
EXECUTIVE SUMMARY

INTRODUCTION

M/s Pusala Power Projects Pvt. Ltd. (PPPPL), Hyderabad, a private company involved in the activities of civil construction, has business interest in developing mini hydel schemes in Karnataka.

PPPPL intends to set up a mini hydel project with 4.5 MW (2x2.25 MW) capacity across Tungabhadra river near Kenchanaguddam Village in Siruguppa Taluk - Bellary District in Karnataka. The project called, Kenchanaguddam Mini Hydel Project (KMHP), has been approved and allotted to PPPPL by Government of Karnataka (GoK) vide its allotment order GO No. 36/NCE/2002 dated 15/2/2003.

PROPOSED PROJECT

The proposed mini hydel scheme envisages utilisation of flows in Tungabhadra River and a gross head of around 7 m available at the location of the proposed project (Gangammannakatte anicut) advantageously to generate power. This is a run-of-the-river type project. The scheme comprises the following components: a) an intake structure; b) a powerhouse; and c) a tailrace channel from the powerhouse discharging back into the same river course without any consumption. Apart from these, plugging the leakages at the existing 7 nos. of anicuts viz., Aralikatte, Usginakatte, Agasaragudikatte, Kalanayakanakatte, Bellakkikatte, Hanumanppanakatte and Gangammanakatte, across river Tungabhadra near Kenchanaguddam village is also envisaged. The generated power will be evacuated from the powerhouse to the substation located at Siruguppa town, which is about 13 km from the project site. The annual generation capacity of the proposed KMHP will be 18.5 Mu.

OBJECTIVES

The proposed KMHP is expected to achieve following major objectives and benefits.

- **Satisfying power demand in the region**

The proposed power project is designed to generate 4.5 MW (2x2.25MW) of electric power, which can be utilized to partially satisfy the increasing power demand in the region.

- **Lower cost for power generation**

The proposed project is a mini hydel project with simple design of turbines, generators and civil works. Also, it does not involve use of any fuels such as coal, natural gas or naphtha which need substantial expenditure towards their procurement (indigenously or import) and transportation. Water is a naturally recurring domestic product. As a result, the cost of generation of power will be much less compared to thermal power.

- **Minimal environmental impacts**

Hydropower is a free gift of nature – clean, economical, perennial and renewable. It is the leading source of renewable energy. The small hydel projects are considered to have minimal impacts on the surrounding environments due to small area of submergence, no gaseous emissions and solid waste generation

such as fly ash. Hydropower leaves behind no waste. Hydropower plants are simple to operate and easy to maintain.

▪ **Socio-economic benefits**

Setting up the proposed hydel project will provide direct employment to local persons helping to better the socio-economy in the area. Agriculture is the main economic activity in the area. The power generated from the proposed project may be made available for agricultural irrigation in the area thus boosting the agricultural activities in the region.

Also, during the construction phase, approximately 50 temporary labourers will be employed for a period of about 18 months, thus providing a direct employment benefit to the area. Moreover, indirect employment will be generated due to the power project in view of creation of secondary supporting job opportunities.

PROJECT SITE LOCATION

The site of the proposed mini hydel scheme across Tungabhadra river is located about 5 km upstream of Siruguppa. The site can be reached by road from Bangalore via Hiriyr (NH 4) and from there on with a deviation on SH 19 leading to Siruguppa via Bellary, Tekkalkote and Halekote to project site at Kenchanaguddam village. The project site is about 350 km from Bangalore.

The geographical coordinates of the project site are Latitude 15°36'55"N and Longitude 76°50'30"E.

ALTERNATIVE SITES CONSIDERED

Hydel project is a site-specific project for the following two major reasons.

- There should be sufficient flow of water in terms of discharge and head in the stream to generate power throughout the year.
- The project site should be located at an ideal site for construction of intake structure.

The proposed project site at Kenchanaguddam satisfies the above criteria. In addition, the site offers following advantages.

- The project site does not cover any forest land. Majority of the area on the right bank of the river is private lands. A portion of the land on left bank (islands) of Siruguppa branch belongs to private owners.
- It is envisaged to utilise a) Gangammanakatte anicut and b) the left bank anicut of Desanaur branch of the river downstream of Gangammanakatte anicut across Tungabhadra River to divert the river flows for the power generation. Thus, there will not be any additional diversion structure to be constructed across the river except streamlining and strengthening of the existing anicuts.
- The intake and powerhouse will be located appropriately to minimize water conductor length with an easy access.
- Since there is no submergence of land under the project and hence nil/minimum impact on the economic and ecological status of the area.
- There is availability of required infrastructure facilities near the project site.

- No major human habitation in the vicinity. The project does not involve any rehabilitation or resettlement of any human habitation.
- There is availability of a flat terrain so that there is easier access to the site. These will lead to less excavation of earth.

In view of the above, the proposed project site at Kenchanaguddam has been considered appropriate for construction of the mini hydel project.

DETAILS OF THE HYDEL SCHEME

POWER GENERATION

The general layout of the hydro scheme comprises construction of an integrated intake and powerhouse. This is at the toe of the existing Gangammanakatte anicut on the left bank of the river to divert water through the proposed tailrace canal passing through the existing left bank anicut of Desanur branch thereby utilising the head for power generation. After power generation, flows are released back to the river by a tail race canal.

On the basis of techno-economic studies 2 No. TG Units each with a capacity of 2.25 MW will be installed with horizontal full Kaplan turbine (S type) for this project. The total installed capacity will therefore be 4.5 MW.

The power generated is proposed to be evacuated to Siriguppa substation located at about 10 km from the proposed project site.

SOURCE OF WATER

Tungabhadra River is the source of water for the proposed hydel scheme. This is one of the major rivers in South India. The river flows through Shimoga and Bellary districts before joining River Krishna.

Releases from TB dam and the regenerated flows constitute available flows for power generation at the proposed project site. Hence, the flow available for power generation will be the discharge in Tungabhadra River near Kenchanaguddam village.

INFRASTRUCTURE FACILITIES REQUIRED

KMHP will require provision of certain infrastructure facilities for carrying out construction, operation and maintenance of hydropower station. The details of such infrastructure facilities are discussed below.

LAND

Land has to be acquired for the project components and housing for the staff of the project. The total land requirement for the project is 20 acres. Out of this, 14 acres of land has to be acquired from the Irrigation Department for the portion of tailrace canal and the remaining on private land. The powerhouse and switchyard will be located in the private lands.

Further, it is proposed to dispose off the excavated material on private land separately, which also has to be acquired. The details of land to be acquired by type is given below.

Land Requirement for the Project

Type of Land	Area in acres
a. Private	6
b. Irrigation	14
Total	20

WATER

Water for construction purpose will be drawn from the borewells. Potable water for PPPPL staff and construction personnel can also be obtained from borewells.

POWER SUPPLY

Power for construction purpose could be tapped from nearby KPTCL lines. Further, a 100 kVA rated DG Set will act as stand-by when power supply is not available in construction phase. Subsequently, after commissioning of the hydro scheme, this DG Set would be used for powerhouse auxiliary requirements whenever regular supply is not available.

MANPOWER

It is understood that 50 temporary labourers will be engaged for the construction phase. During the operational phase 15 employees will be required.

APPROACH ROADS

The hydro scheme is proposed to be located on the left bank of Tungabhadra river. Approach road to the proposed powerhouse location shall be the road from Kenchanaguddam leading to Gangammannakatte anicut on the right bank of the river. In order to access the various components of the scheme on the left bank, the existing Gangammannakatte anicut will be suitably strengthened for transport of various materials including electro-mechanical equipment. During the time of floods and high flows in the main river, rope-way shall be planned across the river.

SITE OFFICES AND QUARTERS

Residential accommodation for staff during construction and subsequently during operation is necessary. Permanent offices of operation staff will be located at the powerhouse area and if found necessary, some additional buildings such as store sheds and store yards could be constructed in the vicinity of the power house. Temporary site offices and store sheds of staff could be located at the project site near at the powerhouse location on the left bank (islands). Actual allocation of space for site offices and quarters would be finalised only after the process of land acquisition is complete.

ENVIRONMENTAL IMPACT ASSESSMENT

PPPPL has appointed **Centre of Symbiosis of Technology, Environment & Management (STEM)** to carry out a Rapid Environmental Impact Assessment (REIA) study of their proposed Mini Hydrel Project near Kenchanaguddam. The objective of the REIA study is to identify, predict and evaluate the likely environmental impacts of the proposed hydrel project during its construction and

operational stages. The REIA study also aims at developing an appropriate Environmental Management Plan (EMP) for mitigating adverse environmental impact of the proposed project, if any.

BASELINE ENVIRONMENTAL STATUS

WATER ENVIRONMENT

Tungabhadra River is the main source of surface water in the study area. Regenerated water also enters the river. As there is no sources of water pollution in the upstream of the river, the river water quality is expected to be within the acceptable limits.

In order to ascertain the quality of surface water, the river water samples were collected at two locations. Groundwater sample was collected from a borewell at Kenchanaguddam.

The results of the water quality analysis indicate that the river water quality is within permissible limits. Also groundwater quality is found to be within the permissible limits when compared to the Indian Drinking Water Quality Standards prescribed in IS:10500.

The design discharge (mandatory releases) of the irrigation canals in the project vicinity, viz., Siruguppa and Desanur canals shall be maintained. Thus the agricultural and economic activities of the region are unaffected.

In view of the above, it can be said that the proposed project will have negative impact on water availability and no impact on the water quality in the study area during the operational phase.

AIR ENVIRONMENT

There are no significant sources of air pollution near the proposed KMHP site. The Siruguppa Town is around 5 km as the crow flies and 8 km by road from the project site. There is a state highway (SH-19) near the project site at a distance of 5 km. There is a sugar industry in the study area at a distance of around 8 km (as the crow flies) downstream of the project site at Desanur Village, with an installed crushing capacity of 1,500 tonnes of cane per day. Hence, the above mentioned industry, the town and the highway are more than 5 km distance from the project site and are expected to have no significant impact on the air quality at the project area.

The proposed project uses river water for running the turbines for power generation. The power generation process does not involve any combustion of fossil fuels and hence, there will not be any gaseous emission from the power plant during its operational phase. However, there will be occasional movement of vehicles to & fro from the site. The movement of vehicles may result in dust pollution and vehicular exhaust emissions, which are expected to have insignificant impacts, as this will be a very limited activity.

To assess the baseline ambient air quality at the project site, two monitoring stations were considered. The results are presented in Table 3.3 for easy reference.

The results of air quality monitoring show that the ambient air quality around the proposed project site is well within the permissible limits prescribed by the National Ambient Air Quality Standards (NAAQS) - CPCB, India.

NOISE LEVEL

To establish the baseline noise scenario, results of noise level monitoring carried out during the study period at two locations in the study area have been considered. On comparison of the noise monitoring results with the residential noise standards shows that the average noise levels during day-time and night-time at both the monitoring locations conform to the applicable standards.

LAND ENVIRONMENT

The land is an important part of the ecosystem as it supports the vegetation of the area.

The study area has plain topography with a gentle slope and is characterised by dendritic drainage pattern. Minor hillocks are seen in some parts of the area. Tanks are present in the study area which are most seasonal in nature. There are also a few distributories, which are branching from the Tungabhadra right and left bank canals and leading back to the river. These are mainly for irrigation purpose in the area. There are a few islands in the bed of the river near the Kenchanaguddam village. The Desanuru Village is situated on the Desanuru island, which is about six miles long. Much of these islands have richly cultivated land.

The study area is mostly composed of crystalline schists, epidiorites, granitic gneisses and later granite. The soils of the study area consists of the reddish sandy loam, reddish brown and black cotton soils. Major portion of the study area is covered by medium to deep black soil.

For the proposed mini hydel project, the solid waste will be generated mainly in the form of excavated material during the construction phase. The excavated material is estimated to be of the order of about 233160 cum. Nearly 70 per cent of the total excavated earth will be soft rock and the rest will be hard rock (11 per cent) and soil (19 per cent).

TERRESTRIAL ECOLOGY

Forest

There is no reserve forest or other type of forest in the study area i.e., 10 km radius from the proposed project site.

Flora

The tree species including those planted by the forest department on the road side and in Siruguppa town limits are *Delonix regia*, *Peltophorum pterocarpum*, *Samanea saman*, *Pithecellobium dulce*, *Dalbergia sisso* and *Terminalia catappa*. The *Typha angustata*, *Typha australis* and *Iseilema* species are the grasses found along the river.

Fauna

Most of the birds found near the project area are water birds. As far as wild animals are concerned occasionally the Indian Fox, Indian Porcupine are found in the study area.

Aquatic Ecology

Common carps are the important exotic fishes introduced in the area and the exotic carps. The common carps are the most popular owing to their easy acclimatization, fast growth and self-sustenance in lentic environment. Crocodiles are reported to be present in the river upstream of the proposed project site.

AESTHETICS

The main domestic activities adjacent to the project site include washing clothes, washing of domestic animals, which includes buffalo, cow, etc, bathing by villagers and grazing by domestic animals. Presence of the washing and bathing activities seem to be confined up to 300 m downstream of proposed intake structure area i.e., downstream of the Ganammanakatte anicut. There is Raghavendraswamy temple next to the project site on the right bank. The downstream anicut is being used by the people and animals to cross over to the Desanuru island and vice versa.

Natural landscape forms another important component of aesthetics as a clean and greener environment is a visual treat. The proposed project area is located in a scenic location on an island. The natural beauty of the location can be enhanced by developing a systematic green belt at the facility gelling with the existing landscape of the area.

As per the data available and the observations during site visit made, there are no places notified as historical and archaeological sites. Further, since the project is mini hydel and does not involve any submergence of land, it will not have any adverse impacts.

SOCIO-ECONOMIC ENVIRONMENT

For assessing the baseline socio-economic data, information from secondary data sources i.e. the 1991 Census data has been considered. The 2001 census data has not been published yet however, the present socio-economic status of the study area has also been assessed on the basis of the field observations and interviews during the site visit. .

In all there are 19 villages and 2 towns which fall under the purview of the 10 km radius of the study area. Ten of these villages are in Siruguppa Taluk of Bellary District and 9 are in Sindhnur Taluk of Raichur District. The nearest habitation is Kenchanaguddam Village at about 1 km from the proposed project site. It has a population of around 3000 persons.

Based on the 1991 census data, total population of the study area is 95894 and the population density is around 329 persons per sq. km. Female to male ratio in the study area is 0.984 (i.e 984 females per 1000 male). There would not be any displacement of population due to the proposed mini hydel project. The overall literacy rate in the study area is 27.38 %, whereas male and female literacy rates are 36.96 % and 17.65 % respectively. Majority of the population is agricultural labourers (56%). Other than the cultivators are about 24% whereas about 20% are other workers. Basic infrastructure facilities such as drinking water supply, electricity supply, transportation were found to be adequately available in the study area. Most of the villages in the study area are served by private medical practitioners. Modern communication facilities such as STD telephone are also available in the study area.

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATIVE MEASURES

The impacts on the surrounding environment in the 10 km radial distance of project site during construction and operational stages on various environmental components are also summarized below in Table 1 and Table 2 respectively for ready reference.

Table 1
Construction Phase
Potential Impacts and Mitigative Measures

Environmental components	Potential impacts	Source of impacts	Mitigative measures	Remarks
1. Water	Demand of water supply in addition to extraction from borewells, if required. Local increase in suspended solids	Construction equipment cooling, concrete mixing & curing, cleaning, workers' domestic needs, dust suppression etc. Erosion due to excavation activities	Equipment selection, steam curing, high pressure hose for cleaning. Plantation around site before construction. Scientific Disposal of Excavated material.	Temporary minor negative impact
2. Air quality	Increased SPM concentration in ambient air.	Construction equipment, vehicular traffic, excavation, concreting, <i>etc.</i>	Vehicular check; water spraying for dust suppression;	Minor negative & localized and for short term
3. Noise	Increased noise levels	Construction equipment, various construction activities	Equipment selection & maintenance; usage of ear plugs/muffs by the construction workers	Temporary minor negative impact
4. Land	Construction wastes, unstable slopes, soil erosion	Construction waste	Appropriate waste disposal measures; slope stabilization and greenbelt development.	Temporary minor negative impact
5. Terrestrial Ecology	Impact on top soil & existing ecosystem in the vicinity of the site.	Construction activities	Low noise generating equipment, soil binding vegetation, greenbelt development	Very minor impact
6. Aquatic Ecology	Loss of habitat, change in flow	Construction activity of power house & penstock and tailrace canal	Provision of mesh before the intake structure to stop fish from passing beyond that point	Short term Minor negative impact
7. Aesthetics	Impact on surrounding	Construction activities,	proper material management and dust	Temporary

Environmental components	Potential impacts	Source of impacts	Mitigative measures	Remarks
		storage of building material, dusty atmosphere	suppression measures	Minor negative impact
8. Socio-economic factors				
• Population	No impact	Construction jobs	Employing local people, Providing proper facilities and community services for the workers	No impact
• Education	No impact	None	Employing local people	No impact
• Employment	Increase in employment opportunities	Construction jobs to the local manual labourers and professionals	-	Beneficial
• Infrastructure facilities & Community services	Medical & transportation facilities	Increased project & social need for infrastructure	-	No impact

Table 2
Operational Phase
Potential Impacts and Mitigative Measures

Environmental components	Potential impacts	Source of impacts	Mitigative measures	Remarks
1. Water	None	None	Minimise water usage by water conservation measures such as reuse of treated sewage for greenbelt irrigation.	No impact
2. Air quality	None	Occasional vehicular movement	Green belt development, usage of good quality fuel	No impact
3. Noise	Increased noise levels but below the prescribed standard.	Operation of noise generating equipment such as turbines, pumps & compressors located within the power plant	These equipment will be provided with noise reduction measures such as acoustic barriers, vibration pads etc. Green belt development. Two door arrangement.	Insignificant impact
4. Land	None	Project activities	Development of a systematically managed green belt to maintain ecology of the area. Appropriate disposal of solid waste, garbage.	No impact
5. Terrestrial Ecology	Minor loss of habitat	Project activities	Greenbelt development.	No impact
6. Aquatic ecology	Trapping of aquatic species	Diversion of flow	Provision of appropriate meshing at the intake structure to stop the aquatic species from entering into canal	Very minor negative impact
7. Aesthetics	None	None	Good housekeeping, maintaining green cover in the area.	No impact

Environmental components	Potential impacts	Source of impacts	Mitigative measures	Remarks
8. Socio-economic factors				
• Population	Small increase in population.	Direct / indirect job opportunities, secondary services	Employment of local people to the extent possible	No impact
• Education	None	None	Employment of local people to the extent possible	No impact
• Employment	Better employment opportunities. Reduction in water availability in the canals for irrigation purpose.	Operational phase direct & indirect project and social requirements. Diversion of water flow.	Employment of local people to the extent possible. Mandatory flows will be maintained in the canal.	Minor beneficial impact on indirect employment opportunities and no impact on the agriculture related economic activities
• Infrastructure facilities & Community services	Improvement in infrastructure requirements	Operational phase project and social requirements	-	Beneficial
• Population displacement and rehabilitation	None	No displacement of population	-	No impact