 1.63% of the time the winds were under calm condition.



Air Environment

Ambient air quality of the study area has been assessed through a network of 8 ambient air quality locations representing the downwind, cross wind and upwind impact scenario of the project site.

The Ambient Air Quality monitored in the study area was found to be well within the limits of NAAQ standards prescribed for Residential, Rural & Other Areas.

SUMMARY OF AAQ MONITORING ($\mu\text{g}/\text{m}^3$)

Station Code	Locations	98 TH PERCENTILE VALUES				
		PM ₁₀	Pm _{2.5}	SO ₂	NO _x	Ozone
A1	Project site	44.5	27.0	10.4	11.9	29
A2	Sillanattam	39.2	23.5	9.4	10.8	31
A3	Rajavinkovil	40.8	25.0	10.2	11.7	22
A4	Pudiyamputtur	43.0	24.6	9.6	10.5	27
A5	Ottapidaram	44.2	24.9	10.0	11.5	23
A6	Lakshmipuram	42.6	25.5	9.9	10.7	25
A7	Venkateshwarapuram	43.1	24.4	10.3	11.4	28
A8	Mel Arasadi	41.9	25.6	9.8	10.6	32

Note: CO at all locations was found < 1.0 ppm

Noise Environment

Eight monitoring locations were selected to assess the noise levels in the study area. Noise levels recorded in the day and night time were found to be less than 54 dB (A).

Water Environment

Seven water samples were collected within 10 km radius of the project site. The parameters thus analysed were compared with IS -10500. The water quality showed high TDS, Chlorides and hardness due to proximity of sea.

Soil Environment

Eight samples were collected to assess the soil quality in the 10 km study area of plant site which revealed low fertile quality



Biological Environment

From the study it has been observed that there are no endangered, endemic or threatened species.

11.8 Prediction of Impacts

The proposed project will be constructed in two phases. The project may influence the environment in two distinct phases:

- a) During construction phase which is temporary and of short term
- b) During operation phase which may have long term effects

11.8.1 Impacts during Construction Phase

The construction of proposed power plant would result in increase of fugitive dust concentrations due to fugitive dust. Frequent water sprinkling in the vicinity of the construction sites would be undertaken to reduce the fugitive dust generation.

Noise levels generated during construction activity will be temporary in nature. Onsite workers working in noise prone areas would be provided with earmuffs and plugs.

During construction, provision for infrastructural services including water supply, sewage, drainage facilities and electrification will be made. KUTPPL will ensure proper sanitation facilities for the labor colony and the temporary staff quarters

The site development activities like site clearing, leveling, earth work excavation and infrastructural development like roads etc will lead to stagnation of water. Adequate arrangements will be made to ensure proper drainage of water.

The impact on soil will be minimum as the construction activity for the main plant and auxiliary units would be confined within the plant boundary.



A senior Environment and Safety Officer will be made in-charge of the Environment and Safety aspects during construction. Proper Sanitation, dwelling and drinking Water facilities will be provided to the workforce at site.

11.8.2 IMPACTS DURING OPERATION PHASE

AIR ENVIRONMENT

The proposed operation of the power plant will result in emission of particulate matter, sulphur dioxide and oxides of nitrogen due to burning of coal in the boilers. Ground level concentrations of PM, SO₂ and NO_x were estimated due to emissions from proposed 1320 MW coal based power plant. The following table shows the incremental ground level concentrations:

INCREMENTAL GROUND LEVEL CONCENTRATION, $\mu\text{g}/\text{m}^3$

		PM10	SO ₂	NO _x
Scenario – A	1320 MW KUTPPL plant with operation on Imported coal	1.22	27.7	18.7
Scenario – B	1320 MW KUTPPL plant with operation on Blend coal	1.32	29.0	20.2

Predicted maximum incremental ground level concentrations are superimposed on the maximum baseline concentrations 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 below :

OVERALL SCENARIO WITHIN STUDY AREA ($\mu\text{g}/\text{m}^3$)

	PARTICULATE MATTER (PM10)	SULPHUR DIOXIDE SO ₂	OXIDES OF NITROGEN NO _x
Baseline Scenario (max)	44.5	10.4	11.9
Predicted Ground level Concentration (Max) (Worst Case : Scenario – B)	1.32	29.0	20.2
Overall Scenario (worst case)	45.82 (100)	39.4(80)	32.1(80)

Note: Value in parenthesis is NAAQ standard for Industrial, Rural and Residential Areas



ESTIMATION OF CUMULATIVE GROUND LEVEL

Information on operating and proposed industries within 10 km radius of the study area was collected. The industries which are presently operating are

- Ind Bharath Thermal Power plant – 2 X 150 MW - 0.1 km – W
- Ind Bharath 3x63 MW Power station- 5.3 km – ESE
- Sterlite Copper Smelter - Sterlite Industries – 6.0km – SSE.
- Sterlite Thermal Power Plant – 160 MW power plant
- Coastal Energen - Thermal Power Plant - 1 X 600 MW – 7.8 km – ENE

The emissions from the above industries are reflecting in the baseline monitoring studies carried out during the period May-July, 2015

The industries which are proposed/under implementation and yet to be commissioned within 10 km are:

- a) Ind Bharath Thermal Power plant – 1 X 150 MW - 0.1 km – W
- b) Coastal Energen - Thermal Power Plant –1 X 600 MW 7.8 km – ENE
- c) Coastal Energen - Thermal Power Plant –2 X 800 MW 7.8 km – ENE

Ground level concentrations of PM10 SO₂ and NO_x were estimated to project the incremental increase of concentrations above baseline concentrations due to emissions from the power plant. The following table shows the summary of the same



INCREMENTAL GROUND LEVEL CONCENTRATION, $\mu\text{g}/\text{m}^3$

	SOURCES CONSIDERED	PM	SO₂	NO_x
Scenario - C	a. 1320 MW KUTPPL with Imported Coal b. Ind Bharath Thermal Power plant - 1 X 150 MW - 0.1 km - W c. Coastal Energen - Thermal Power Plant -1 X 600 MW 7.8 km - ENE d. Coastal Energen - Thermal Power Plant -2 X 800 MW 7.8 km - ENE	2.01	45.8	28.2
Scenario - D	a. 1320 MW KUTPPL with Blend Coal b. Ind Bharath Thermal Power plant - 1 X 150 MW - 0.1 km - W c. Coastal Energen - Thermal Power Plant -1 X 600 MW 7.8 km - ENE d. Coastal Energen - Thermal Power Plant -2 X 800 MW 7.8 km - ENE	2.12	47.36	31.4

Noise Environment

During operation, the major noise generating sources are:

Source	Noise level (dB (A))
Steam turbines	90
Compressors	90
Coal crushers	85
Ash Slurry pumps	90
Boiler feed water pumps	90-102

All high noise making equipment will be provided with acoustic enclosures.

Noise level at the plant boundary, calculated from the above equation, is expected to be less than 55 dB (A) without considering any attenuation factors. The insulated source boundary walls and development of greenbelt along the periphery of the power plant will further reduce the noise levels.



Water Environment

The Air cooled condenser is envisaged for the project to limit water usage. Makeup water requirement for the auxiliaries cooling and other makeup requirements (for auxiliary cooling, makeup water, service water etc) are estimated to be about 260 m³/h(6.24MLD).

Land Environment

The main solid waste generated from the power plant is ash. Maximum ash generation from power plant is from blend coal. Steam generating units are the main sources of the solid waste where coal is burnt. The following table shows the ash generation from the power plant.

ASH GENERATION (MTPA)

	100% Imported coal	Blend coal (70% Indian & 30% imported)
Coal consumption at full load (100%)	620.43 TPH	812.83 TPH
Ash content considered for design	5.52%	31.06%
Ash generated per hour in Tonnes	34.25	252.43
Ash generated per year in Million Tonnes @85%PLF	0.255	1.876
Fly Ash Generation (80% of total ash)	0.204	1.50
Bottom ash (20% of total ash)	0.051	0.376

11.9 ENVIRONMENTAL MANAGEMENT PLAN

AIR POLLUTION CONTROL MANAGEMENT

The power plant is a coal based power plant where imported coal or blended coal would be used as fuel. Particulate Matter, SO₂ and NO_x are the major pollutants emitted due to combustion of coal containing Sulphur content of 0.50 % (max) .

The bottom ash generated in the form of clinker will be collected in the hoppers. The plant will have facility to offer bottom ash to users. Unused bottom ash will be disposed to ash pond.

In order to minimize fly ash emission to atmosphere, high efficiency



Electrostatic Precipitators (ESP) (2 nos) will be installed. The Pollution control system will be designed to limit the particulate emission to less than 50 mg/Nm³. Therefore the impact due to particulate emission due to combustion of coal leading to rise of suspended particulate concentration in the ambient air will be minimal. The fly ash collected in the hoppers will be removed through dry collection system.

One bi-flue stack of 275 m height will be provided as per CPCB guidelines.

Dust extraction system of coal crusher and other equipment will be provided with Bag filters to minimise fugitive dust emission from Coal Handling Plant.

Combustion of coal will result in NO_x emission of about 650 mg/Nm³ from the stack of the proposed power plant. This will lead to increase of ambient NO_x level. Predicted NO_x level due to emission from the proposed power plant super imposed on the baseline concentrations showed the ground level concentrations to be well within the limits of NAAQ standards.

Low NO_x burners will be provided for the steam generators to minimize the emission of Nitrogen oxides from boilers.

FUGITIVE DUST CONTROL

For control of fugitive dust, water spray arrangement will be provided to spray water all-round the coal stockpiles to suppress the dust and to wet the coal while compacting to minimize the dust nuisance. A closed conveyor system will be implemented to minimize the dust nuisance. All transfer points will be provided with bag filters.

NOISE CONTROL

All equipment in the power plant would be designed for noise levels not exceeding 90 dB(A). Proper encasement of noise generating sources will be done to control the noise levels. The proposed greenbelt development will further reduce the noise levels.



All operations and maintenance personal working near noise prone areas would be provided with earmuffs & earplugs.

A thick greenbelt in an area of 160 acres will be developed all around the plant with a width of 50 m (min), which acts as noise barrier.

WATER QUALITY MANAGEMENT

The total wastewater generation from the plant is 43.4 m³/hr. Detail of wastewater generation from various areas is given below:

WASTEWATER GENERATION (m³/day)

		Waste Water
Cooling Water - auxiliary cooling tower blowdown		20
Service / Plant Utilities		10
Domestic	Plant	6.4
	Township	8
Total		43.4

Plant service water (floor wash in oily area) will be treated for oil and grease removal and will be routed along with CT blowdown to Central monitoring Basin (CMB)

All the wastewater water streams except domestic wastewater will be routed to Central Monitoring Basin. Water from this is being fully utilized for greenbelt and horticulture development.

Treated wastewater from the CMB totaling to 28 m³/hr will be recycled back to for use in coal handling plant for dust suppression and for greenbelt development Domestic waste water will be treated in Sewage Treatment plant and it will be used for greenbelt development.

LAND ACQUISITION

Power Plant will be located in an area of about 750 acres Private Land. About 725 acres of private patta land had been procured



ASH MANAGEMENT

The area estimated for ash disposal is about 100 acres, to store ash generated from the 1320 MW power plant. The Fly ash generated would be utilized in dry form. An action plan for utilization of flyash to achieve 100 % utilization within four years will be drawn.

Maximum flyash generation from the plant is 6320 t/day. KUTPPL has tied up with the following for offtake of flyash generated from the plant for the following quantities.

1. My Home Industries Limited – 0.35 MTPA as on today and 0.7 MTPA by 2018.
2. The Ramco Cements Limited – 0.50 MTPA.

KUTPPL is exploring the possibility of exporting Flyash.

The Fly ash, which cannot be utilised, would be disposed off to the ash dump area in slurry form. Ash pond will be provided with suitable lining to prevent leaching.

11.10 CSR - COMMUNITY DEVELOPMENTAL ACTIVITIES

An amount of Rs. 20.25 crores will be earmarked for the implementation of the community development plan in the area as part of corporate social responsibility plan by KUTPPL.

Additionally an amount of Rs. 1.5 crores per year will be earmarked towards the recurring expenditure during the operation phase of the power plant and also take up the implementation of the community development plan in the buffer zone of the study area.

BUDGET FOR IMPLEMENTATION OF ENVIRONMENTAL MANAGEMENT PLAN.

A budget of Rs 418 Crores is earmarked for implementing the Environmental Management Plan



11.11 POST PROJECT MONITORING PLAN

KUTPPL will establish a full-fledged Laboratory equipped/hire services of recognized laboratory for monitoring all the environmental parameters as per CPCB /MOEF guidelines.

11.12 CONCLUSION

The project will help meet the growth of demand for electricity in Tamil Nadu state and Southern India. It will strengthen the regional power supply system and stimulate industrial development, and improve living standards of the people.

The technology adopted and the implementation ensures that the impacts due to the proposed power plant are amenable to technological control and effective environmental management.

The air emissions, noise generated, and wastewater quality will be regulated to the meet environmental quality standards prescribed by CPCB for thermal power plants.

Apart from eco-friendly operations, KUTPPL will undertake various socio economic development activities in the project and surrounding areas as per the community development plan. The positive economic output will improve the overall quality of life of the people living in the area.

CHAPTER - 12

DISCLOSURE OF CONSULTANTS



CHAPTER – 12 : DISCLOSURE OF CONSULTANTS

The Revised Environmental Impact Assessment (EIA) Report of M/s **KU THERMAL POWER PRIVATE LIMITED** at Ottapidaram & Sillanattam Villages, Ottapidaram Taluk, Thoothukudi District, Tamil Nadu for setting up of 2x660 MW (1320 MW) Coal Based Thermal Power Plant for obtaining Environmental clearance has been prepared by B. S. Envi-Tech (P) Limited, Secunderabad.

Draft EIA Report and Final EIA report are prepared by M/s Vimta Labs Limited who are NABET, QCI Accredited Consultant Organisation.

The Revised EIA Report is prepared incorporating the Fresh Baseline data collected during May- July, 2015 and replies to the clarifications raised by MOEF vide MoEF&CC minutes of 34th meeting of the re-constituted expert appraisal committee on Environmental Impact Assessment of Thermal power & Coal Mining Projects held on 29th - 30th April, 2015.

B. S. Envi-Tech (P) Limited is accredited as Category “A” Consultant by National Accreditation Board for Education and Training (NABET), Quality Council of India (QCI).

The Revised EIA report has been prepared by B. S. Envi-Tech (P) Limited with the qualified professionals having experience of more than 20 years in the field of Environmental Engineering and Management.

B. S. Envi-Tech (P) Ltd extends the Consultancy Services in the following fields:

- Environmental Impact Assessment studies for Environmental Clearance
- Obtaining Consent For Establishment/Operation from SPCB's



- Analytical services – NABL accredited Laboratory
- Monitoring of Environmental Parameters as per statutory requirements.
- Performance Testing of Emissions/Pollution Control Equipment
- Environmental Audits
 - (1) Third Party Environmental Audit
 - (2) Environmental Statement (Form – V)
- Preparation of Mining Plans (Registered as Qualified Person (RQP) by Indian Bureau of Mines (IBM))
 - (1) Preparation of Mining Plans
 - (2) Monitoring of Environmental Parameters for Mines as Per IBM and DGMS Guidelines.



National Accreditation Board for Education & Training



Quality Council of India

CERTIFICATE OF ACCREDITATION

M/s B. S. Envi – Tech (P) Ltd.

12-13-1270/71/73 'Amity Ville', 4th Floor, ST. Ann's School Road, Tarnaka, Secunderabad – 500017

is hereby accorded accreditation under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations (Rev. 09, August 2011) for the following scope:

Sl. No.	Name of the Sector	Cat.
1.	Mining of Minerals including Opencast/ Underground mining	A
2.	Thermal Power Plants	A
3.	Mineral beneficiation including pelletisation	A
4.	Metallurgical industries (ferrous & non-ferrous) – both primary and secondary	A
5.	Cement Plants	A
6.	Coke oven plants	B
7.	Asbestos milling and asbestos based products	A
8.	Distilleries	A
9.	Sugar Industry	B
10.	Building and large construction projects including shopping malls, multiplexes, commercial complexes, housing estates, hospitals, institutions	B
11.	Townships and Area development projects	B

Name of approved EIA Coordinators & Functional Area Experts are given in minutes of AC Meeting dated Nov 22, 2013; Jan 10 and Feb 21, 2014 posted on QCI website

Accreditation to the above Sectors is subject to the EIA reports being prepared by the experts (EIA Coordinators & Functional Area Experts) mentioned in the above minutes and compliance to the Terms and Conditions of Accreditation.

Certificate No: NABET/ EIA/ 1316/ RA002

Valid up to: Nov. 14, 2016

C.E.O.



(Please refer <http://nabet.qci.org.in/environment/> for latest status of accreditation)

Note

- Subject to continual compliance to NABET Scheme including Surveillance Assessment
- Updated status of accreditation available at www.qcin.org every 5th of the month



CHAPTER - 13

MOEF & CC CLARIFICATIONS & KUTPPL REPLIES



CHAPTER - 13 : MOEF & CC CLARIFICATIONS & KUTPPL REPLIES

KUTPPL has submitted Final EIA report incorporating the details of the Public Consultation to Ministry in March 2015. The proposal was discussed in the Expert Appraisal Committee meeting on 29th April 2015. During the discussions, the committee observed that the baseline data was collected in the period October to December 2011, which is monsoon season in Tamilnadu. The Committee, hence advised the proponent to collect fresh data in the period May to July 2015 and submit the revised Final EIA report along with few more clarifications. The Ministry also advised the proponent to advertise in local newspapers about the fresh baseline data and the Revised EIA report

Accordingly, the Fresh data was collected from May to July 2015, and the Revised Final EIA was prepared using the new data which is presented in Chapter - 3.

Clarifications raised by MoEF&CC vide minutes of 34th meeting of the re-constituted Expert Appraisal Committee on Environmental Impact Assessment of Thermal Power & Coal Mining projects held on 29th - 30th April, 2015 (enclosed as **Annexure-1D & Annexure-1D (contd.)**) Minutes of meeting of MoEF &CC along with replies is presented in this report at respective chapters as per the content and the same is given below as ready reference:

KUTPPL REPLIES TO MOEF & CC CLARIFICATIONS

Point (i) **The ash content in blended coal is given more than the domestic coal. The Sulphur Content is given the same for both domestic and imported coal. These needs to be relooked into. The ash content has to be less than 34%.**

Reply The ash content in blended coal (70 % Imported Coal and 30 % Indian Coal) considered is 31.06 % and domestic coal is 42 % (max). the same is furnished in



Chapter - 1, para - 1.5.2

Sulphur Content in imported coal ranged between 0.10 to 0.50. for estimation of worst case scenario 0.5 % is considered. Sulphur content domestic coal ranged between 0.3 to 0.4 % and for estimation of worst case 0.4 % was considered

Point (ii)

The base-line monitoring was done during Oct-Dec, 2011, which is a rainy season in the area. Further, the data is more than three years old. Hence, the monitoring shall be re-done during non-monsoon season and cumulative impacts (including those of proposed industries, TPPs etc. in the area) shall be assessed. The data may corroborate with other data available with the existing industries and data of proposed projects. Prediction of air quality may be done after incorporating their data too. The Sulphur content used for prediction modeling shall be of the worst case scenario. List of other industries, both existing and proposed may be given. Protocol for ambient Hg monitoring may also be given

Reply

The base-line monitoring was redone during May-July, 2015 which is non rainy season. The data is presented in Chapter - 3 Para-3.2.2 and sub paragraphs

Cumulative impacts considering the proposed industries in 10 km radius have been estimated. Details are present in Chapter - 4, Para - 4.2.1.6, 4.2.1.7 & 4.2.1.8

Due to non availability of the latest baseline data for the region, the following available data which is one year old has been considered for corroboration



- a. Data Recorded by Sterilite through online auto ambient air quality monitoring for October, 2014
- b. TNPCB monitored data for August, 2015 for Sterilite Industries
- c. Monitored Data of M/s Vimta Labs Limited for EIA studies of Sterilite Industries for July-September, 2014

The data corroboration is given in Chapter – 3, Para – 3.3.2.4

The Sulphur content considered for prediction modeling for imported coal is 0.5 and for Blend Coal is 0.40 % which are the worst case scenario.

List of other industries, both existing and proposed are provided under Chapter – 1 para – 1.4

Protocol for ambient Hg monitoring is enclosed as Annexure – 3B.

Point (iii) Since there are variations in sea and land breeze during the day, the monitoring result may be reported 8 hrly.

Reply The project site is 11 km away from the sea coast. 8 hourly wind rose pattern are shown in Chapter – 3 Fig – 3.1 & 3.2.

Point (iv) This would change the data and EIA report too. However, the Committee felt that there is no need to carry out the Public Hearing again. To make the Public Aware, public notice/s in the leading newspapers including local language informing the



public about the revised EIA/EMP with revised AAQ data etc. should be published. The comments from the public should be obtained giving a time period of minimum 15 days after the public notice is published. The revised EIA/EMP report should be placed on the website for public information.

Reply

Public notice in the English and Tamil newspapers informing the public about the revised EIA/EMP with revised AAQ data etc. is being published.

A copy of the Revised Final EIA Report is made available at the following offices and is also available on KUTPPL website at <http://www.kuthermal.com> for public information.

- a. District Collector Office, Thoothukudi
- b. Village Panchyat - Sillanatham and Ottapidaram
- c. District Industries, Thoothukudi
- d. Tamil Nadu Pollution Control Board, Thoothukudi

The comments from the public will be obtained giving a time period of minimum 15 days after the public notice is published.

Point (v)

Breakup of the proposed project area specifying storage areas etc.

Reply

Land breakup specifying storage areas is given in Chapter - 2, Para - 2.1, Table - 2.1

Point (vi)

Coal storage area and quantity shall be re-looked into and submitted.

Reply

Area earmarked for coal storage is 75 acres. This area will accommodate coal of 30 days requirement at



the consumption of 15000 tonnes/day.

The above details are provided in Chapter – 2, Para – 2.6.2 under coal storage

Point (vii) Action plan for establishment of railway siding for coal transportation.

Alternatively, a separate study may be carried out for impact of transportation of coal by road in case of delay in commissioning of railway siding.

Reply Action plan for establishment of Railway siding for coal transportation has been prepared by M/s Jeeva Management & Financial Consultant Private Limited. A report of the same is enclosed as Annexure – 1 J

The above details are referred in Chapter – 1, Para – 1.5.2

A separate study has been carried out for impact of transportation of coal by road in case of delay in commissioning of railway siding by M/s Jeeva Management & Financial Consultant Private Limited. A report of the same is enclosed as Annexure – 1 K

The above details are referred in Chapter – 1, Para – 1.5.2

Point (viii) Details of proposed CDM benefits as mentioned in the EIA report.

Reply CDM benefits are detailed under Chapter – 4, Para – 4.2.1.11. However, KUTPPL will not be availing CDM benefits

Point (ix) Details of number of Salt pans including any closed one and the distance of nearest salt pan



from the site. These may be given on a site map.

Reply Total number of Salt pans falling within 10 km radius are 1075. All salt pans are operating and there are no abandoned salt pans

The nearest salt pan is at 7.8 km. From 7.8 km the salt pans extend towards the sea in Eastern direction. The location of salt pans are shown in satellite imagery and interpreted map in Chapter -3, Para 3.4.6, Fig - 3.8 and Fig - 3.9

Point (x) Status of CRZ clearance and CMFRI approval for the Desalination plant of M/s South Ganga Water Technologies Pvt. Ltd. Ensure that impact on Marine ecology has been taken into account by the Supplier.

Reply Chapter -1
Para- 1.5.3
M/s South Ganga Water Technologies Pvt. Ltd (SGWTPL) was not directed to obtain CMFRI approval by any statutory body. Letter of SGWTPL is enclosed with the compliance

Point (xi) Alternate source of water in case of any breakdown or close down of the de- salination plant from where water will be obtained.

Reply Chapter -2
Para- 2.5.2

Point (xii) Details of COC for recirculation of water.

Reply The project is based on air cooled condensate system. COC considered for Auxiliary cooling is 5.



Point (xiii) Storm water management system.

Reply Chapter – 4
Para – 4.2.3.6
Fig - 4.9

Point (xiv) Commitment for non alteration of the surface drainage pattern of the area and for not extracting ground water.

Reply No perennial nallas are existing within the project site. No alteration of the surface drainage pattern of the area is proposed.

The project will meet water requirement as per details provided in Chapter – 1, Para – 1.5.3. No ground water extraction is proposed.

Point (xv) In the EIA report, it is mentioned that fly ash shall be used as fertilizer. This may be corrected as usage of fly ash as fertilizer is not allowed.

Reply In the revised ash utilisation plan, fly ash utilization as fertilizer is not proposed.

Point (xvi) Clear and discrete fly ash utilization plan.

Reply Chapter-4
Para - 4.2.7

Point (xvii) Copies of tie up with cement plant/s.

Chapter-4
Para – 4.2.7

Point (xviii) Optimized land area for ash pond.

The details of the ash pond and design details for



optimization of land is enclosed as Annexure – 2A

Point (xix) Action plan for provision of drinking water to the locals. . In the Public Hearing, it is mentioned that people in the project area are suffering from Kidney problem. Plan to take care of the same.

Reply Based on the primary data collected from 15 villages there was no Kidney problem case was observed. According to the Govt. hospital medical records given by the Ottapidaram Taluk also, confirms this.

However, as per issue raised during PH, it is proposed to install mineral water plants in 15 villages located around 5 km radius of the plant phase wise covering five villages in each year.

An amount of Rs 195 lakhs has been budgeted as part of CSR activity for the same.

Point (xx) **Population of fishermen in the area and affect on their livelihood.**

Reply Chapter – 8
Para – 8.5.3

Point (xxi) Revised detailed response and Action plan with budgetary provisions for issues raised in PH.

Reply Chapter – 7
Annexure – 7 B

Point (xxii) **Justification for the venue for holding PH at Collectorate instead of the project site.**

Reply Chapter – 7
Para – 7.1.1



QUESTIONNAIRE

**Proposed Supercritical Coal Based Thermal Power Plant
of
1320 MW (2x660 MW)**

**At
Ottapidaram & Sillanatham Villages Ottapidaram Taluk,
Thoothukkudi District
Tamil Nadu**

By



**KU Thermal Power Private Limited
Hyderabad.**

Prepared By



B.S. ENVI-TECH (P) LTD

Secunderabad – 500 017

NABET Accreditation No : NABET/EIA/1316/RA002

**QUESTIONNAIRE FOR ENVIRONMENTAL APPRAISAL
(THERMAL POWER SECTOR PROJECTS)**

Note 1 : All information given in the form of annexures should be part of this file itself. Annexures as separate files will not be accepted.

Note2 : Please enter x in appropriate box where answer is Yes/No

I.	General Information			
A.	Name of the Project :	KU THERMAL POWER PRIVATE LIMITED		
		1320 MW (2x660 MW) Supercritical Coal Based Thermal Power Plant		
1.	Existing project/ proposed project/ expansion project/ modernization project :	Proposed Project		
2	If Existing/expansion/modernization project, whether environmental clearance has been obtained	Not Applicable		
B	Generation Capacity (MW)	Total Capacity : 1320 MW (2 x 660 MW)		
C	Location			
	Village	Tehsil	District	State
	Ottapidaram & Sillanatham Villages	Ottapidaram Taluk,	Thoothukudi District	Tamil Nadu
D	Geographical Information			
	1. Latitude	Between 8°52'26.04"N - 8°53'57.91"N North		
	2. Longitude	Between 78° 3'25.19"E - 78° 4'30.88"E East		
	3. Elevation above Mean Sea Level (metres)	31 m above Mean Sea Level		
	4. Total Area envisaged for setting up of project (in ha.)	303.64 ha (750 -acres)		
	5. Nature of terrain (hilly, valley, plains, Coastal plains etc.)	Plains		
	6. Nature of Soil (sandy, clayey, silty loam etc. with permeability in cm/sec)	Sandy Loam to Clayey		
	7. Permeability (cm/sec)	Not Available		
E.	Alternate sites considered			
	Site-1:	Veppalodai site, near veppalodai Village, Tuticorin district, Tamilnadu		
	Site-2:	Kayalpattinam site, near Kayalpattinam village, Tuticorin		

	District, TN	
	Site-3: Ottapidaram & Sillanattam village, Ottapidaram taluk, Tuticorin District, Tamilnadu	
F.	Reasons for selecting the proposed site on comparative evaluation on environmental consideration.	Pl refer Chapter -5, Para 5.2

II. Current land use age of the proposed project site Area (in hectares)		
A.	Notified Industrial Area/Estate	-
B.	Agricultural	-
1.	Irrigated	-
2.	Unirrigated	-
C.	Homestead	-
D.	Forest	-
E.	Grazing	-
F.	Fallow	-
G.	Mangroves	-
H.	Marshes	-
I.	Others (Please specify)	Private Land: 303.64ha
	Total	303.64 ha

III	Is the proposed site located in a low-lying area? If yes,	Yes (X)	No (✓)
A.	Level before filling (above MSL, in. metres)	31 m	
B.	Level after filling (above MSL in metres)	33 m (for main plant block and other required structures based upon the design engineering)	
	Quantity of Fill Material required (in cum.)	Excavation is only for foundations, water storage and ash pond	
	Source		
C.	Does the project involve land preparation/ reclamation ?	Yes (X)	No (✓)
	If yes provide details		

IV.	Please indicate area earmarked for each of the following	(in ha.)
	A. Plant Facilities	50.60
	B. Ash Disposal	40.48
	C. Storage (Fuel)	30.36
	D. Storage (Water)	10.12
	E. Storage (Hazardous Waste)	-
	F. Storage (Hazardous Chemicals)	-
	G. Storage (Others)	-
	H. Approach Road(s)	-
	I. Township/Colony	12.14
	J. Green Belt	64.77
	K. Others (Please specify) Coal handling plant, corridor for Raw water pipeline, Railway siding and land for the River water intake pump house	95.13
	Total	303.64

V. Proximity to sea/water bodies :		
	Sea	Other Water bodies like River/ creek/ lake etc. (Please specify)
Distance of site* boundary (in m)	Bay of Bengal – 11.0 km – E	Malattar - 12.3 km- NNE Kallar- 13.2 km- ENE Korampallam - 14.0 km- SSE
Distance of plant facilities (in m)	Bay of Bengal – 11.3 km – E	Malattar - 12.4 km- NNE Kallar- 13.3 km- ENE Korampallam - 14.2 km- SSE

* **From highest flood line/high tide line**

VI.	Whether any of the following exist within 7 km. of the periphery of the project site. If so, please indicate aerial distance and the name of the eco-system as given under the Table.			
S.No		Name	Area falling within 7 km periphery of project (ha.)	Aerial Distance (in km.)
1	National Park/Wildlife Sanctuary	-	-	-
2	Tiger Reserve/Elephant Reserve/Turtle Nesting ground	-	-	-
3	Core Zone of Biosphere Reserve	Chalikulam RF	1199	5.5 km
4	Habitat for migratory birds	-	-	-

5	Lakes/Reservoir/Dams	-	-	-
6	Stream/Rivers	Malattar River Kallar River Korampallam River Bay of Bengal	1567	12.3 km-NNE 13.2 km-ENE 14.0 km-SSE 11.0 km - E
7	Estuary/Sea	-	-	-
8	Mangroves	-	-	-
9	Mountains/Hills	-	-	-
10	Notified Archaeological sites	-	-	-
11	Any other Archaeological sites	-	-	-
12	Industries/Thermal Power Plants	1. M/s. Sesa Sterlite Ltd, SIPCOT 2. M/s. Ind-Bharath Thermal Power Ltd, Saminathan. 3. M/s. V.V. Titanium Pigments Pvt Ltd, SIPCOT. 4. M/s. Sesa Sterlite Ltd (Power Plant), Meelavittan. 5. M/s. Ind-Bharath Power Gencom Ltd, Keelaarasadi. 6. M/s.	353	Within 10 km

		Kalpaga Chemicals Ltd, Silanatha m.		
13	Defence Installation	-	-	-
14	Airports	-	-	-

If located within limits of municipal bodies, please confirm. - NA

From National/ State Highways and railway lines, distance of 0.5 km should be maintained.

If located in the landing funnel of the airport, clearance from Airports Authority of India should be obtained. –

VII.	Description of the flora/vegetation within 7 km under following headings.		
A.	Agricultural crops :	Pl refer Chapter – 3 para 3.5.4.2	
B.	Commercial crops :		
C.	Plantation :		
D.	Natural Vegetation/Forest Type :		
E.	Grass Lands :		
F.	Endangered species :		
G.	Endemic species :		
H.	Others (Please Specify) :		
*There are no endangered species within 7-km radius			
VIII.	Description of fauna (non-domesticated) within 7 km under the following headings		
A.	Total listing of faunal elements	Pl refer Chapter – 3 Para 3.5.9.1	
B.	Endemic fauna species		
C.	Endangered species		
D.	Migratory species		
E.	Route of migratory species of birds and mammals		
F.	Details of aquatic fauna (if applicable)		
*There are no endangered species within 7-km radius			

IX.	Meteorological Parameters	
A.	Seasonal – Monitoring Data (continuous monitoring for one full season except monsoon should be carried out)	
1.	Temperature (in °C)	
	(a) Maximum	41.4
	(b) Minimum	14.8
	(c) Mean	38.6°C
2.	Rain fall (in mm)	
	(a) Maximum	-
	(b) Minimum	-

	(c) Mean	-
3.	Mean value of humidity (in %)	59 %
4.	Inversion occurrence :	Data Not available
	(a) in percentage	
	(b) Height in meters	
5	Seasonal Wind-rose pattern (16 points on compass scale)	Pl refer Chapter – 3 Fig – 3.1 and 3.2

B.	Hourly Mean Meteorological data (based on one full season data collected at site required as input for air quality modelling)					
Hour	Low/Medium Cloud amount (in OCTAS)	Wind Speed in (Kmph)	Predominant wind direction	Ambient air temperature (in deg K)	Hourly stability	Mixing depth (in m)
1.						
2.						
3.	Pl Refer Pl refer Chapter – 4 Annexure- 4 A					
.....						
.....						
23.						
24.						
Attach additional sheet as required						

X.	Ambient Air Quality Data [Frequency of Monitoring should be as per guidelines of CPCB and monitoring should cover one full season (excluding monsoon)]				
A.	Season and period for which monitoring has been carried out:			May - July 2015	
B.	Frequency of sampling:			2 samples per week per location	
C.	Number of samples collected at each side				
	Date, Time & Location	Wind direction & Speed	24 hourly Concentration as monitored (in µg/m3.) SPM, RPM, SO₂,NO_x.CO	Permissible Standard(As per EPA/SPCB consent)	Remarks (Name of the instrument and sensitivity)
<i>Pl Refer Pl refer Chapter - Annexure- 3 A</i>					
D.	24 hourly concentrations (in µg/m3)				
	Pollutant(s)	Maximum	Minimum	Mean	98%
	SPM	<i>Pl Refer Pl refer Chapter – 3 Annexure- 3 A</i>			
	RPM				
	SO₂				

	NOX	
	CO	
E.	Specific air pollution issues in the project area. :	None

XI. Water Requirements (cum/day)						
	Purpose	Avg. Demand	Peak Demand	Source	Type Treated / untreated/Fresh /Recycled	Remarks
A. Project						
1.	Process					
2.	Cooling water					
3.	DM water					
4.	Dust suppression					
5.	Drinking					
6.	Green Belt					
7.	Fire Service					
8.	Others (pl. specify)					
B. Township						
1.	Green Belt					
2.	Drinking					
3.	Others (pl. specify)					
C. Total						

**Pl Refer
Chapter – 4 Para -4.2.3
Figure -4.7**

XII. Source of Raw Water Supply				
	S.No	Source	Cu.m./hr	Cu.m./day
	1	Sea	--	--
	2	River	-	-
	3	Groundwater	--	--
	4	Other surface water bodies (Please specify)	260 Supply from South Ganga Water Technologies Private Limited, Tuticorin	6240

XIII.	Lean Season flow in case of surface water source (cusecs/cumecs) :	Not Available
XIV.	Groundwater	No ground water

		will be drawn for the project
A.	Recharge Rate	-
B.	Withdrawal rate	-
C.	Ground water level (metres)	-
1.	Premonsoon	-
2.	Postmonsoon	-

XV. Competing Users of the Water Source							None.	
	S.No	Usage	Present Consumption (cu.m./day)		Addition Proposed as per local plan (cu.m./day)		Total (cu.m./day)	
			Surface	Ground	Surface	Ground	Surface	Ground
	1	Irrigation						
	2	Industry						
	3	Drinking		Desalinated water Supply from South Ganga Water Technologies Private Limited, Tuticorin				
	4	Others (Please specify)						
		Total						

XVI.	Physico chemical analysis of Raw Water at intake point		
	Desalinated water will be used		
XVII.	Physico chemical analysis of treated water to be used in project/township.		
	Not Applicable		
XVIII.	Waste Water Management		
A.	Description of waste water treatment plant with flow chart		
	1.	Coal storage	<i>Pl Refer Chapter - 4 Para - 4.2.3 Figure -4.7</i>
	2.	Other than coal storage	
B.	Composition/characteristics of discharge stream(s) before and after treatment		
	S.No	Item	Characteristics
			Before treatment After treatment
	1		Treated wastewater will meet onland discharge standards of GSR 422 (E)
	2		
C.	Daily discharge (cu.m./day) from different sources		

	1	Cooling	Pl Refer Chapter – 4 Para – 4.2.3.3 Figure – 4.7
	2	Processing	
	3	D.M. Plant effluent	
	4	Domestic	
	5	Others (specify) Service water Seal water	
	6	Total	
D.	Quantity of water recycled		
	1	(in %)	16.6 % (reuse)
	2.	(in cu.m/day)	1042
E.	Details of recycling mechanism		Pl Refer Chapter -4 . Para – 4.2.3.3 Figure -4.7

F.	Mode of final discharge/disposal of treated effluent :		
	S. No.	Mode	Length (in m.) Quantity (in cum/day)
	1	Open Channel	- -
	2	Pipeline	- -
	3	Others (Please specify)	No treated wastewater will be discharged outside the plant except during monsoon
	Total		
G	Point of final discharge:		
	S.No	Final Point	Quantity (in cu.m/day)
	1	Green belt within the plant/township	321.6
	2	Agricultural land	--
	3	Fallow Land	--
	4	Forest Land	--
	5	River/Stream	--
	6	Lake	--
	7	Estuary	--
	8	Sea	--
		Total**	321.6

** The balance quantity (720 m³/day) is recycled and reused for dust suppression and Ash handling.

H.	Lean season flow rate in case of discharge in a river/stream (cusecs/cumecs)	
	1. Human	Not Applicable
	2. Irrigation	

	3. Industry		
	4. Others (pl. specify)		
I	Analysis of river water 100 metres upstream of discharge point and 100 metres downstream of discharge point (except in rainy/monsoon season) along with details of aquatic life.	Not Applicable	
J	What is the predicted impact on water quality of the receiving body due to discharge? (Briefly state the prediction tool adopted) :	Not Applicable, since no discharge is envisaged.	
XIX.	Quantity of fly ash/residue produced per day (tonnes)	Dry	Wet
A.	Fly Ash	4848	-
B.	Bottom Ash	1212	-
C.	Others, pl. specify	-	-
	Total :	6060	-

XX.	Solid Waste Management			
A.	Details	Source	Qty(TP M)	Form
1.	Raw water treatment Plant	-	-	-
2.	ETP	-	-	-
3.	Process	Boilers	181800	ash
4.	Others (pl. specify)	STP	20.52 (approx.)	Sludge
B.	If waste(s) contain any hazardous/toxic substance/ radioactive materials or heavy metals, provide data and proposed precautionary measures. :	Hazardous Waste will be stored in a destined area		
C.	What are the possibilities of recovery and recycling of wastes?	Will be Disposed to Authorised Vendors		
D	Possible users of Solid Waste (s).	Ash will be disposed to Cement Industry Exporting of flyash will be explored		
XXI.	Method of disposal of solid waste (s)			
	Method	Qty(TPM)		
A.	Landfill	Utilization of Fly Ash as per the directive of MoEF will be done The unutilized ash comprising fly ash and bottom ash will be disposed to the ash dyke proposed in an area of 100 acres of land. The dyke will be initial height of 5 Meters and		
B.	Incineration			
C.	Recovery			
D.	Downstream users			

		extension of height will be done using fly ash from the plant	
XXII.	Please indicate the methods used for handling ash		
	A. Collection	Flyash - Dry form Bottom ash - wet form	
	B. Transport	Flyash - Closed tanker to designated users Bottom ash - to ash pond through pipeline	
	C. Disposal	Flyash -To designated users Unutilized ash - to ash pond	
XXIII	Utilization of ash (tonnes per day)		
A.	Proposed use	My Home Industries Limited - 0.35 MTPA (958 t/day) as on today and 0.7 MTPA (1917 t/day) by 2018. The Ramco Cements Limited - 0.50 MTPA (1370 t/day).	
	1. Bricks		
	2. Cement		
	3. Road construction		
	4. Landfill		
	5. Soil amendment		
	6. Others (Pl. specify)		
B.	In case of landfill		
1.	Is solid amenable for landfill?	Yes (✓) - ash pond	No
2.	Dimensions of landfill	100 acres	
3.	Life of landfill (Years)		
4.	Proposed precautionary and mitigation measures along with design Features.	Suitable impervious lining will be provided for ash pond based on Geo - technical investigations	
C.	Indicate the phased programme for utilization of fly ash. (Number of years for full utilization, area etc.)	Enclosed as Exhibit-1	

XXIV.	Noise Pollution Control and Management		
A.	Source	Coal Crusher, Turbine Units, Boilers, Cooling Towers, Air Compressors and Transformers	
1.	Level at Source (dB)	<100 dB(A)	
2.	Level at project boundary (dB)	<75 dB(A)	
B.	Abatement measures (give source-wise details)	<ul style="list-style-type: none"> ➤ The use of complete or partial enclosures ➤ Introduction of control and monitoring rooms having good sound insulation properties for the benefit of operators ➤ The use of vibration insulation techniques 	

		<ul style="list-style-type: none"> ➤ Proper plantation of trees depending on the wind velocity can reduce noise pollution on the surrounding area ➤ Providing ear muffs and ear plugs to the plant personnel
--	--	--

XXV.	Fuel Requirements					
A.	Details of Fuel used					
S. No	Fuel	Daily Consumption (TPD)		Calorific value (Kcals/kg)	% Ash	% Sulphur
		Existing	Proposed			
1	Gas	-	-	-	-	-
2	Naphtha	-	-	-	-	-
3	HSD	-	-	-	-	-
4	Fuel Oil			-	-	-
5	Coal	-	19000 (max)		31.06	0.5
6	Lignite	-	-	-	-	-
7	Other (please specify)	-	-	-	-	-
B.	Source of Fuel (Distance in km)					
1.	Port	-				
2.	Mine	Indigenous and imported				
3.	Refinery	-				
4.	Storage depot/Terminal	-				
C.	Mode of Transportation of fuel to site					
1.	Trucks (numbers/day)	-				
2.	Pipeline(length in km.)	-				
3.	Railway Wagons (numbers/day)	5.5 rakes/day (say 6)				

XXVI.	Coal handling and dust suppression		
	Give details of dust suppression/collection equipment for reducing pollution from coal fines and other fugitive emissions from coal handling		
A.	Wagon tipping	For control of fugitive dust, water spray arrangement will be provided to spray water all-round the coal stockpiles to suppress the dust and to wet the coal while compacting to minimize the dust nuisance. A closed conveyor system will be implemented to minimize the dust nuisance. All transfer points will be provided with bag filters.	
B.	Conveyer transfer points		
C.	Storage		
D.	Crushing mills		
E.	Bunker filling		
F.	Other (pl. specify)		

XXVII.	Emissions and Stack details			
A.	Flue gas characteristics(SPM, SO₂, NO_x)			
S.NO.	POLLUTANT	SOURCE OF EMISSION *	Emission rate kg/hr	Concentration in flue gas (g/m³)
1	SPM	Boiler	Flue-1: 171 Flue-2:171	0.050
2	RPM		-	-
3	SO ₂		Flue-1: 3250 Flue-2: 3250	1.81
4	Nox		Flue-1: 2300 Flue-2: 2300	0.650
	*one stack comprises of two flues			
B.	Size distribution of SPM at the top of the stack			
	S.No	Range	% by weight	
	1	Micron	Not Available	
	2	1-10 Micron		
	3	10-20 Micron		
	4	<20 Micron		

C. Stack emission details									
- Frequency of stack emission monitoring as per CPCB guidelines									
- Emission rate for each pollutant (kg/hr)									
S. No.	Stack Attached to (Boiler)	Stack Height (m)	Stack Internal diameter (m)	Temp. of exhaust gases (degK)	Exit Velocity (m/sec)	SPM	SO ₂	NOX	Heat emission rate (in k.cal/h)

		*							our)
One common stack with bi-flues									
1	Flue -1	275	7.0	413	25	171	3250	2300	-
2	Flue-2	275	7.0	413	25	171	3250	2300	-
*One stack comprises of two flues									
Equipment used for stack monitoring should be indicated.					It is proposed to implement Continuous Emission Monitoring System for monitoring PM, SO ₂ , NO _x				

XXVIII. Predicted impact on air quality (as per CPCB Guidelines for conducting the air quality modelling) ($\mu\text{g}/\text{m}^3$)									
	PM10	SO ₂					NO _x		
Baseline	44.5	10.4					11.9		
Predicted GLC	1.32	29.0					20.2		
Overall Scenario	45.82	39.4					32.1		
NAAQ Standards	100	80					80		
XXIX. Storage of chemicals (inflammable/explosive/hazardous/toxic substances)									
S.No	Name	Number of Storages	Capacity (TPD)	Physical and Chemical Composition	Consumption (in TPD)	Maximum Quantity of storage at any point of time	Source of Supply	Means of transportation	
1	LDO	1	500		Only for startup operations		Nearby oil depot	Tankers	
2	HFO	2	1000					Tankers	
3	Hydrogen	1	35 X 6.5m ³ /cylinder	Flammable, Colourless, Odourless	28 m ³	230 m ³			

XXX. Occupational Health and Industrial Hygiene.		
A.	What are the major occupational health and safety hazards anticipated. (Explain briefly).	No fire hazards are expected in the plant due to handling of any fuel oils. However, the fire hazards due to handling of coal will be taken care by adequate sprinkling of Water and proper stacking methods.
B.	What provisions have been made/propose to be made to conform to health/safety requirements. (Explain briefly).	<ul style="list-style-type: none"> ➤ Regular medical checkup for all employees. ➤ 24 HR Medical Aid Room with qualified Para-medical staff and fully equipped Ambulance will be made available at site.

		<p>➤ Measures will be taken to provide timely medical help and treatment in case of medical emergency.</p>
C.	Details of personal protective equipment provided/to be provided to the workers.	Provision of ear plugs / ear muffs and all other safety equipment like hard hats, shoes, overalls, nose masks to plant personnel. Plant personnel will be trained in safe operation and maintenance of the power plant.
D.	Details of proposed measures for control of fugitive emission/odour nuisance from different sources.	Water spray arrangement will be provided to spray water all round the coal stockpiles to suppress the dust and to wet the coal while compacting to minimize the dust nuisance. A closed conveyor system will be implemented to minimize the dust nuisance.
E.	Details of fire protection and safety measures envisaged to take care of fire and explosion hazards.	<p>It is proposed to provide a full fledged fire protection system namely hydrant system for all the areas of the power plant, high velocity water spray system for transformer, turbine lube oil tanks, medium velocity spray system for cable vault/gallery and portable fire extinguishers for all the buildings of the plant.</p> <p>The source of water will be from the fire water storage tanks of adequate capacity. This water is utilized incase of fire within the plant. Therefore this requirement is not a consumptive requirement on daily basis.</p>
XXXI.	Green Belt Plan	
A.	Total area of project / township (in ha.)	303.64
B.	Area already afforested (for existing projects), in ha.	Not Applicable
C.	Area proposed to be afforested (in ha.)	64.77
D.	Plant species proposed	The list of species proposed for greenbelt development will be as per CPCB guidelines.
E.	Width of green belt (minimum, in metres)	
	1. Along plant boundary	50-100 m
	2. Roads and avenues within the	1 – 2 m

	plant	
	3. Ash Dyke	50
	4. Township	50
	5. Other-ornamental, garden spaces, Commercial plantations etc.	25 – 50 m
F.	Trees planted & proposed	
1.	Planted	Not Applicable
2.	Proposed	95994 in 64.77 ha
3.	List of species planted	The list of species proposed for greenbelt development will be as per CPCB guidelines.

XXXII.	Construction Phase	
A.	Estimated duration of construction in months	Unit-1: 40 Months Unit-2: 44 Months
B.	Number of persons to be employed for construction – 2,000	
1.	Peak	1,000
2.	Average	1,500
C.	What provision has been made for the sewage treatment for the construction workers?	Temporary sanitation will be provided for the construction workers. Septic tank and soak pit will be provided.
D.	How the fuel (kerosene/wood, etc.) requirement of labour force will be met to avoid cutting of trees from the adjoining areas	The contractor will be asked to supply cooking fuel like kerosene to the construction labour .
E.	Proposed Health care Measures with emphasis on protection from endemic diseases.	Health and safety officer will oversee the health and safety aspects of the labor camp
F.	Educational and other social welfare measures proposed.	<i>Pl refer Chapter -8, para 8.4</i>

XXXIII.	Human Settlement		
	Aerial distance from the periphery of the site		
	Upto 500m from periphery	500m to 3000 m from the periphery	3000m to 7000m from the periphery
Population	1594	15690	317756
Number of Houses	424	4326	83961

Present Occupational Pattern	Agriculture Industrial working	Agriculture Industrial working Salt farming	Agriculture Industrial working Salt farming
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XXXIV.	Rehabilitation & Resettlement Plan (Wherever applicable)			
A.	Village(s) affected by the project:			
S. No.	Village (Tribal/Others)	Population	Occupation	Average Income per annum
1.		No habitations are existing on the proposed project site		
2.				
B.	Population to be displaced			
S.No	Name of Village	Population		
		Land oustees only	Homestead Ousteers only	Land and Homestead oustees
1	Sillanatham	71	0	71
2.	Ottapidaram	200	0	200
	Total	271	0	271
C.	Salient features of Rehabilitation Plan for oustees			
1.	Site where the people are proposed to be resettled	Land is acquired based on mutual consent of land owners and KUTPPL		
2.	Facilities proposed at the resettlement site			
3.	Compensation package			
4.	Agency/Authority responsible for their resettlement.			

XXXV.	Pollution Control Aspects		
A.	Details of Pollution Control Systems :		
S. No	Control system for	Existing	Proposed to be installed
1	Air	-	ESPs for boilers
2	Water	-	ETP for raw water treatment STP for domestic wastewater
3	Noise	-	<ul style="list-style-type: none"> ➤ Equipment design for noise levels not exceeding 90 dB(A). ➤ Encasement of noise generating sources ➤ Acoustic enclosures for steam turbines ➤ Closed buildings for

			<p>steam turbines</p> <ul style="list-style-type: none"> ➤ Ear muffs for plant personnel working near noise prone area. ➤ A scientifically designed 50 - 100 m wide greenbelt all along plant boundary. ➤ Introduction of control and monitoring rooms having good sound insulation properties for the benefit of operators. ➤ The use of vibration isolation techniques
4	Solid Waste	-	<ul style="list-style-type: none"> ➤ Solid waste generated from the plant is ash in the form of fly ash and bottom ash. ➤ Medium concentration slurry disposal has been envisaged for disposal of ash from the power plant and the land area for Ash Pond is computed accordingly. ➤ Progressive utilization of Fly ash as per the directive of MoEF has been taken into account while computing the quantities.
B.	Efficiency of each pollution control equipment/system installed for the existing units		
S. No	Name of the System/ Equipment	Design Efficiency %	Present Working efficiency %
1	Electro Static Precipitator (ESP)	99.8 (outlet particulate emission - 50 mg/Nm ³)	Not applicable

XXXVI.	Expenditure on Environmental Measures (Rs. Lakhs)		
A.	Capital cost of the project (as proposed to approved by the funding agency/financial institutions)	660000	
B.	Cost of environmental protection measures (Rs. Lakhs)	41800	
S. No		Recurring Cost per annum	
1	Air Pollution Control	Pl refer chapter -6 Para 6.2	
2	Water Pollution Control		
3	Noise Pollution Control		
4	Environment Monitoring and Management		
5	Reclamation borrow/mined area		
6	Occupational Health		
7	Green Belt		
8	Others (Pl. Specify)		
	Total		
C.	Details of organizational set up/cell for environmental management and monitoring.	Pl refer Chapter - 10 Para 10.1	
D.	Details of community welfare/peripheral development programmes envisaged/being undertaken by the project proponent :	Pl refer Chapter - 8 Para 8.2	
XXXVII.	Public Hearing details :		
	Date of Advertisement	20 th February, 2014 25 th March, 2014	
	Newspapers in which the advertisement appeared (with copies)	Dinamani Indian Express	
	Date of Hearing	24.7.2014	
	Panel Present	Pl refer Chapter - 7 Annexure - 7 A	
	List of public present along with address and occupation		
	Summary/details of public hearing report		
S. No	Issues raised	Recommendation of panel	Response of Project Proponents
1	Pl refer Chapter - 7 Annexure - 7 A		
2			
3			

The data and information given in this Performa are true to the best of my knowledge and belief

Date:

Ch. Rama Krishna 5/10/2015

Signature of the Applicant with
Full name & address.

Mr. Ch. Ramakrishna
Vice President – Project Development
KU THERMAL POWER PRIVATE LTD
Block C, Ground floor,
Stemwood Apts NO.14 Factory Road,
Adj to Safdarjung Hospital
New Delhi

Place:
applicant

Given under the seal of organisation
on behalf of whom the
is signing.



LIST OF DOCUMENTS TO BE ATTACHED WITH THE QUESTIONNAIRE

Thermal Power Sector

S.No	Documents to be attached	
1	Topographic map of the site indicating contours (1:25000 scale).	<i>Revised EIA Fig – 1.5</i>
2	Topographic map covering 7kms radius from the periphery of the site indicating main features.	<i>Revised EIA Fig – 1.5</i>
3	Wind rose diagram of the site (Seasonal)	<i>Revised EIA Fig – 3.1</i>
4	Wind rose diagram of the site (Artificial)	<i>Not Available</i>
5	Site map indicating the positions of the ambient air quality monitoring stations vis-à-vis wind direction.	<i>Revised EIA Fig – 3.3</i>
6	Flow sheet of the process adopting indicating mass input/output brief description of the process including technological and engineering details.	<i>Revised EIA Fig – 2.2</i>
7	Alternative technologies considered along with details of criteria used for selecting the technology and result of evaluation.	<i>Revised EIA Chapter -5 Para – 5.1</i>
8	Approval of ground water board/irrigation departments/Municipality etc for supply of water.	<i>Not applicable</i>
9	Mass balance for water used by project in a flow chart.	<i>Revised EIA Fig – 4.7</i>
10	Flow chart for waste water treatment with mass balance.*	<i>Revised EIA Fig – 4.7</i>
11	Site map indicating solid waste disposal facilities.	<i>Revised EIA Fig – 2.1</i>
12	Lay out of the plant showing the position of stack for deciding the inter stack distance.	<i>Revised EIA Fig – 2.1</i>
13	Site map indicating the storage facilities.	<i>Revised EIA Fig – 2.1</i>
14	Approval of the controller of explosives for lay out and storage of hazardous substances.	<i>NOT APPLICABLE</i>
15	Lay out green belt indicating width on all sides, trees, lawns and bushes.	<i>Revised EIA Fig – 4.10</i>
16	Copy of advertisements issued in respect of public hearing.	<i>Revised EIA Annexure – 7 A</i>
17	No objection certificate from the pollution control board.	<i>Not Applicable</i>
18	In case of proposals for expansion copies of renewals of consent from SPCB/PCC.	<i>Not Applicable</i>
19	Copy of the application submitted to the state Government for forest clearance in case diversion of forestland is involved.	<i>Not Applicable</i>
20	Comments/Observation/Recommendation of chief wildlife warden in case wildlife habitat/migration path exists within 25 kilometres of the project site.	<i>Not Applicable</i>
21	Hydro-geological report in case ground water is to be used and/or the area is drought prone or the wastewater is likely to be discharged on land.	<i>Not Applicable</i>
22	Environmental audit report for the previous two years in case of expansion of the existing undertaking.	<i>Not Applicable</i>
23	In case the proposal involves installations in coastal zone, copy of the application forwarded by the State Government.	<i>Not Applicable</i>

EXHIBIT-1**ASH UTILISATION PROGRAMME (Values in MTPA)**

Year	Flyash			Bottom ash
	Generation	Utilisation	Disposal to ash pond	Generation and disposal to ash pond
1	1.5	0.85	0.65	0.3
2	1.5	1.2	0.3	0.3
3	1.5	1.5	0	0.3
4	1.5	1.5	0	0.3
5	1.5	1.5	0	0.3
6	1.5	1.5	0	0.3
7	1.5	1.5	0	0.3
8	1.5	1.5	0	0.3
9	1.5	1.5	0	0.3
10	1.5	1.5	0	0.3
11	1.5	1.5	0	0.3
12	1.5	1.5	0	0.3
13	1.5	1.5	0	0.3
14	1.5	1.5	0	0.3
15	1.5	1.5	0	0.3
16	1.5	1.5	0	0.3
17	1.5	1.5	0	0.3
18	1.5	1.5	0	0.3
19	1.5	1.5	0	0.3
20	1.5	1.5	0	0.3
21	1.5	1.5	0	0.3
22	1.5	1.5	0	0.3
23	1.5	1.5	0	0.3
24	1.5	1.5	0	0.3
25	1.5	1.5	0	0.3
Total to ash pond in million tonnes	37.5	36.55	0.95	7.5

Ash Utilization

- 1. My Home Industries Limited – 0.35 MTPA as on today and 0.7 MTPA by 2018.**
- 2. The Ramco Cements Limited – 0.50 MTPA.**
- 3. Export option from 3rd year onwards for 0.3 MTPA**