Prefeasibility Report

For the proposed
5x800 MW Super Critical Coal Based
Yadadri Thermal Power Station
at
Veerlapalem village, Damarcherla Tehsil,
Nalgonda District, Telangana

Project Proponent

Telangana State Power Generation Corporation Limited
A- Block, Vidyut Soudha, Khairatabad,
Hyderabad-82

Environmental Consultant

Bhagavathi Ana Labs Pvt Ltd
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Road No.3, Venkateshwara Hills,
Banjara Hills, Hyderabad-34

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1. EXECUTIVE SUMMARY

INTRODUCTION

Telangana State Power Generation Corporation Limited (TSGENCO) is one of the pivotal organizations of Telangana, engaged in the business of Power Generation. Apart from operation & maintenance of the power Station it has undertaken the execution of the ongoing & new power projects scheduled under capacity addition programme and is also taking up renovation & modernization works of the old power stations.

TSGENCO has been incorporated as per Companies Act-2013 on 19.05.2014 and commenced operations from 02.06.2014. This was a sequel to Government's reforms in power sector to un-bundle the activities relating to generation, transmission and distribution of power. All the Generating Stations owned by erstwhile APSEB in Telangana area were transferred under the control of TSGENCO.

The installed capacity of TSGENCO as on date is 4365.30 comprising of 2282.5 MW Thermal, 2081.80 MW Hydel and 1 MW from renewable energy sources thus contribute about 58% of the total energy requirement of Telangana. TSGENCO is the third largest power utility in the country.

The state of Telangana requires substantial addition to its power generating capacity to meet power demand of its rapidly growing industrial, agricultural and other sectors. Presently, the peak demand supply gap in the state of Telangana is amounting approximately to 2000 - 2700 MW. In view of the proposed Lift irrigation projects, Drinking water scheme declared by Government and due to various proposed projects, the gap between supply and demand escalates. To meet the progressive demand of about 8000 MW in the next few years apart from the increasing agricultural load, as detailed in the **Enclosure-IV**, establishing of new Thermal Power Units in next three years in necessitated.

The proposed site is mostly reserved forest, semi-agricultural and partly revenue land with isolated pockets of habitation. There are no historic places in the vicinity. The total area of extent for establishment of Power Station is 2800 Acres (Forest land is Ac. 2095.28 Gts, Patta Land, Government Land, Udfa patta Land and D-Patta Land etc is Ac. 704.12 Gts)

The Coal will be sourced from the Singareni Coal Collaries Ltd (SCCL) and imported coal and supporting fuel will be HFO/LDO from nearest refinery/oil depots. The coal will be transported to power station from coal mines through Indian Railways. The nearest port is Kakinada which is about 328 KM from the project site. The quantity of fuel requirement is given in table below

Fuel Requirement	Quantity	Source
50% Domestic coal + 50% Imported coal of GCV 4550 kcal/kg and heat rate 2109.4 kcal/kwh	1854.42 tph 13.81 mtpa	Domestic Coal from SCCL by rail and Imported Coal from Kakinada Port rail
100% Imported coal) of GCV 5700 kcal/kg and heat rate 2109.4 kcal/kwh	1480.28 tph 11.02 mtpa	Imported Coal from Kakinada Port rail
Support fuel (HFO/LDO) 0.5 ml/kwh	17520 KL/Year (Average)	Supported fuel sourced from nearby refinary/oil depots by rail tankers

The steam turbine generator will be single shaft, two / three cylinders, tandem compound, reheat, regenerative, condensing unit directly coupled to AC Generator giving a continuous output at generator terminal of 800, 000 KW at 22~27 KV.

Distributed Digital Control and Management Information System (DDCMIS) with integrated, CRT/Key Board operation for Steam Generator, Turbine, Generator and auxiliaries from Central Control room.

Two(2) twin flue and One(1) single flue chimney of 275 M high

In line with the MoEF guidelines for new Thermal Power Projects, it is proposed to adopt closed circuit cooling water system deploying cooling towers and draw only make up water requirement from the source.

The makeup and consumptive water requirement of 5x800 MW thermal power station is assessed as 12100 m3/Hr. the source of water is Krishna River is 3 km from proposed project site.

Ash utilization plan will be drawn as per MOEF guidelines. In the vicinity of the proposed power project, 22 cement plants are already set up at a radius of 10 Km. The ash generated by the proposed power project about 14280 TPD will be fully utilised for manufacture of Pozzolona cement and for other purposes.

Salient Features of the Project	
Type of proposed project	Establishment of 5x800 MW super critical Coal based Yadadri Power Station
Category of Project	Category A
S. No. in the schedule as per EIA notification, 2006	1 (d) Thermal Power Station
Project coordinates	16^0 40’ 19’’N, 79^0 35’ 18’’E 16^0 41’ 42’’N, 79^0 36’ 13’’E 16^0 42’ 38’’N, 79^0 35’ 46’’E 16^0 41’ 53’’N, 79^0 33’ 15’’E 16^0 40’ 41’’N, 79^0 33’ 54’’E
Elevation	72m to 93m above MSL
Area of land	Main Plant: 250 Acres BOP Area: 350 Acres Raw Water Reservoir: 100 Acres Coal Handling Plant: 250 Acres Ash Dyke Area: 700 Acres Green Belt Area: 1000 Acres Colony Area: 100 Acres Pipeline & Rly Corridor: 50 Acres **Total Area: 2800 Acres**
Accessibility	
Nearest Railway station	Vishnupuram (5 km)
Air Port	Hyderabad Airport (135 km)
Sea Port	Kakinada port (328 km)
Nearest habitation	Veerlapalem (1.0 km)
Nearest head quarter	Nalgonda(50 km)
Road to the project site	Site is approachable from Narketpally on NH 65 via Miryalaguda (80 KM) or via Addanki on SH 2 (100 KM). State Highway No. 2 connecting Hyderabad and Addanki.

Distance from highway	7 km
Environmental Sensitivity	
Water bodies	Krishna River about 3 km
Forest Area	Plant area falls under forest area and partly in patta lands. Forest Clearance is obtained vide **Lr. No. F.No. 8-07/2015-FC, dated: 7th July 2015.**
Sanctuaries / National Parks	None within the study area
Archaeological/ Historically Important Site	None within the study area
Seismic zone	Seismic Zone – III

2. INTRODUCTION OF THE PROJECT/ BACKGROUND INFORMATION

Identification of project and project proponent

Telangana State Power Generation Corporation Limited (TSGENCO) is one of the pivotal organisations of Telangana engaged in the business of Power Generation. TSGENCO has been incorporated under Companies Act-2013 on 19th May 2014 and commenced its operations from 2nd July 2014. All the generating stations owned by erstwhile APSEB & APGENCO were transfered to TSGENCO.

Telangana State Power Generation Corporation Limited (TSGENCO) is planning to set up a 5 x 800MW Super critical Coal fired Yadadri power Station at village Veerlapalem in Damarcherla Tehsil of Nalgonda district in Telangana to cater to the requirements of empowering Telangana state. The Site is located at about 20 km from Miryalaguda Town.

Project Proponent

The installed capacity of TSGENCO as on date is 4365.30 comprising of 2282.5 MW Thermal, 2081.80 MW Hydel and 1 MW from renewable energy sources thus contribute about 58% of the total energy requirement of Telangana. TSGENCO is the third largest power utility in the country.

Brief description of nature of the project

The state of Telangana requires substantial addition to its power generating capacity to meet power demand of its rapidly growing industrial, agricultural and other sectors. Presently, the peak demand supply gap in the state of Telangana is amounting approximately to 2000 -2700 MW. In view of the proposed Lift irrigation projects, Drinking water scheme declared by Government and due to various proposed projects, the gap between supply and demand escalates. To meet the progressive demand of about 8000 MW in the next few years apart from the increasing agricultural load, as detailed in the **Enclosure-IV**, establishing of new Thermal Power Units in next three years in necessitated.

The proposed site is mostly reserved forest, semi-agricultural and partly revenue land with isolated pockets of habitation. There are no historic places in the vicinity. The total area of extent for establishment of Power Station is 2800 Acres. Including 100 Acres for Colony.

The Coal will be sourced from the Singareni Coal Collaries Ltd (SCCL) and Imported coal supporting fuel will be HFO/LDO from nearest refinery/oil depots. The coal will be transported to power station from coal mines through Indian Railways. The nearest port is Kakinada which is about 328 KM from the project site from where imported coal will be received.

In line with the MOEF guidelines for new Thermal Power Projects, it is proposed to adopt closed circuit cooling water system deploying cooling towers and draw only make up water requirement from the source.
The makeup and consumptive water requirement of 5x800 MW thermal power station is assessed as 12100 m^3/Hr. The source of water is Krishna River is 3 km from proposed project site.

Need for the project and its importance to the country and or to region.

The State of Telangana requires substantial addition to its power generating capacity to meet power demand of its rapidly growing industrial, agricultural and other sectors. A number of projects, including Yadadri Thermal Power Station (5x800 MW), have been identified by TSGENCO for augmentation of generating capacity.

Demand-Supply Gap.
The state of Telangana requires substantial addition to its power generating capacity to meet power demand of its rapidly growing industrial, agricultural and other sectors. Presently, the peak demand supply gap in the state of Telangana is amounting approximately to 2000 -2700 MW. In view of the proposed Lift irrigation projects, Drinking water scheme declared by Government and due to various proposed projects, the gap between supply and demand escalates. To meet the progressive demand of about 8000 MW in the next few years apart from the increasing agricultural load, as detailed in the **Enclosure-IV**, establishing of new Thermal Power Units in next three years in necessitated.

Imports vs. Indigenous Production.
Since the Project is Power generation, only indigenous production envisaged. The proposed power Station will use the Indian coal and imported.

Export Possibility.
The proposed Project is not export to any foreign country. As it has been planned to operate as a IPP, the generated power will be connected to grid and further transmitted through state grid transmission lines to cater to the requirements of Telangana state only.

Domestic / Export Markets.
Power generated from the Project will be transmitted and used to cater telangana state.

Employment Generation (Direct and Indirect) due to the project
A manpower of 1200 is anticipated for operation, maintenance and general requirements of the power Station. Exact number and deployment of manpower shall be decided during detailed Engineering.

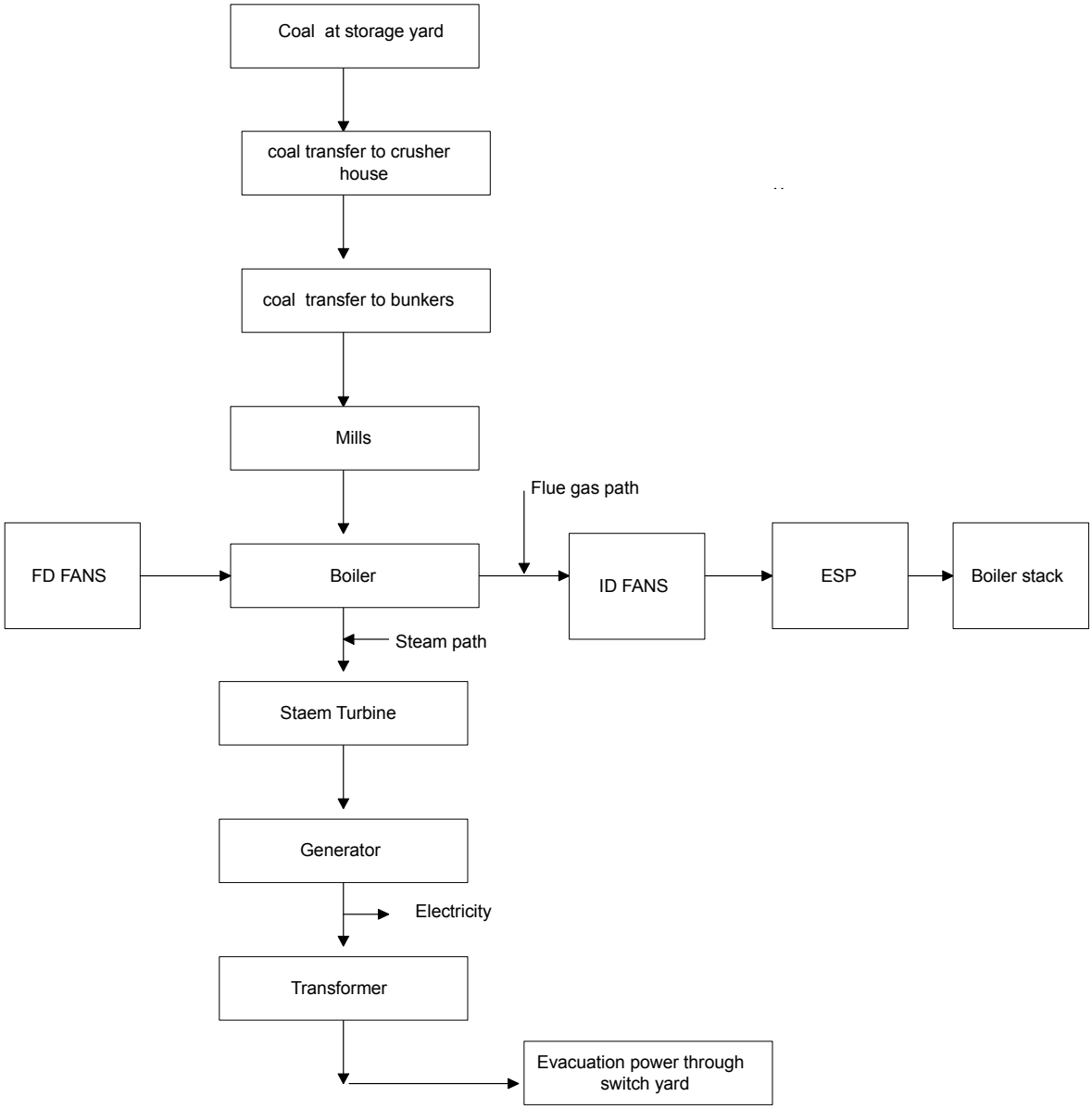
3. PROJECT DESCRIPTION

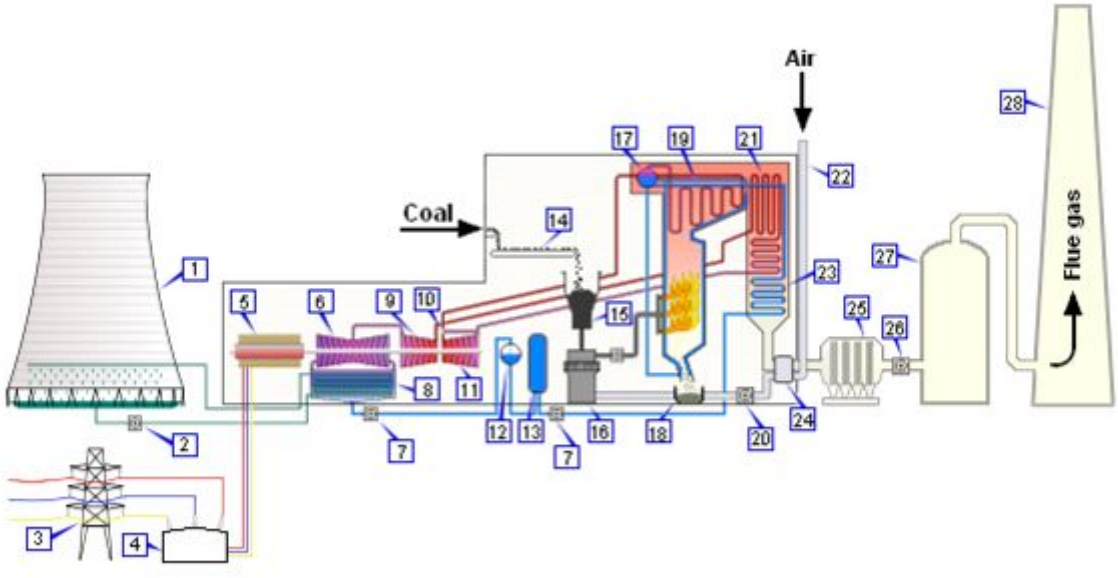
Type of project including interlinked and interdependent projects, if any.

Telangana State Power Generation Corporation Limited (TSGENCO) is planning to set up a 5 x 800MW Super critical Coal fired Yadadri power Station at Veerlapalem Village , Damercherla Tehsil , Nalgonda District, Telangana State to cater to the requirements of Telangana state. The Site is located at about 20 km from Miryalaguda Town.

The project is not interlinked with any other projects. Indegenious Coal will be sourced from SCCL and imported coal through kakinada port.

THERMAL POWER PLANT FLOW DIAGRAM





1. Cooling tower
2. Cooling water pump
3. transmission line (3-phase)
4. transformer (3-phase)
5. Electrical generator (3-phase)
6. Low pressure steam turbines
7. Condensate and FW pumps
8. Surface condenser
9. Intermediate PS turbine
10. Steam control valve
11. High pressure steam turbine
12. Deaerator
13. Feedwater heater
14. Coal conveyor
15. Coal hopper
16. Coal pulverizer
17. Steam drum
18. Bottom ash hopper
19. Superheater
20. Fan
21. Reheater
22. Combustion air intake
23. Economiser
24. Air preheater
25. Electrostatic precipitator
26. Fan
27. FGD
28. Flue gas stack

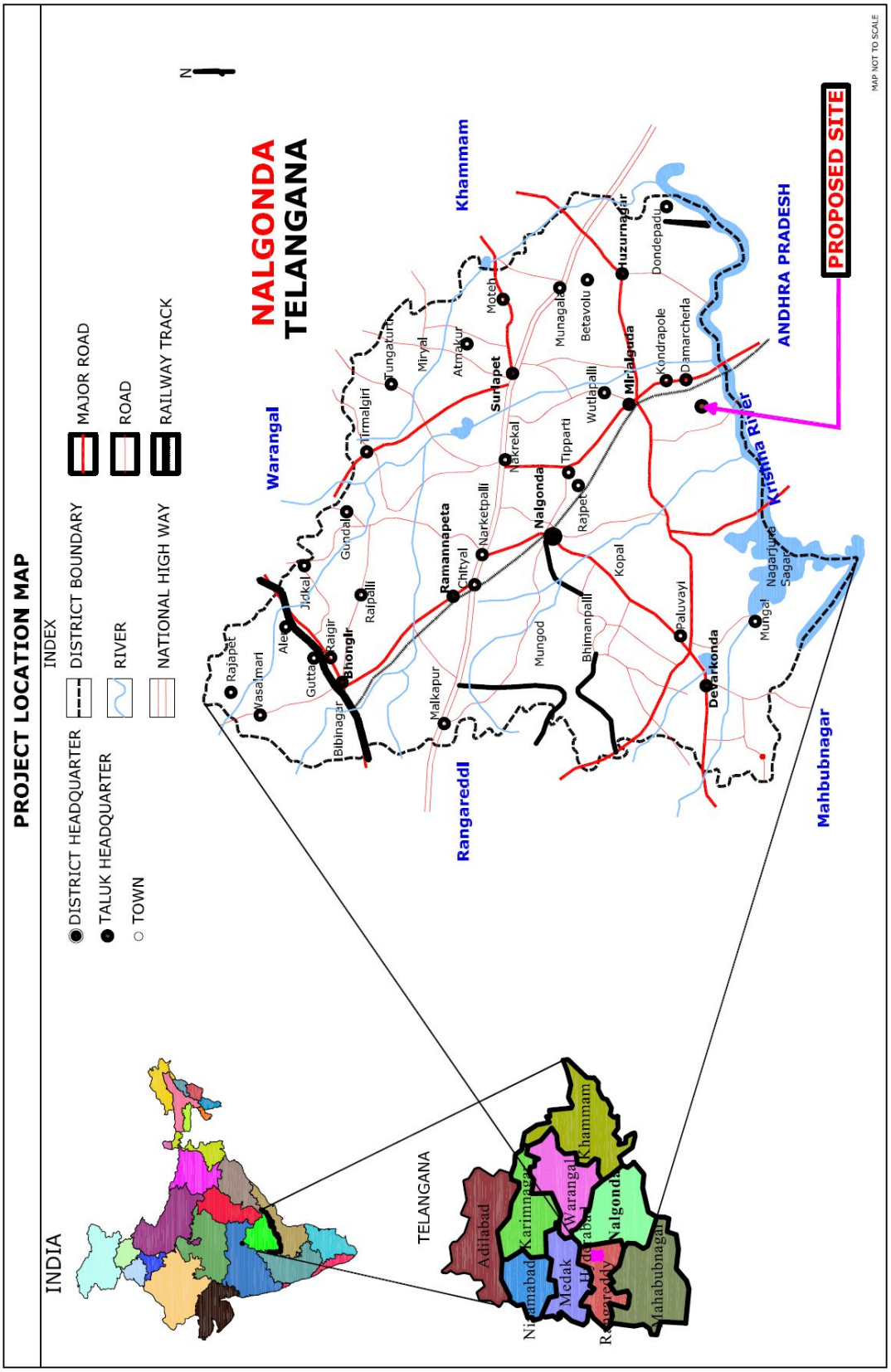
Location (map showing general location, specific location, and project boundary & project site layout)

This site is located near Veerlapalem village, Dameracherla Tahsil, Nalgonda district. Available land is approx. 2800 Acres for setting up the power project. This includes ash disposal area and colony for the thermal power project. The nearest town is Miryalaguda which is about 20 km from the site. The nearest railway station is Vishnupuram railway station which is 5 km from the plant. Nearest domestic and international airport is Hyderabad which is about 135 km away from project site. Water requirement for this project will be drawn from river Krishna.

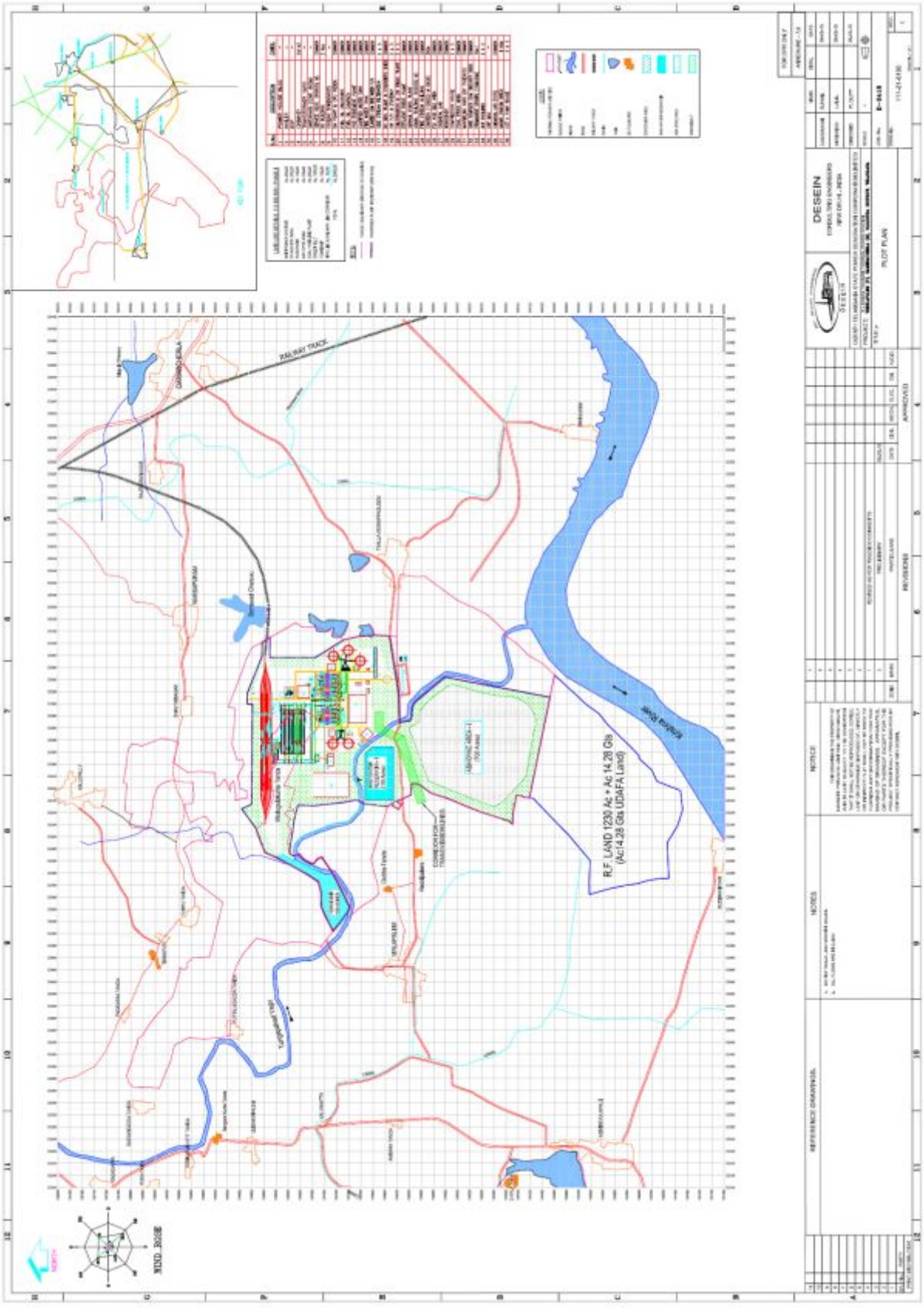
The coordinates of the site at Veerlapalem village are

16^0 40’ 19’’N, 79^0 35’ 18’’E
16^0 41’ 42’’N, 79^0 36’ 13’’E
16^0 42’ 38’’N, 79^0 35’ 46’’E
16^0 41’ 53’’N, 79^0 33’ 15’’E
16^0 40’ 41’’N, 79^0 33’ 54’’E

Project Location Map



Layout of the Proposed Power Station



Preliminary the elevation of project site is about 72m to 93m Meters above MSL. The Thungapahad stream is passing through plot area. On an average about 2 Meters of cutting / filling of the existing land shall be required to develop the land upto designed level. The land is mostly non-agricultural and uninhabited mostly reserved forest partly agricultural and partly revenue land with isolated pockets of habitation.

Site is approachable from Narketpally on NH 65 via Miryalaguda (80 KM) or via Addanki on SH 2 (100 KM). State Highway No. 2 connecting Hyderabad and Addanki which is about 7 Km from the project site. Approach to site is possible through the district road network. Transportation of heavy equipment from manufacturer's works to site shall be by road and by railway network.

A railway line is available between Secunderabad and Nadikudi Junction (on Secunderabad – Guntur BG line). The nearest railway station is Vishnupuram which is 5 km from project site. The rail line will be used for transportation of heavy equipment to the site in consultation with Indian Railways for permissible weight & height of consignments during construction period and subsequently for transportation of coal & fuel oil during operation & maintenance.

Details of alternate sites considered and the basis of selecting the proposed site
Alternative sites were examined and the coordinates of alternative sites are given below;

Site:1
This site is located in village punukulachilka of Kothagudem mandal, Khammam district. The land availability is 8800 acres. This land falls under Kinnarasani Wild Life Sanctuary and the area falls under eco-sensitive zone. Hence this site is not considered.

Coordinates: 17^0 44' 41.53"N 80^0 33' 44.84"E

Site:2
This site is located in Karukonda and Kunaram villages, Kothagudem mandal, Khammam district. The site is endowment land to an extent of 4916.33 Acres available with pattedar passbooks and presently under the possession of Amba Satram under the maintenance of Sree Seetha Ramchandra Swami vari Devasthanam, Bhadrachalam which was registered with endowment department Khammam district. A Writ Petition is pending in Honourable High Court and Honourable High Court has granted stay for all further proceedings in relation to the acquisition of lands belongings to the temples Hence this site is not considered. Acopy of Letter from District Collector is enclosed as **enclosure-I**

Coordinates: Block-I:	80^0 34' 52"N, 17^0 36' 31"E
	80^0 36' 08"N, 17^0 35' 28"E
	80^0 35' 04"N, 17^0 34' 57"E
	80^0 36' 47"N, 17^0 33' 57"E
	80^0 34' 50"N, 17^0 34' 16"E
	80^0 34' 45"N, 17^0 35' 03"E
	80^0 32' 18"N, 17^0 35' 05"E
	80^0 33' 55"N, 79^0 35' 32"E
Block-II:	80^0 32' 06"N, 17^0 34' 27"E
	80^0 33' 31"N, 17^0 33' 53"E
	80^0 32' 00"N, 17^0 32' 41"E
	80^0 30' 47"N, 17^0 32' 52"E
	80^0 30' 49"N, 17^0 30' 12"E
	80^0 31' 42"N, 17^0 33' 14"E

Site 3: Proposed Site Location
This site is located near Veerlapalem village, Dameracherla mandal, Nalgonda district. The land required for establishing 5x800 MW Power station in Veerlapalem is approximately 2800 Acres

The nearest town is Miryalaguda which is about 20 km from the site. The nearest railway station is Vishnupuram which is 5 km away from the plant. Nearest airport is Hyderabad which is about 135 km away from site. Water requirement for this project is planned to be drawn from Krishna river which is located at a distance of about 3 KM.

The Geographical Coordinates of the proposed plant site corners are;

16^0 40' 19''N, 79^0 35' 18''E
16^0 41' 42''N, 79^0 36' 13''E
16^0 42' 38''N, 79^0 35' 46''E
16^0 41' 53''N, 79^0 33' 15''E
16^0 40' 41''N, 79^0 33' 54''E

The reasons for site selection criteria
Based on the site selection team assessment, the **site-III** is preferable for implementation of the thermal power Station.

- The site-III is a government Forest Land
- Good road connectivity
- Rail connectivity
- There are no archaeological monuments near project site
- Availability of water source
- Availability of Land
- Existence of 22 Cement industries for utilization of Fly Ash

Based on the above points the site III, at Veerlapalem village is considered as proposed project site.

Raw material required along with estimated quantity & Storage details.

Fuel
The coal requirement for the proposed power project based on station heat rate of 2109.4 kcal/kwh, GCV of coal as 4550 kcal/kg and 85% PLF is estimated as 13.81 mtpa.

Imported coal and Indian coal will be blended in 50:50 ratio and will be fired in the steam generators. The source of coal will be as per coal linkage by the Ministry of Coal. For the purpose of this study, domestic coal and imported coal in 50:50 ratio is considered.

Primary Fuel (Coal)A
The coal will be transported to power station from coal mines through Indian Railways. The nearest port is Kakinada which is about 328 KM from the project site.

Secondary Fuel (HFO/LDO)
Secondary fuel LDO & HFO for start-up of boilers and to use as support fuel will be brought to site in railway tankers through Indian Railways.

Availability of Water
In line with the MOEF guidelines for new Thermal Power Projects, it is proposed to adopt closed circuit cooling water system deploying cooling towers and draw only make up water requirement from the source.

The makeup and consumptive water requirement of 5x800 MW thermal power station is assessed as 12100 m3/Hr. the source of water is Krishna River is 3 km from proposed project site. The water withdrawal permission letter from I & CAD vide G.O.Ms No. 13 dated: 30.01.2015 is for 6.60 TMC per year is enclosed with this report

Adoption of Supercritical Technology

The proposed 5 x 800 MW units will have super critical steam parameters to achieve higher efficiency and hence, lower cost of generation. Steam parameters of supercritical technology are as follow:

Pressure : 247 kg/cm² (a)
Main Steam Temperature : 565°C
Reheat Steam Temperature : 593°C

The main advantages of adopting higher unit size of 800 MW with supercritical parameters are brought out below:

i. From Plant Performance Point of View:

- ✓ Reduction in coal consumption.
- ✓ Reduction in ash generation.
- ✓ Reduction in effluent gasses to atmosphere.
- ✓ Reduction in suspended particulate matters to environment.
- ✓ Better performance during off-design operation due to variable “Evaporate End Point”.

ii. From Operation Point of View

- ✓ Better heat rate at full load as well as partial load.
- ✓ Lesser percentage of auxiliary consumption, hence increase in net power export.
- ✓ Lesser startup time and hence less consumption of startup fuel and power.
- ✓ Quicker load following capabilities i.e. better response to load rise / fall.
- ✓ Lesser consumption of cooling water.
- ✓ Boiler drum is eliminated hence no need of level control.
- ✓ More favourable for frequent start / stop even for two-shift operation.
- ✓ Lesser requirement of service like compressed air; water etc. because of reduction in number of units.

iii. From Plant Upkeep Point of View

- ✓ Lesser requirement of manpower for the operation & maintenance.
- ✓ Lesser number of equipments to maintain, hence lesser inventory.
- ✓ Increase in cost due to expensive materials to withstand higher pressure and temperature is off-set for reduction in size of balance of plant as well as number of units.

Super Critical Pressure power Station is envisaged in view of above indicated benefits.

TECHNICAL FEATURE OF THE BOILER & TG PLANT

General

The Super-critical technology is being adopted by number of Independent Power Producers & Utilities in India with 660 MW & 800 MW unit sizes.

Steam Generator, Design Considerations

Furnace Type

(i) Two Path / Tower Type

Furnace configuration is derived from each equipment manufacturer’s specialty. Two path types is

mainly adopted in Japan and tower type is typical in Europe.
No significant difference is observed in the applicability to kind of coal. It is because boiler design can be adjusted in accordance with coal characteristics such as abrasion of ash.

(ii) Spiral (plain/bare tube) Wall and Vertical (rifled/ribbed tube) Wall Type
The principal concern with a variable-pressure super critical-pressure design is the requirement for once-through operation. The mass flow in the furnace-wall tubes must be sufficiently high to avoid overheating or Departure from Nucleate Boiling (DNB) while generating steam at sub-critical pressures and to avoid excessive metal temperatures and uneven steam outlet temperatures when operating at super critical pressure at higher boiler loads.

To accomplish these objectives, the spiral-wall design is used for the unit. The principle of the spiral or helical-wall furnace is to increase the mass flow per tube by reducing the number of tubes needed to envelope the furnace without increasing the spacing between the tubes. This is done by arranging the tubes at an angle and spiraling them around the furnace. For instance, the number of tubes required to cover the furnace wall can be reduced to one half by putting the tubes at a 30 degree angle. The centerline spacing or pitch (P) is made the same as on a vertical wall to prevent fin overheating. Additionally, by spiraling around the furnace, every tube is part of all the walls, which means that each tube acts as a heat integrator around the four walls of the combustion chamber.

The spiral-wall concept thus addresses two major challenges of the full variable pressure super critical pressure boiler.

- Achieving the required mass flow to avoid overheating and excessive metal temperature by reducing the number of tube circuits.
- Minimizing difference in tube to tube heat absorption by exposing each tube to all four furnace walls.

Spiral-wall furnaces have been in operation in Europe and Japan for many years and have given satisfactory performance.

As an alternative to the spiral-wall design for larger-size steam generators, a certain manufacturers offer a tangentially fired unit with vertical walls consisting of rifled tubes for ease of fabrication, erection, and maintenance. A stable fireball is formed in the center of the furnace with tangential firing, with essentially equal distribution of the lateral heat absorption on all furnace walls. Unbalances are minimized and lateral heat-absorption patterns are predictable over the entire load range.

Rifled tubing is used in the furnace walls to avoid overheating or DNB at sub-critical pressures.

(iii) UP Type / Benson Type
UP type is applied to constant pressure once through boiler and Benson type is applied to variable pressure once through boiler. Variable pressure Benson type boiler is suitable to improve plant efficiency at partial load and flexible operability.

Startup System
In the case of UP type (constant pressure) boiler, it is necessary to keep the super critical pressure at boiler and the minimum water flow rate at water wall from the early stage of unit starting in order to prevent the water wall from tube burning-out, while the turbine needs low pressure superheated steam at starting. For these purposes, UP type boiler usually has flash tank drainage start up system and uses de-pressurized steam from flash tank for starting turbine. This start up system requires so-called ramping operation which means switching operation from starting system to main

system during load increasing operation, because this start up system capacity is only around 10% of turbine TMCR. This ramping operation is so complicated operation under the large different pressure that some valves are required with enough durability.

On the other hand, Benson type boiler can start from under the low pressure condition because Benson type boiler has availability of variable pressure operation owing to spiral structure of water wall tubes (or rifled tubes used for vertical water walls), and circulation system with Boiler Circulation Pump (BCP) can be applied to this type of boiler. This system can shorten the start up time and heat loss during start up period.

Description of Steam Generator

The steam generator will be supercritical, technology designed for firing coal as primary fuel, balanced draft furnace suitable for semi-outdoor installation. Boiler including auxiliaries will be designed for operation with 100% Imported coal and with a coal blending of imported coal and indigenous coal in the ratio of 50:50.

The steam generator will be capable of operating on sliding parameter. The load charge for sliding parameter will be from 40% SGMCR to 100% TGMCR. However, it will be possible to operate the steam generator with modified pressure sliding mode with constant pressure mode operating between 90% TGMCR to 100% SGMCR. Steam generator will be designed to meet the Indian Boiler Regulation (IBR) requirement. Wherever IBR is not specific, ASME or equivalent reputed international code will be used.

Steam and water system will essentially comprise of steam separator, separator storage tanks evaporator down comers, water walls, superheater, reheater, desuperheater, economizer, valves, fittings, piping, insulation, supporting hanger's instrumentation etc.

The furnace will be designed to withstand pressure regimes without permanent deformations and will be made of gas tight welded membrane walls design required for openings of wall blowers, observation ports, access doors and instruments.

The furnace walls will either be spiral wound and vertical tubes or vertical rifle tubes as per the manufacturer's design. The furnace will have hopper bottom with stainless steel seal plates suitable for connection to an ash hopper. A suitable sealing arrangement shall be provided for connecting to water impounded wet type bottom ash hopper.

The water / steam separators will be arranged at the evaporator outlet and will be so sized to ensure adequate steam separation. The water / steam mixture will be fed into the separators by connecting pipe work which will enter around the circumference at an inclined angle to ensure mixture moving spirally downwards and the water / steam separation is done by means of applied centrifugal force. The water will be led downwards to the collecting vessel and the steam escapes centrally upwards to the connections towards the first superheater stage.

The water received in the separators will be re-circulated to the economizer inlet via 1x100% startup water re-circulation pump. At higher loads the re-circulation pump will not be in operation and the entire flow from the evaporator is directed to the superheater. It will also be possible to start the steam generator without the re-circulation pump.

The superheater and reheater will be designed to maintain superheat and reheat steam temperatures at superheater and reheater outlet over the entire steam temperature control range.

The attemperators are to be of spray type fitted with an inner removable lining. RH temperature control is by means of damper control of the flue gases or gas recirculation.

The economizer will be of non-steaming and bare tube type. The tube banks will be of inline arrangement.

Coal Feeding and Burning System

Coal feeding and burning system will essentially comprise of gravimetric coal feeders, coal mills, coal pipes and coal burners.

For firing high ash content abrasive coal, medium speed vertical spindle of large capacity bowl mills will be provided having low power consumption; relatively high availability, low aintenance cost and fineness control. The mill size and numbers will be selected such that on an average two mills remain standby.

Considering the grinding fineness required, the mills will be equipped with rotating classifiers having speed adjustment to control grinding fineness. The firing system will employ latest “State of the Art” burners and will permit load variation from 40 to 100% BMCR without use of support fuel. The ratio of fuel and air flow will be controlled. Due to sufficient burner wall distance and the burner swirl direction, operation with low excess air will be possible without the risk of wall damage.

Tilting Tangential Firing system in which injection of fuel and air from wind box in the furnace corner is envisaged.

AUXILIARY BOILER

One number outdoor installation type, natural circulation, single / bi-drum, pressurized furnace, water tube Boiler suitable for firing LDO and having required steaming capacity but not less than 60 T/hr (Excluding steam requirement of Auxiliary Boiler) with operating steam parameters of 19 kg/sq.cm(g) pressure & 250 deg.C temperature at super-heater outlet. Output steam of the auxiliary boiler shall be connected to the low temperature station header.

Boiler and its supporting auxiliaries are capable to generate 110% MCR steaming capacity for half hour every shift of eight hours.

The steam temperature control range of Auxiliary boiler shall be from 60% to 100% load.

The design of Auxiliary Boiler shall meet (or exceed) all requirements of IBR. The Bidder shall be responsible to obtain necessary approval of Inspection Authority / Chief Inspector of Boiler on behalf of Customer as may be required for design & design calculation, manufacturing & erection procedures, testing etc as called for under IBR.

The auxiliary Boiler, including its interlock & protection system shall conform to NFPA – 85.

Steam Turbine and Auxiliaries

Steam Turbine Plant

The turbine component and its auxiliaries will be designed and selected to meet the stringent requirements in respect of superior thermal performance, excellent product reliability & operational flexibility.

The turbine will be designed based on modular design approach that divides the turbine into three main parts:

- High-pressure (HP) section
- Intermediate-pressure (IP) section and
- Low-pressure (LP) section

The turbine will have one single flow HP, one double flow IP and two double flow low-pressure cylinders exhausting downwards into condensers. All components will be selected based on long-proven records and standardized modules. The turbines will be of the tandem compound design. The individual shafts of the cylinders and the generator rotor shaft will be coupled rigidly together.

Gland Steam Sealing System

A fully automatic gland sealing steam supply system will be provided for the TG Set and the turbine drives of BFPs. HP & IP turbine shaft glands will be sealed to prevent escape of steam into the atmosphere and the LP turbine glands will be sealed for preventing leakage of atmospheric air into the turbine. Steam will be used for sealing these spring backed labyrinth glands.

During start-up and low loads (say 40% load), seal steam will be supplied to the turbine glands from the auxiliary steam header or cold reheat line through a seal steam regulating valve. During normal operation (above 40% load), the HP and IP turbines will be of self-sealing type and under that condition the auxiliary / CRH steam source will be cut off and the leak-off steam from HP and IP glands will be used for sealing the LP glands. The excess leak-off steam will be led to the condenser.

A gland steam condenser will be provided to condense and return to the cycle, all gland leaks off steam including that from BFP turbines. 2x100% capacity vapour exhausters will be provided to remove non-condensable gases from the gland steam condenser.

Electrostatic Precipitators

The high efficiency electrostatic precipitators having collection efficiency of 99.89% will limit the outlet dust emission to 50 mg/Nm3 at ESP outlet with all fields in service while the boiler is operating at its BMCR, firing worst coal having maximum ash content in coal.

For each unit, four electrostatic precipitators comprising of eight (8) bus sections in the direction of gas flow and two bus sections perpendicular to the gas flow will be provided. Electrostatic precipitators will be provided with microprocessor based programmable type rapper control system and ESP management system to ensure the safe and optimum operation of ESP. The dust collection hoppers at all strategic locations will have a minimum storage capacity of eight (8) hours.

Boiler Structures

Boiler and auxiliaries will be complete with necessary piping, valves and fittings. Supporting structural steel, stairways, platforms and walkways, hand rails complete, weather covering interconnecting platforms, buck stay and tie bars for boiler, refractory & insulation etc. will be provided.

Space provision for the FGD system to be installed in future (if required), will be kept behind the chimney as per environmental stipulation. The design and layout of steam generator and its auxiliaries will be such that a wet/dry flue gas desulphurisation system can be installed, taking suction from duct after ID fan and feeding the desulphurised flue gases back to the chimney with provision for bypassing the FGD system.

HP-LP Bypass Station

60% HP / LP Turbine bypass station will be provided to act not only as a protection to the turbine during pressure rise resulting from sudden load throw-off but also to enable operation of the unit at loads lower than the control load. Further, HP/LP bypass will permit quick, repeated hot starts of the unit on its tripping.

The LP bypass station will be connected to the hot reheat line and discharges the steam into the condenser. The hot reheat steam will be desuperheated by means of condensate injection. The

bypass system shall be in operation when the steam turbine is not able to receive the entire steam quantity, e.g. during start-up or in case of a load rejection.

Boiler Feed Pumps (BFP)

The unit will comprise of 2x50% turbine driven boiler feed pumps and 1x50 % electric motor driven boiler feed pump per unit with boiler feed booster pumps mounted on the common shaft. The boiler feed booster pump will be double volute casing, vertical split, casing type. The discharge line of the booster pump will be connected to suction boiler feed pump. Each boiler feed pump will be designed to give parameters to suit the steam generator requirements; such that motor driven feed pump will be used for start-up of unit and will also act as standby BFP. Turbine driven boiler feed pumps will be located at operating floor and the motor driven pump will be located on operating floor and both types will be accessible to turbine house EOT crane for erection and maintenance.

The feed pump will be able to handle feed water of pH. 8.5 to 9.5 and of temperature up to 1850C (tentative).

The boiler feed pumps will be of horizontal, centrifugal type. The boiler feed pumps outer casing will be of barrel type with end removal. The inner pump assembly comprising of shaft, impellers, stage casings will be capable of being removed and replaced as a unit without disturbing the feed piping. Each feed pump will be provided with ON-OFF / modulating type recirculation control valve to protect the pump under low flow condition. The boiler feed water system will be designed to operate primarily in an automatic mode over the range of system design loads. The arrangement will provide automatic start-up one of the standby motor driven feed pump under conditions like tripping of the running TDBFP's and/or discharge header pressure low etc.

The turbine of boiler feed pump will be of total controlled governing and consist of reaction stages. During stable / normal operation, steam sources for TDBFP will be from IP / LP crossover piping. Hydraulic coupling will be utilized to achieve speed control of motor driven feed pumps. Provisions will be made for warm up to standby pump, if required.

Typical Design Parameters of Steam Turbine

The data mentioned below is indicative and each supplier will offer data for the machine being offered:

Description	Unit	Parameter
Type	-	Tandem Compound
Number of cylinders	-	Four (4)
Type of governing	-	Digital electro hydraulic
Speed	RPM	3000
Rated output (continuous)	kW	800,000
Steam pressure before emergency stop valve HP	$Kg/cm^2(a)$	242
Steam temperature before emergency stop valve	^0C	565
Reheat steam inlet pressure	$Kg/cm^2(a)$	56
Reheat steam temperature	^0C	593
SH Steam flow required with 0% make-up and 0.098 ata back pressure	tph	2427
Reheat steam flow	tph	1995
Rated pressure at exhaust of LP turbine	kg (a)	0.1
Maximum temperature rise of circulating water	^0C	9

MECHANICAL SYSTEMS

Coal Transportation, Unloading Facilities and Handling Plant

a) The coal will be transported to power Station from coal mines through Indian Railways. The nearest port is Kakinada which is about 328 KM from the project site

b) The coal handling plant (CHP) will be designed to operate throughout the year with coal with average gross, calorific value of 4550 kcal/kg.

c) As per BHEL considering Gross Station Heat Rate of 2109.4 kcal/kwh, the coal requirement for the each unit works out at full load with GCV of coal as 4550 kcal/kg as:

i)	Tonnes per hour (tph)	$\frac{800 \times 2109.4}{4550} = 370.88$
ii)	Tonnes per day (tpd)	8901.20
iii)	Million tonnes per year at 85% PLF (mtpa)	2.76

COAL HANDLING PLANT

Two (2) independent CHPs are envisaged designated as CHP I & II. CHP-I caters to the fuel requirements for Unit-1/2 and CHP-II for Unit-3/4/5. Two (2) Wagon Tippler Complex# WTC-1A/1B (each with two (2) Crescent type Wagon Tipplers) are provided for CHP-I as well as for CHP-II. Track Hopper Complex # THC-1A & THC-1B are provided for CHP-I & CHP-II respectively. Suitable number of rail tracks appropriately interconnected with each other shall be laid ahead & prior to the track hoppers / wagon tipplers for handling / return of empty rakes. Necessary line side equipment and signaling arrangement for rake movement shall be provided.

Two (2) Wagon Tippler Complex are proposed so that stock building and rake unloading operations can be carried out expeditiously. Two (2) Track Hopper Complex are proposed so that during emergency situation, rakes with bottom discharge wagons can be unloaded in sufficient numbers.

CHP-I & CHP-II are interconnected so that coal can be transferred from CHP-I to CHP-II & vice versa. Each of CHP- I /II is composed of two (2) streams (1W + 1S) operating at guaranteed capacity of 2156 tph each. However, both streams of CHP-I /II shall be designed to operate simultaneously in case of emergency.

SYSTEM REQUIREMENTS

Following Tables describe the coal handling capacity requirements for above CHPs:

Table – 1: System Requirements

Sr. No.	Item Description	Symbol	Unit	Formula / ref	Value for CHP-I	Value for CHP-II
1	Installed, MW				2x800 [U-1/2]	3x800 [U-3/4/5]
2	No of Units	N	no.		2	3
3	Unit capacity	C_{p1}	MW	…	800	800
4	Total MW	C_t	MW	$C_t = N \times C_{p1}$	1600	2400
5	Fuel	-	-	…	Blended Coal	Blended Coal
6	Calorific value of above coal	C_{v1}	kcal/kg	…	4550	4550
7	Station heat rate for 1x800 MW	SHR_1	kcal/kwhr	…	2109.4	2109.4
8	Hrly coal consumption per unit	q_0	tph	$q_0=(C_{p1} \times SHR_1) \div (CV_1)$	370.88	370.88
9	Coal consumption per hour	q_1	tph	$q_1 = N \times q_0$	741.8	1112.7
10	Coal consumption per day	q_2	tpd	$q_2 = 24 \times q_1$	17802.4	26703.4
11	Operating Hrs/ day for one CHP stream	t_1	hr	----	14	14
12	Capacity of one CHP stream	C_0	Tph	$C_0 = q_2 \div t_1$	1271.6	1907.4
13	Hence, Capacity of one CHP stream with 10% Margin & post round off	C_1	tph	$C_1 \cong 1.1 \times C_0$	1400	2100
14	Capacity of one CHP Stream selected	C_2	tph	For standardization & interconnection of CHP-I & II	2156	2156
15	Hence operating hr. per CHP Stream	t_0	hr	$t_o = q_2 \div 2156$	~9 (<14)	~13 (<14)
16	Coal rake size i.e. no of wagon per rake	n_1	no	One coal rake has 58 no. of wagon	58	58
17	Pay load per wagon	q_1	tonne	q_1=77 tonne [Coal]	77	77
18	Coal qty per rake [=rake load]	q_d	tonne	$q_d = n_1 \times q_1$	4466	4466
19	No. of coal rakes to be unloaded per day (Round off)	n_2	no	$n_2 = q_2 \div q_d$	4	6
21	No. of coal rakes to be unloaded per day considering 2-rake for stock building	n_4	no	$n_4=n_3+2$	6	8

ASH HANDLING SYSTEM

Ash handling system of each unit will include bottom ash handling system, coarse ash system, wet fly ash handling system, dry fly ash handling system, ash disposal system and ash water recovery system. The ash handling system will be complete in all respects with mechanical, civil, structural, electrical, control and instrumentation systems.

Coal consumption at BMCR per unit - 370.88 TPH
Ash content in coal @ 32 %

(50% Indian + 50% Imported) per unit	- 119 TPH
Bottom ash hopper generated @ 25%	- 29.75 TPH
Ash generated in Eco hoppers @ 5 %	- 6 TPH
Ash generated in APH hoppers @ 5 %	- 6 TPH
Ash generated in Duct hoppers @ 5%	- 6 TPH
Fly ash in ESP hoppers @ 90 %	- 107.1 TPH

System Description

Ash formed due to combustion of pulverized coal in the steam generator will be collected either as bottom ash in the bottom ash hopper; coarse ash in economizer hoppers, air pre heater hoppers, duct hoppers and fly ash ESP hoppers.

Bottom ash of each unit will be collected in a W-shaped water impounded hopper and conveyed to ash slurry sump through jet pumps once in a shift of eight hours. The ash slurry will further be conveyed to ash disposal area by means of Ash disposal pumps.

Ash collected in the economizer hoppers of each unit will be extracted continuously by means of flushing apparatus located below each economizer hopper and conveyed to bottom ash hopper. The ash slurry collected in the bottom ash hopper will further be conveyed to the ash slurry sump along with bottom ash slurry for further disposal to ash disposal area.

Ash collected in the air pre heater and duct hoppers of each unit will be extracted intermittently by means of feeder ejectors located below each APH & Duct hoppers and conveyed to coarse ash tank. The slurry collected in the coarse ash tank will be conveyed to the ash slurry sump through jet pumps.

The fly ash collected in Electrostatic Precipitator hoppers of each unit will be extracted through vacuum and conveyed to buffer hoppers and thereafter to fly ash silos through pressure conveying system. Fly ash stored in fly ash silos will be disposed in dry form through closed trucks; in conditioned form in open trucks through ash conditioner. Alternatively fly ash will be extracted through vacuum conveyed to Collector tanks for wet fly ash slurry disposal to ash slurry sump through Collector tank, wetting head and ash slurry disposal system.

Bottom Ash Handling System

Bottom Ash System of each unit will consist of ‘W-shaped’ water impounded, storage type, water-cooled refractory lined bottom ash hopper located directly below the bottom water wall header of boiler. Bottom ash will be collected continuously from the boiler furnace. Bottom ash hopper will be designed for an effective storage capacity of 8 hours collection of bottom ash and coarse ash from Economizer hoppers generated during worst coal firing.

The bottom ash hopper will have the shape to ensure free flow of bottom ash. BA hopper of each unit will consists of two sections; each section of the hopper will have two outlets provided with two clinker grinders installed directly below the feed gate assembly to limit the size of clinkers to maximum 25 mm. Jet pumps will be provided below each clinker grinder for conveying the ash slurry to the ash slurry pump house for further transportation to ash disposal area. Out of two clinker

grinders and two jet pumps provided for each “V” section, one grinder and jet pump will operate while other will be standby.

Bottom Ash Hopper overflow will be routed through overflow seal box to Bottom Ash overflow sump for onward disposal to AHP clarifier for re-use. Two adequately sized BA Overflow pumps (1W+1S) will be provided for each unit to pump contents of BA overflow sump to ash slurry sump or to AHP clarifier. Seal trough overflow will also be led to the BA overflow sump.

Ash collected in Economizer hoppers will be automatically extracted and conveyed to the flushing apparatus located below each economizer hopper. Necessary vacuum/momentum required for extracting ash from the hoppers will be created by the flushing apparatus. The ash slurry thus produced will be routed to bottom ash hopper by gravity. The ash slurry collected continuously along with bottom ash slurry in the bottom ash hopper will be conveyed to the ash slurry sump by Jet pumps from clinker grinders.

PLANT WATER SYSTEM

Raw Water

Consumptive water requirement of five units of 800 MW will be made available by pumping from Krishna river to Plant Raw Water reservoir of capacity 10,17,500 m^3, which is sufficient for 3.5 days consumptive water requirement.

Water is required in a thermal power station for:

a) Cooling Tower make-up.
b) Auxiliary cooling water system - Water for bearing cooling and other auxiliary systems through closed loop circulation
c) Boiler make-up.
d) Potable water for plant/colony.
e) Plant services
f) Fire fighting
g) Ash handling

Composite Water Balance

The consumptive water requirement of 5 x 800 MW units is worked out as follows:

A.	DM Water Requirement	Unit	Quantity for 5 units
-	Make-up water in power cycle 2600 x 1.5% = 39 m^3/hr/unit	M^3/hr	195
-	DM CW make-up 2.0 m^3/hr/unit	M^3/hr	10.0
-	Stator Cooling make up 1.0 m^3/hr/unit	M^3/hr	5.0
-	Chemical dosing 1.0 m^3/hr/unit	M^3/hr	5.0
-	Condensate polishing unit regeneration for 5 units	M^3/hr	15.0
-	DM regeneration	M^3/hr	10.0
	Sub total	M^3/hr	240
	Hence four DM streams (3 operating + 1 standby) each of capacity 80 m^3/hr are considered.		
B.	**FILTERED water requirement**		
a.	Feed to DM plant including regeneration requirement	M^3/hr	240
b.	Potable water needs for plant & colony	M^3/hr	110
c.	Service water	M^3/hr	750
d.	Ultra / Micro filtration reject	M^3/hr	1200
e.	CW Makeup 1945 m^3/hr/unit	M^3/hr	9725
	Sub Total (B)	M^3/hr	12,025
	Raw water requirement	M^3/hr	12,100

In the initial year of the Plant, the water requirement may be varying from 11-12 cusecs depending upon the ash handling system i.e. wet disposal or dry disposal.

Pretreatment System

Raw water drawn from in plant water storage reservoir will be filtered through 40 (36W + 4S) 335 m3/hr capacity ultra / micro filtration units along with back wash arrangement. Chlorine will be dozed in raw water reservoir to avoid micro–biological growth. The filter water with SDI<3 and turbidity of 0.5 NTU will be stored in filter water storage of capacity 32,000 cu.m. The reject of ultra / micro filtration units will be transferred to CMB OR ASH HANDLING PLANT.

Filter Water System

Filter water will be distributed to various areas of the plant through dedicated pump sets as follows:

a) Four (4) – (3 working + 1 standby) 33% capacity & adequate head DM plant supply pump sets to supply water to 4 nos. (3 working + 1 standby) DM plant streams, each of capacity of 80 cu.m/hr.

b) Four (4) - (3 working + 1 standby) 33% capacity adequate head service water pumps to supply filter water to service water distribution network all over the plant building through an adequately sized overhead tank suitably located at a height in the Power Station.

c) Five (5) – (4 working + 1 standby) 25% capacity CW make up water pumps to supply make-up water to two(2) nos. CW sumps for loss towards evaporation & CW blow down losses.
d) Two (2) – (1 working + 1 standby) 100% capacity service water pumps to supply filter water to APH/ESP wash each of capacity 550 cu.m/hr.

Demineralization Plant

A fully automatic PLC based Demineralizing plant having four (4) (3W+1S) – 80 cu.m/hr capacity streams (3 normally operating) will be provided to have mixed bed outlet quality as follows:

Silica : < 10 ppb
pH : 6.8 – 7.2
Conductivity : ≤ 0.1 µS/cm
TOC : < 200 ppb

The filtered water will be pumped to DM plant through cation exchangers, degassifiers, anion exchangers and mixed beds all installed within the DM plant building. The DM water will be stored in five (5) – 1000 cu.m each capacity steel plate fabricated vertical cylindrical DM water storage tanks along with proper breathers and floating PVC balls arrangement to prevent absorption of atmospheric gases.

DM water from storage tank will be transported to five (5) nos. Condensate Storage Tanks (CST), DM water will be used for heat cycle makeup, chemical feed system, DMCW make up, etc. For this, purpose, two (2) numbers 100% capacity Hot well make up pumps for each units, will be provided. Two (2) 100% boiler fill pump sets common for 3 units & two (2) 100% boiler fill pumps sets common for 2 units will be provided, for filling of boiler, condenser and deaerator as per operational requirements.

Hydrogen Generation Plant

Requirement of the generator for hydrogen quality and make-up quantity, the parameter is as follows:

Quality - Purity > 99.9% (H2)
- Moisture < 4g/Nm3
- Dew Point ≤ -40°C

Quantity - $(C \times 1.5 \times A + B) / 10$ Nm3/hr.
30
C Number of TG units

A Nm3/hr Leakage rate per generator
B Nm3 Requirement of one generator filling

Three (3) (2Working + 1Standby) unit of hydrogen generation plant of 10 Nm3/hr., 3.2 MPa shall meet the requirement 5 x 800 MW Unit use.

The hydrogen shall be generated by the electrolysis of a suitable mixture of DM water & soda or Potash lye or Bipolar Proton Exchange Membrane.

Sewage Treatment Plant

The sanitary waste of all the toilets from the different buildings of the plant shall be collected by gravity into the respective collection chambers and shall lead to common collection sump under gravity flow as far as possible. However, if hydraulics do not permit gravity flow the intermittent collection sumps shall be provided with the lifting stations and such lifting stations shall be provided with 2 nos. (1W + 1S) of pumps.

The sewage treatment plant shall be designed as per guidelines of CPHEEO Manual. The anticipated no. of users shall be 4000 persons. The sewage treatment plant shall be designed to handle a flow of 180 Kld considering average per capita consumption of 45 lpcd with 80% of used water generated as sewage. The Sewage Treatment Plant shall be modular type based on FAB/MBBR technology followed by disinfection by Hypo and necessary tertiary treatment prior to reuse in horticulture purpose.

The finally treated sewage shall meet the norms of environment protection rules 1986 and its amendments and the rules of CPCB / MOEF/ State Pollution Control Board.

Fire Protection System

For protection against fire, all yard equipment and plant equipment will be protected by a combination of hydrant system; automatic sprinkler spray system (emulsifier system); fixed foam system for oil handling areas; automatic high velocity and medium velocity sprinkler spray system; auto-modular inert gas based system for control rooms apart from portable and mobile fire extinguishers located at strategic areas of plant buildings and adequate Passive Fire Protection measures. The systems will be designed as per the recommendations of NFPA or approved equals in accordance with the Tariff Advisory Committee (TAC) of the Insurance Association of India stipulations.

(a) In view of vulnerability to fire and its importance in the running of the power station, effective measures will be taken to tackle fire in the susceptible areas such as cable galleries; fuel oil handling areas; coal handling plant areas including transfer points, crusher houses and tunnels, etc.
(b) For containment of fire and preventing it from spreading in cable galleries, unit wise fire barriers with self-closing fire doors will be provided. In addition, all cable entries/openings

in the cable galleries, tunnels, floors will be sealed with non-/fire resistant sealing materials to prevent fire propagation for at least three (3) hours. Fire protection cable coating compound over cables at switchgear entry points, power station building entry points and trays will be provided to prevent damage from fire for at least thirty (30) minutes.

Adequate distances will be maintained between different process blocks and hazardous equipment. To prevent fire from spreading through ventilation & air conditioning ducts, dampers with auto closing arrangements will be provided at appropriate locations.

Dedicated fire water pumps will be installed in the clarified water pump house. In the clarified water storage tank about 4000 M3 water will be stored as dedicated dead storage for meeting fire water requirement in exigencies. The details of system are as follows:

a) Three (3) electric motor driven fire water pump sets of 410 M³/hr capacity having 88 MWC head along with two (2) identical capacity & head diesel engine driven backup fire water pumps will provided for hydrant and sprinkler system in addition to two (2) Jockey pump sets having capacity of 25 M³/hr and 88 MWC which would be brought to operation automatically when hydrant pressure drop indications are received. In addition to these pump sets, other auxiliaries for the fire protection system such as hydro- pneumatic tanks, compressors, pipe work, valves etc will be provided as required.

b) Hydrant system will feed pressurized water to hydrant valves located throughout the plant and also at strategic locations within the powerhouse.

c) High velocity water spray system (HVWS) will be provided for Generator transformers; Unit auxiliary transformers, station transformers, turbine oil storage tanks, boiler burner zone and generator seal oil system.

d) Medium Velocity Water Spray System (MVWS) will be provided for

i) Cable galleries, cable valets, cable vaults, cable spreader room, cable riser/shaft in main plant, switchyard, ESP, AHP control room & CHP control room, coal conveyers & transfer points etc.
ii) Fuel oil area,
iii) Compressor room & DG set room.

Adequate arrangement for detection of fire and smoke will be provided at different locations of vital installations. Laser based fiber optic type LHS fire detection and alarm system will be provided for coal conveyors and cable galleries. IRD system with sprinkles will also be provided for coal conveyors. Centralized control panel indicating zone of fire will be located at central control room. Fire alarms will be distributed throughout the plant and important location so that security gate/fire station persons and control room get immediate information.

The ventilation system provided in cable galleries will be so interlocked with the fire alarm system that in the event of a fire, the ventilation system would be automatically switched-off.
Automatic high velocity spray system will be used for protection of burner zone of each of the boilers.

e) Fuel oil tanks in the fuel oil farm area will be provided with MVWS system as well as fixed foam mechanical system to extinguish accidental fires in tanks as well as outside the dyke. Water for foam system will be drawn from the plant hydrant system. Adequate numbers of hydrant points will be distributed near the oil tanks farm area. Fire hoses fitted with couplings and nozzles will be located suitably at the oil unloading station and kept in hose boxes.

f) Automatic inert gas based flooding type extinguishing system will be provided for unit control room, areas independently apart from the provision of detection and fire alarm system in that area.

g) Adequate number of fire hydrant points will be distributed through out the plant building, service building, coal handling plant, ash handling plant and other areas along with fire hoses fitted with couplings and nozzles and kept in the hose boxes.

In addition to the above facilities, adequate number of manual call points; (MCP) as well as portable and mobile (wheel mounted) fire extinguishers of soda acid type; foam type; chemical type; and carbon-dioxide type will be provided at strategic locations throughout the plant area to meet National Fire Protection Association (NFPA) and Loss Preventive Association (LPA) codes, Tariff Advisory Committee (TAC) stipulation etc. These extinguishers may be used during the early stages of fire to prevent the fire from spreading.

Two (2) nos. of fire tenders will be provided which will be kept in readiness complete with all accessories at fire station located close to fire control room.

Quantity of wastes to be generated (liquid and solid) and scheme for their Management/disposal.

The power Station, being Coal-fired power station, would generate coarse as well as fine ash. All efforts shall be made to utilize the fly ash for various purposes. Ash Management Plan will be developed for 100 % utilisation of fly ash within the time period prescribed by MoEF. The unused ash, till such time, would be disposed in the emergency ash pond to be built within the plant premises.

All the necessary equipment and systems will be provided in the plant to meet all applicable environmental regulations. The plant has been proposed to have the following features, which will help in minimizing emissions and effluents.

DeNO_x /SCR is not considered to be provided as the boiler will be designed with low NOx burners and a stack of 275 m as per CPCB requirements shall be provided in line with the MOEF guidelines, which will help dispersion of air borne emissions over larger area and thus reducing the impact of the power Station on ground level concentrations.

On the basis of raw water quality available, clariflocculation, filtration, and demineralization plants would be required and the treatment plants would be accordingly designed permitting adequate redundancy as well as storage capacities for different qualities of treated water.

It is proposed to collect 100% bottom ash and fly ash in dry form which is proposed to be utilized for industrial purposes as per MoEF guidelines. Ample opportunities for ash use tie-up with prospective users/off-takers exist and the same are proposed to be finalized during construction phase of the project. The responsibility for transportation of ash from plant area lies with the entrepreneur/off-taker of ash. Provision for transportation of ash by railway wagons and road tankers has been kept in the layout. During emergency only, ash may be sent to the ash dyke with a provision for storage of ash up to 15mt. level as per CEA norms. A plot of land measuring 160 Ha, outside the allocated plot has been selected for ash dyke with a storage of 3 to 9 years ash generation as per CEA recommendations, to cater for any exigencies.

4. SITE ANALYSIS

Connectivity

Road: Site is approachable from Narketpally on NH 65 via Miryalaguda (80 KM) or via Addanki on SH 2 (100 KM). State Highway No. 2 connecting Hyderabad and Addanki which is about 7 Km from the project site. Approach to site is possible through the district road network. Transportation of heavy equipment from manufacturer's works to site shall be by road and by railway network.

Rail: A railway line is available between Secunderabad and Nadikudi junction (on Secunderabad – Guntur BG line). The nearest railway station is Vishnupuram which is 5 km from project site. The rail line will be used for transportation of heavy equipment to the site in consultation with Indian Railways for permissible weight & height of consignments during construction period and subsequently for transportation of coal & fuel oil during operation & maintenance.

Air: Hyderabad Airport is at a distance of 135 km

Port: Kakinada port is 328 km from the project site.

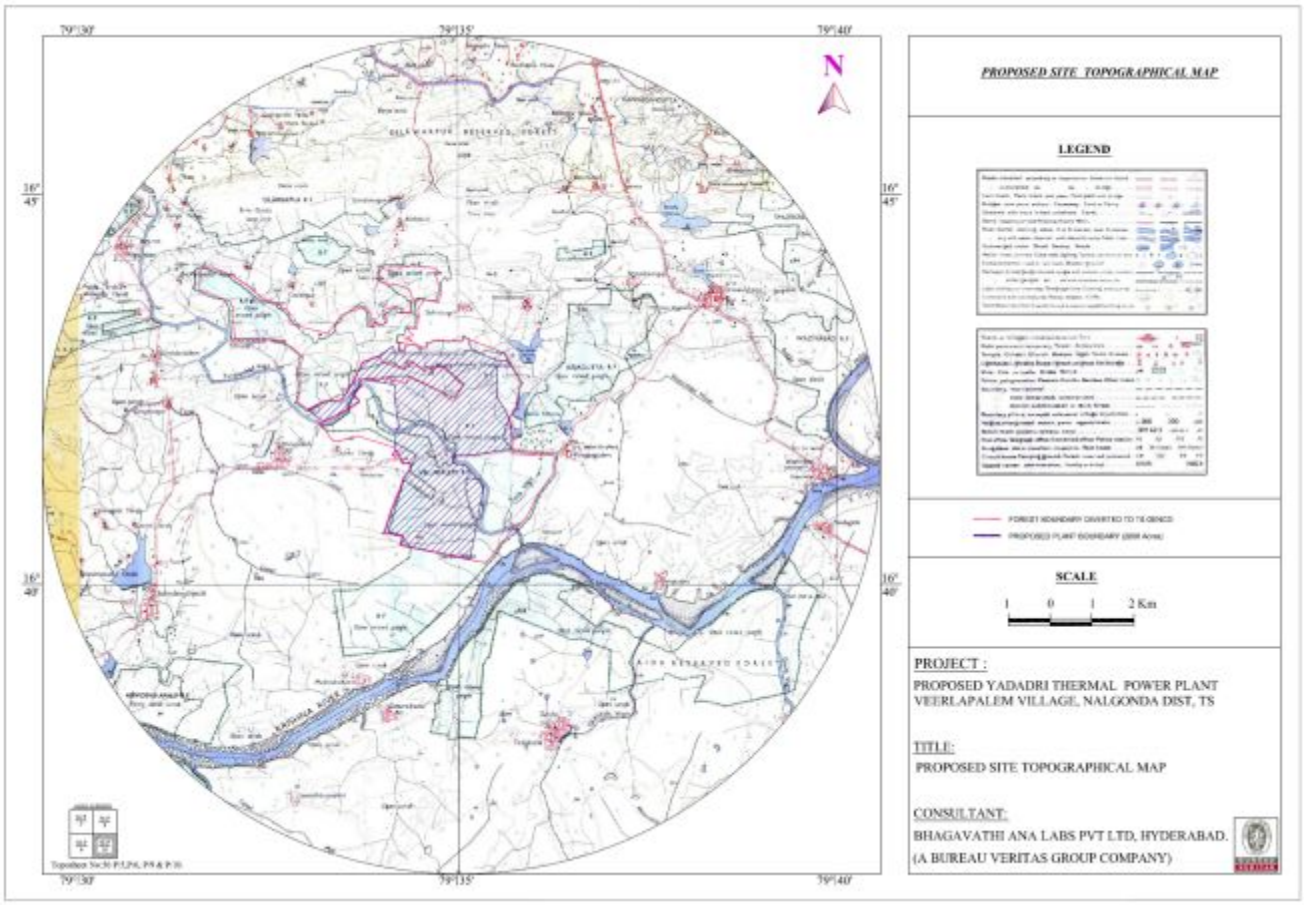
Land Form, Land use and Land ownership.

The proposed site is mostly reserved forest, semi-agricultural and partly revenue land with isolated pockets of habitation. There are no historic places in the vicinity.

Total 2800 Acres land is required for proposed 5x800 MW Yadadri Thermal Power Station, Including 100 Acres for Colony. Breakup of land required for the proposed power Station is as below:

Sl.No	Details	Area in Acres
1	Main Plant Area	250.00
2	BOP Area	350.00
3	Raw Water Reservoir	100.00
4	Coal Handling Plant	250.00
5	Ash Dyke Area	700.00
6	Green Belt Area	1000.00
7	Housing Colony	100.00
8	Additional Pipeline and Railway Corridor	50.00
	Total	**2800.00**

Topography (along with map)
The elevation of the contours of the site varies between 72m to 93m accounting to a level difference of 13m. Topographical Map is given below. Contour Map is Encosed as **Enclosure-VI**



Existing land use pattern (agriculture, non-agriculture, forest, water bodies (including area under CRZ)), shortest distances from the periphery of the project to periphery of the forests, national park, wild life sanctuary, eco sensitive areas, water bodies (distance from the HFL of the river), CRZ. In case of notified industrial area, a copy of the Gazette notification should be given.

There is no National park, wild life sanctuary, eco sensitive areas within 10 km radius of study area. Thungapahadu stream passing through the site is passing through the plot area.

Existing Infrastructure.
Location:

Industry: few cement industries are located around the proposed project site.

Soil classification
Mix of plain rocky with some hilly patches and fair extent of undulating areas, shallow to very shallow soils with broken sheet rock and rocky areas, Degraded shrub forest with few trees in some areas. The fertile soil forms only 9% and occurs in isolated patches in here and there.

Climatic data from secondary sources.

The region experiences hot and dry summer throughout the year except during the South West Monsoon season. The year may broadly be divided into four seasons. It experiences cold season from December to Mid February, summer season from Mid February to first week of June. South West monsoon season from June to September and retreating monsoon or the past monsoon season during October to November.

Temperature

Cold season extending from December to February is followed by summer when both day and night temperatures increase sharply. May being the hottest month, the mean daily maximum temperature is about 40^0C (104.0^0F) and the mean daily minimum is about 28^0C (82.4*F) sometimes the day temperature crosses 44^0C during this period. On some days, afternoon thundershowers come as a blessing and though temporarily they bring relief from the oppressive summer heat. By about the beginning of October day temperature decreases steadily signaling the withdrawl of monsoon. Day and night temperature decrease rapidly during November. December is the coldest month with the mean daily maximum and minimum temperatures being 35^0C and 20^0C respectively. Sometimes during the cold season, night temperature may drop down to about 10^0C.

The skies are generally clear or lightly clouded throughout the year except during south west monsoon season when heavy clouds cast the skies.

Rainfall

The average rainfall in the district is 772 mm. 71% of the annual rainfall is received by the district during south west monsoon (i.e. June to September). September is the rainiest month. During summer and retreating monsoon season some amount of rainfall is received in the form of thunder showers. The variation in the annual rainfall in the district from year to year is large. On an average there are 46 rainy days. (i.e days with rainfall of over 2.5mm or more).

High Flood Levels (HFL) Study

The HFL Study was conducted in the lower Krishna division and the year wise HFL observed in the site are enclosed as **enclosure-II**

5. PLANNING IN BRIEF

(i) Planning Concept (type of industries, facilities, transportation etc) Town and Country Planning / Development authority Classification.

The major phases of the project during its implementation are as follows:
1) Planning & Contract Packaging
2) Design, Engineering, Tendering & Contract award
3) Manufacturing, Inspection & Expediting
4) Construction, Erection & Commissioning
5) Operation & Maintenance and Manpower Training & Placement.

During construction phase, a team of engineers headed by Chief Engineer of TSGENCO supported by Implementation Consultant's Site Construction Manager & Construction supervision Engineers will supervise the activities of the EPC Contractor.

(ii) Population Projection

The area surrounding the plant site is having many villages in 10-km radius. The influx of population may further increase lively hood associated activities in the project nearby area.

(iii) Land use planning (breakup along with green belt etc).

The Break-up of the plant area is provided in the following table.

Land Requirement for 5x800 MW Coal Based Thermal Power Station

Sl.No	Details	Area in Acres
1	Main Plant Area	250.00
2	BOP Area	350.00
3	Raw Water Reservoir	100.00
4	Coal Handling Plant	250.00
5	Ash Dyke Area	700.00
6	Green Belt Area	1000.00
7	Housing Colony	100.00
8	Additional Pipeline and Railway Corridor	50.00
	Total	**2800.00**

(iv) Assessment of Infrastructure Demand (Physical & Social).

On Assessment of Infrastructure Demand near the project area, following are the few requirements for the nearby villages of project area.

- Colleges with ITI / Vocational Training institutions, (nearby available).
- Hospitals / Primary Healthcare centers with Ambulance facility, (-- do-)
- Fire stations, (Own as well as nearby available)
- Community halls etc., (--do--)
- Amenities/Facilities. (--do--)

6. PROPOSED INFRASTRUCTURE

Industrial Area (Processing Area).
The area will be used for construction and development of power Station. The infrastructure facilities like main plant building, make-up water system, DM plant, CW system etc.

Residential Area (Non Processing Area)
Considering all the factors and on the ground of economy, accommodation is proposed for personnel for the power Station operation and maintenance staff, staff employed in finance, administration, accounts, welfare and purchase, and staff for schools, bank, post office, hospital, park, township maintenance,for the security and firefighting staff. Guesthouse & bachelor hostels will also be provided.

Green Belt
As per the Guidelines of State Pollution Control board (SPCB) and Ministry of Environment & forests (MoEF), adequate green belt shall be developed in and around the plant area which will fulfill the requirement with a minimum area of 33% of the area (2800 Acres) poposed in Phase-I for 5x800 MW Power Station. The Green Belt area workouts to around 1000 Acres.

Social Infrastructure
In association with the neighbouring industrial community as a corporate responsibility social infrastructure will be developed in the project study area. This development will be in association with the local bodies and village people.
On Assessment of Infrastructure Demand near the project area, following are the few requirements for nearby villages of project area.

- Schools/training institutions
- Hospitals / Primary Healthcare centers with Ambulance facility,
- Fire stations,
- Community halls etc.,

(v) Connectivity (Traffic and Transportation Road/ Rail/Metro/Water ways etc)

Connectivity

Road: Site is approachable from Narketpally on NH 65 via Miryalaguda (80 KM) or via Addanki on SH 2 (100 KM). State Highway No. 2 connecting Hyderabad and Addanki which is about 7 Km from the project site. Approach to site is possible through the district road network. Transportation of heavy equipment from manufacturer's works to site shall be by road and by railway network.

Rail: A railway line is available between Secunderabad and Nadikudi junction (on Secunderabad – Guntur BG line). The nearest railway station is Vishnupuram which is 5 km from project site. The rail line will be used for transportation of heavy equipment to the site in consultation with Indian Railways for permissible weight & height of consignments during construction period and subsequently for transportation of coal & fuel oil during operation & maintenance.

Air: Hyderabad Airport is at a distance of 135 km

Port: Kakinada port is 328 km from the project site.

(vi) Drinking Water Management (Source & Supply of water)
The proposed water demand is met from Krishna River

Industrial Waste Management.

Sewage system

The sewage wastewater will be treated in the Sewage Treatment Plant (STP) and treated waste water will be used for green belt development.

Solid Waste Management.

The power Station, being Coal-fired power station, would generate coarse as well as fine ash. All efforts shall be made to utilize the fly ash for various purposes. Ash Management Plan will be developed for 100 % utilisation of fly ash within the time period prescribed by MoEF. The unused ash, till such time, would be disposed in the emergency ash pond to be built separate.

Ash Management

MoEF vide gazette notification dated 3rd November 2009 have stipulated about the utilization of ash generated by coal / lignite based thermal power station. The details are as under:

New coal and, or lignite based thermal power station and, or expansion units commissioned after this notification to achieve the target of fly ash utilization as per table given below:

S.No	Fly Ash utilization level	Target date
1	At Least 50% fly ash generation	One year from the date of commissioning
2	At least 70% fly ash generation	Two years from the date of commissioning
3	90% of fly ash generation	Three years from the date of commissioning
4	100% of fly ash generation	Four years from the date of commissioning

Power Evacuation & Supply / source.

The evacuation will be at 400 kV transmission system

7. REHABILITATION AND RESETTLEMENT (R&R) PLAN

Policy to be adopted (Central/State) in respect of the project affected persons including home outstees, land outstees; and landless labourers (a brief outline to be given)

Land for the project has been identified. The proposed site is mostly reserved forest, semi-agricultural and partly revenue land with isolated pockets of habitation. There are no historic places in the vicinity. Other than forest land is under acquisition. R&R Scheme should be as per State Government Policies (G.O. Ms No.50 &123). Attached as **Enclosure-III**

8. PROJECT SCHEDULE & COST ESTIMATES

Likely date of start of construction and likely date of completion (Time schedule for the project to be given).

8.1 Project Implementation

For implementing this project within the desired time and cost schedules, it is essential to undertake meticulous planning, right from the conceptual stages. Following aspects of the project implementation will be crucial:

- Effecting timely project development activities, including securing various approvals / NoC's / permissions for each component of the integrated project.
- Selection of a prospective developer simultaneously along with approvals.
- Finalization of mode of project implementation (EPC mode and O&M contracts for individual project components), along with experienced owner engineering / consultancy team for effective monitoring of the implementation / commissioning of each component as per the schedule, is recommended. TSGENCO proposes to appoint experienced project engineering management consultancy firm, as well as experienced in-house project team for the purpose.
- Manpower and resource mobilization at required time and effectively

8.2 Project Schedule

The zero date of the project starts from the date of issue of LOI to the EPC. financial closure. The thermal power Station project implementation will be completed within 48 months as shown in the below table.

Unit I & II	36 Months
Unit III, IV & V	48 Months

The major activities to be carried out after the financial closure will include

i. Detailed design engineering and specifications
ii. Preparation of EPC / package bid cum, bidding, bid evaluation, recommendations and contracting for civil, mechanical, electrical and instrumentation components as well as Kick off meetings with individual vendors / contractors.
iii. Vendor drawing review and approvals, inspection and expediting and delivery at site
iv. Engineering services for wrap around of all packages.
v. Site supervision for erection, testing & commissioning
vi. Bidding, contracting and signing of O&M contracts
vii. Plant stabilization and development of MIS

8.3 Estimated project cost along with analysis in terms of economic viability of the project.

Estimate Of Project Cost

The proposed plant capacity would be 5x800 MW. The total estimated cost of the project works out to Rs. 25099.42 Crores (approx)

9. ANALYSIS OF PROPOSAL (FINAL RECOMMENDATIONS)

9.1 Financial and social benefits with special emphasis on the benefit to the local people including tribal population if any, in the area:

The basic target would be the development of the local villages in the vicinity of the project. Hence, tremendous scope for development of the local population economically is envisaged.

Enclosure-I
Khammam District Collector Letter

GOVERNMENT OF TELANGANA
OFFICE OF THE DISTRICT COLLECTOR, KHAMMAM

Rc.No.E1/3024/2014 Dated: 18.12.2014.

From
Dr.K.Ilambarithi, I.A.S.,
District Collector,
Khammam.

To
The Principal Secretary to Government,
Energy Department,
TS Secretariat, Hyderabad.

Sir,

Sub: TSGENCO - Alienation of land at Karukonda Village & Kunaram Village of Kothagudem Mandal and Gollpalli Village of Tekulapalli Mandal in Khammam District for establishment of 5x 800 MW Thermal Power Plant - Availability of Amba Sathram lands – Report Submitted - Reg.

Ref:
1. Government Energy Department Memo No.537/Budget/2014-1, Dated: 07.11.2014.
2. Government Energy Department Memo No.537/Budget/2014-2, Dated: 17.11.2014.
2. District Collector, Khammam letter Rc.No.E1/3024/2014, Dated: 25.11.2014
3. Assistant Commissioner, Endowments, Khammam, letter Rc. No. C/1879/2014, Dated: 01.12.2014.
4. Sri N. Krishna Mohan, Dharmadhirkari, Sri Pamidi Ghantam Venkataramana Haridasa Nirthannadhana Sri Amba Sathram, Bhadrachalam Letter Dated: 03.12.2014.
5. Revenue Divisional Officer, Kothagudem Rc.No.D/1949/2014, Dated: 06.12.2014.

<><><>

I invite kind attention to the reference 1st cited. Where-In, the Government has requested to send the detailed report on availability of the following Endowment lands presently under the possession of 'Amba Sathram' so as to take further action for establishment of 5x800 MW Thermal Power Plant in the said lands by Telangana State Power Generation Corporation Limited (TSGENCO).

Sl. No.	Name of the Mandal	Name of the Village	Extent Acs.-Gts
1.	Kothagudem	Karukonda	2918.05
2.		Kuknaram	180.28
3.	Tekulapalli	Gollapalli	1818.00
Total			**4916.33**

Government vide reference 2nd cited has requested to complete the survey of endowment lands and send a detailed report.

In this regard the Assistant Commissioner, Endowment Department, Khammam and Revenue Divisional Officer, Kothagudem have submitted reports on the details of the Amba Sathram Lands as follows.

I. The establishment of the Amba Sathram and lands acquired by the institution as per the report of the Assistant Commissioner, Endowment Department, Khammam is as follows:

1. Sri Amba Satram is situated at Bhadrachalam Town and Mandal in Khammam District and it was established by late Sri Pamidighantam Venkata Ramana Haridasu, a great devotee of Lord Sri Seetha Rama Chandra Swamy Varu, in the year 1877, for the purpose of making Annadanam to the visiting devotees of Bhadrachalam Devasthanam.

Enclosure-II

Based on Data collected from Central Water Commission (CWC) Krishna & Godavari Basin Organisation, Hyderabad.

Annual Highest Flood Level for the period 1975-2007

Station Code : AK000E7 (Pondugala)

Division: Lower Krishna Divn., Hyderabad

Local River : Krishna

Sub-Division: Lower Krishna SD 1, N.S.Dam Site Location

YEAR WISE HFL OBSERVED AT SITE PONDUGALA

Year	Highest Flood Level (m)	Date	
1975	47.374	14.11.1975	
1976	55.029	10.8.1976	
1977	51.119	03.08.1977	
1978	56.674	02.10.1978	
1979	56.184	30.09.1979	
1980	55.337	13.07.1980	
1981	53.704	24.09.1981	
1982	50.954	23.08.1982	
1983	55.144	22.08.1983	
1984	49.484	21.08.1984	
1985	45.039	31.08.1985	
1986	45.089	13.08.1986	
1987	45.424	14.11.1987	
1988	55.154	29.09.1988	
1989	54.834	02.10.1989	
1990	54.984	24.08.1990	
1991	54.832	02.08.1991	
1992	49.723	11.09.1992	
1993	53.429	21.10.1993	
1994	55.734	23.07.1994	
1995	45.334	20.10.1995	
1996	56.134	03.10.1996	
1997	55.834	30.08.1997	
1998	60.334	15.10.1998	HFL
1999	51.754	14.08.1999	
2000	51.284	23.8.2000	
2001	48.134	30.9.2001	
2002	45.299	5.10.2002	
2003	43.874	2.10.2003	
2004	45.234	5.10.2004	
2005	56.834	7.8.2005	
2006	56.534	16.8.2006	

Enclosure-III
R & R Go's 50 & 123

GOVERNMENT OF TELANGANA
ABSTRACT

Revenue Department - Land Acquisition - The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (Act No.30/2013) - Telangana State Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2014 -Notification -Orders - Issued.

REVENUE (JA&LA) DEPARTMENT

G.O.Ms.No.50 **Dated: 19.12.2014.**
Read the following:-

1. The Gazette of India No.40, Dt.27.09.2013 of Ministry of Law and Justice, New Delhi.
2. The Gazette of India, Notification No.2839, Dt.19.12.2013.
3. G.O.Rt.No.115, GA (Cabinet) Dept., dt. 23-6-2014.
4. G.O.Ms.No.41, Rev (JA & LA) Dept., dt. 13-11-2014.

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ORDER:

The following Notification will be published in the Telangana State Extraordinary Gazette, Dt. 20-12-2014.

NOTIFICATION

Whereas, the draft rules namely "Telangana State Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2014" were published as required under Section 112 of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (Act 30 of 2013) vide Telangana State Extra-Ordinary Gazette, Part-I Dt. 13-11-2014 inviting objections/suggestions from all the persons likely to be affected thereby before the expiry of a period of 15 (fifteen) days from the date on which the copies of the Gazette containing the Notification were made available to the public.

2. And whereas, the copies of the Gazette containing the said Notification were made available to the public on the 13th November, 2014.

3. And whereas, the appropriate objections and the feasible suggestions have been considered by the Government of Telangana.

4. Now, therefore, in exercise of the powers conferred by Section 109 of the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (Act 30 of 2013), the Government of Telangana hereby makes the following rules called "Telangana State Right to Fair Compensation and Transparency in Land

GOVERNMENT OF TELANGANA
ABSTRACT

Procurement of land and other structures thereon from Willing Land Owners by the Procuring Agencies for public purposes - Orders – Issued.

REVENUE (JA&LA) DEPARTMENT

G.O.MS.No. 123 **Dated 30.07.2015.**

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ORDER:

In order to expeditiously procure land for public projects, Government deem it fit to come out with a framework that allows the land owners to participate in the development process by willingly sell their land and properties thereon, for a consideration on the basis of an agreement between land owners and the user department/undertaking/society/authority, here-in-after called as Procuring Agency, as approved by the District Level Land Procurement Committee (DLLPC).

2. To procure land from Willing Land Owners and others, the following procedure is prescribed:-

i) The Procuring Agency will inform the District Collector about the land required for public developmental purpose along with necessary details.

ii) On receipt of such information, the District Collector will ascertain the willingness of the land owners for sale of land and property thereon.

iii) Subject to getting willingness from the land owners/authorised representatives for voluntarily selling their land and property, the District Collector shall inform about the number of such sellers, extent of land out of total indent, and likely consideration to the Procuring Agency.

iv) On receiving confirmation from the Procuring Agency, the District Collector shall place the matter before the District Level Land Procurement Committee, as constituted below:

(a) The District Collector of the concerned District	- Chairperson
(b) The Joint Collector of the District	- Member
c) Land Procurement Officer i.e., SDCs/RDO	- Convener
d) S.E./E.E. of Roads & Buildings	- Member
e) Representative of the Procuring Agency	- Member
f) District Registrar	- Member

v) The Land Procurement Officer shall place all connected records of enquiry, valuation statements, encumbrances of preceding (12) years and other relevant records duly verified by him before the District Level Land Procurement Committee.

vi) The District Level Land Procurement Committee may take up local inspections, where deemed necessary.

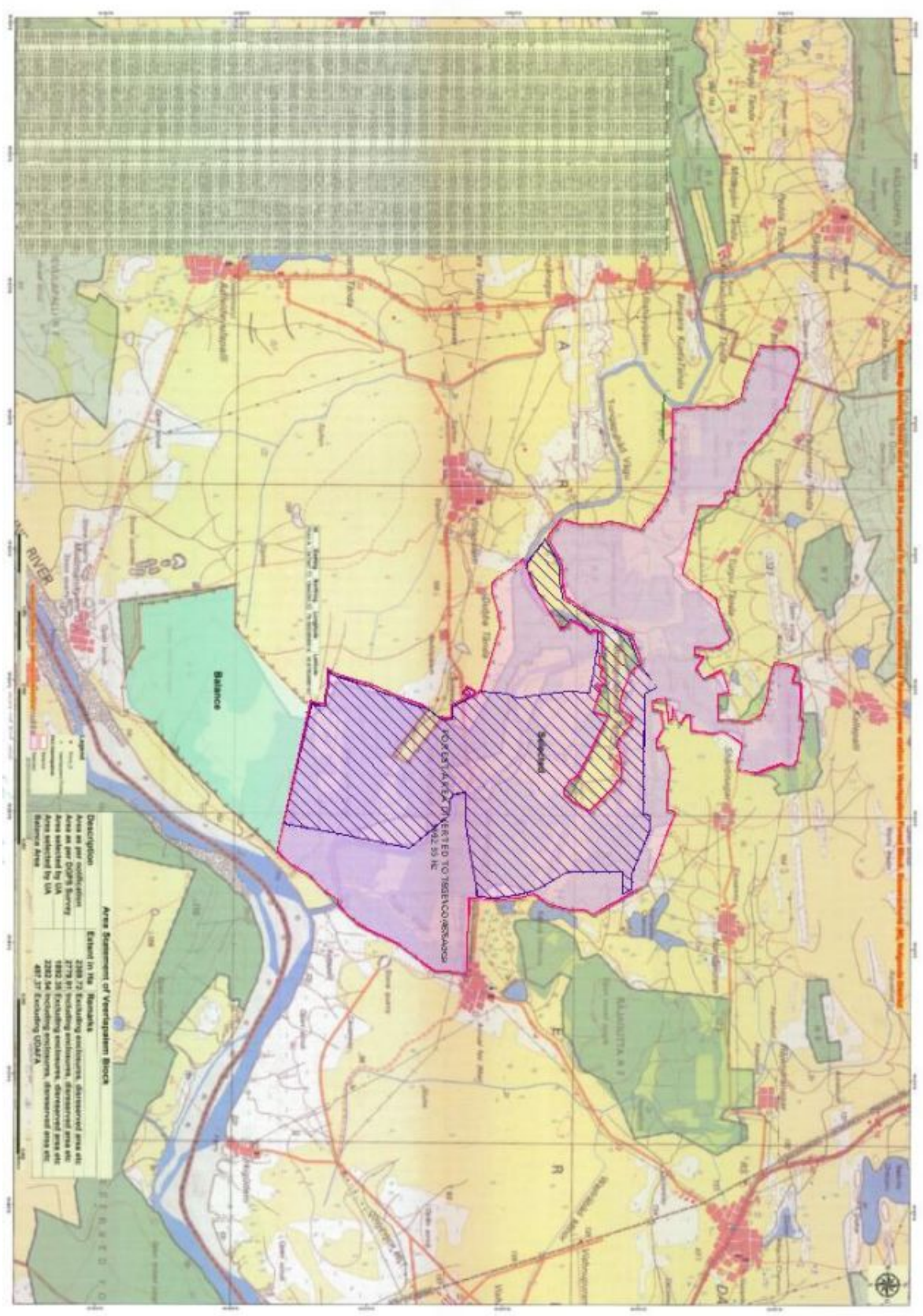
(PTO)

Enclosure-IV

Abstract Statement of TS Grid Load Projections (Figures in M W)

S.No	Description	2015-16 (As per Actuals for the year 2014-15)	2016-17 (Projected Load)	2017-18 (Projected Load)	
				LI during Night time	LI distributed throughout the day
1	Max. Base Load	5320	6349	7374	7374
2	Lift Irrigation	0.00	1600	1600	4500
3	Max. Agricultural Load	3006	3500	7500	7500
Total		**8316**	**11449**	**16474**	**19374**
Max. Load on the System during the day		**6906**	**11449**	**13349**	**15079**

Enclosure-V
Forest Boundary Map



Enclosure-VI

Contour Map