

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
TARALI PUMPED STORAGE PROJECT
(1500 MW)
(Sector 1(c); Cat "A")



Executive Summary

Prepared for:

M/s Adani Green Energy Limited (AGEL)

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Laboratory	Baseline Data Monitoring Period
AGSS Analytical and Research Lab (P) Ltd. An ISO-9001 : 2015 Accredited Laboratory (NABL Accredited Testing Laboratory)	Winter (January- 2023) Pre- Monsoon (April- May 2023)

1. INTRODUCTION

The Tarali Pumped Storage Hydro Project (Tarali PSHP) of capacity 1500 MW is proposed at village Dangistewadi Patan taluka of Satara district in Maharashtra. It envisages construction of upper reservoir in Nivade village in Patan Taula of Satara District and use the existing Tarali lake as Lower reservoir in Bamnewadi near Murud Village of Patan Taluka, Satara District. Upper Dam location is about 25km from Patan and is accessible via Chalkewadi Patan Road. Nearest Railway station is Karad which is about 41km from Patan with an all-weather Road. The nearest airport is in Pune. The location of the project is shown in **Figure 1**.

The purpose of the Environment Impact Assessment (EIA) document is to inform the decision-makers and the public of the environmental consequences of implementing a proposed project and therefore an EIA document is considered as a technical tool that identifies, predicts, and analyses impacts on the physical, biological environment, as well as social, cultural, and health impacts.

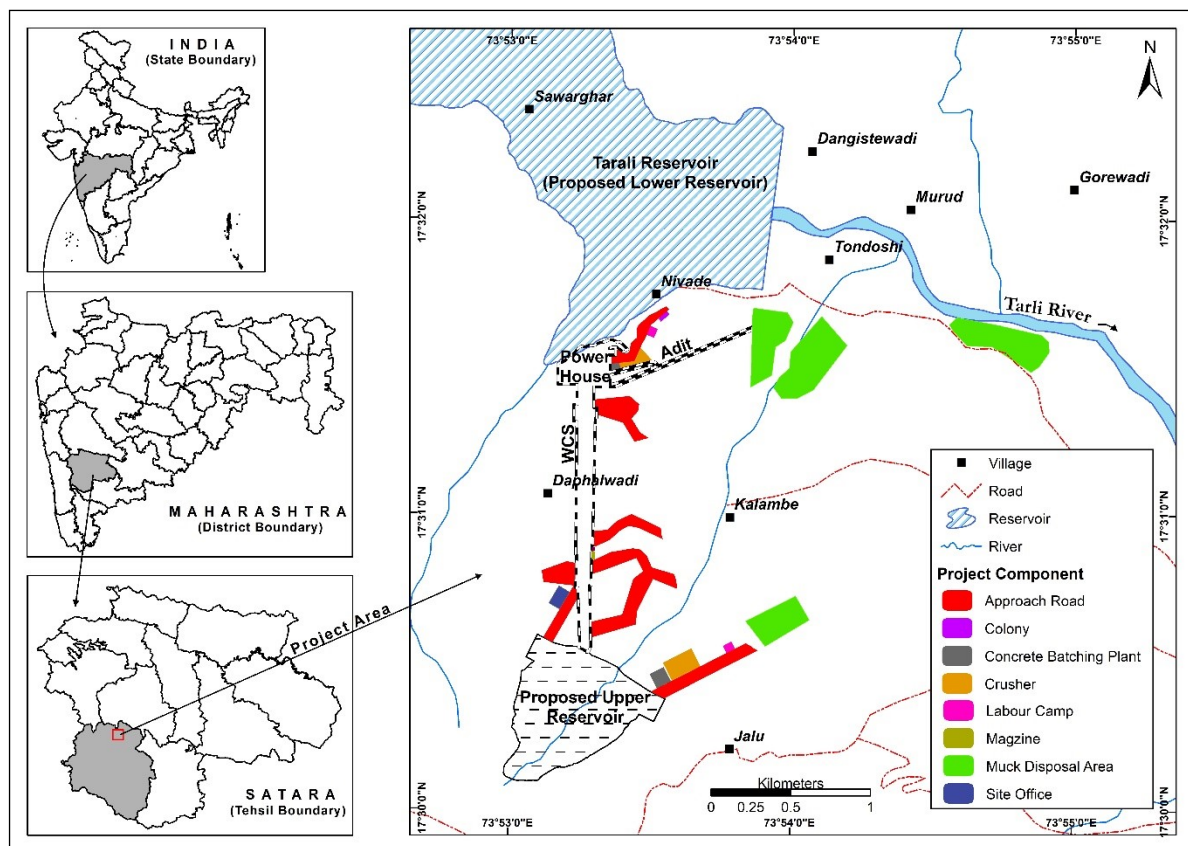


Figure 1: Location Map of Tarali Pumped Storage Project

2. PROJECT DESCRIPTION

Tarali PSH Project is envisaged with a proposed installed capacity of 1500 MW located in the Satara district of Maharashtra. The Tarali Pumped Storage Project will comprise of two reservoirs i.e. Tarali reservoir (already existing) and Upper Reservoir (to be constructed). Proposed Scheme will involve construction of 61.5 m high dam for creation of Tarali PSP Upper Reservoir with 11.36 MCM (0.40TMC) gross storage capacity. 2 nos. of pressure shaft further bifurcated into 5 nos. of independent Penstock will be taking off from Intake structure provided with Trash rack and Gates located in upper reservoir. Pit type Power House will be located on the downstream of the intake structure and shall be equipped with 5 Vertical Reversible Francis type units composed each of generator/motor and a pump/turbine having

generated/pumping capacity of Five units of 300 MW. The total design discharge for the proposed scheme is 90.18 m³/s per turbine with the rated head of 380.43 for larger units.

The proposed Tarali Pumped Storage Project is envisaged with a proposed installed capacity of 1500 MW (300 x 5) located in the Satara district of Maharashtra, is being developed by Adani Green Energy Ltd. It is a standalone scheme with two new off stream reservoirs and drawl of water from existing Pendekallu balancing reservoir for initial filling into the proposed lower reservoir through a pipeline arrangement. Both the reservoirs are planned to be interconnected through water conductor system and the reversible generator pump turbine would be installed in the surface/ pit powerhouse. The scheme is envisaged to meet the peak demand of about 6.47 hours with an estimated annual energy generation of 3365.48 MU.

The salient features is given in **Table 1** and Layout map of proposed Tarali PSP is given at **and Figure 2**.

Table 1: Salient features of Tarali PSP

S. No.	Description	Upper Dam	Lower Dam (existing Tarali Reservoir)
1	LOCATION		
	a) State	Maharashtra	Maharashtra
	b) District	Satara	Satara
	c) Taluka / Village	Jalav, Taluka - Patan	Tondoshi, Taluka - Patan
	d) Latitude	17°30'27.38"N	17°32'00.14"N
	e) Longitude	73°53'19.97"E	73°53'54.11"E
	f) Nearest rail head	Satara, 41 Km from Project Site	Satara, 41 Km from Project Site
	g) Nearest airport	Kolhapur, 123 km from Project Site	Kolhapur, 123 km from Project Site
2	HYDROLOGY		
	a) Catchment Area	1.3 km ²	81.45 km ²
	b) Design Flood	43.0 m ³ /s	1721.03 m ³ /s
	c) Quantity of water required daily for 6.5 hours power generation	10.42 Mm ³	
3	DAMS / RESERVOIRS	Upper	Lower (existing)
	a) Min. operating level MDDL	RL 1060.00 m	RL 675.00 m
	b) MDDL	RL 1060.00 m	RL 649.30 m (existing reservoir)
	c) FRL	RL 1101.00 m	RL 711.30 m
	d) MWL	RL 1102.00 m	RL 711.93 m
	e) Top of Dam	RL 1103.00 m	RL 713.50 m
	f) Live Storage	10.42 Mm ³	165.462 Mm ³
	g) Length of Dam	746.7m	-
	h) Height from deepest riverbed level	61.5m	-
	i) Spillway length	32.0m	-
	j) Spillway crest	1101.0m	-
4	INTAKE	Upper	Lower
	a. Type	Horizontal - 2 Nos.	Horizontal - 5 Nos.
	b. Size	Intake 1- 34.5 m wide & 14.9 m high (Including 3 piers of 1.5m width)	18.0 m wide & 8.7 m high (Including 2 piers of 1.5m width)
		Intake 2- 34.5 m wide & 11.4 m high (Including 3 piers of 1.5m width)	
	c. Trashrack bays	4 Nos. in each intake	3 Nos. in each intake
5	HEADRACE TUNNEL	WCS-1	WCS-2
	a. Number	1 no.	1 no.
	b. Length	500.0 m	542.8 m

S. No.	Description	Upper Dam	Lower Dam (exiting Tarali Reservoir)
	c. Shape	Circular	Circular
	d. Diameter	9.3 m	7.6 m
	e. Lining	Concrete	Concrete
6	SURGE SHAFT	Surge shaft 1	Surge shaft 2
	a. Type	Restricted Orifice	Restricted Orifice
	b. Height	82.0 m	83.90 m
	c. Shape	Circular	Circular
	d. Diameter	15 m	10 m
	e. Top	1117.0m	1117.0m
7	PRESSURE SHAFT		
	Main	Pressure shaft 1	Pressure shaft 2
	a. Number	1 no.	1 no.
	b. Length	1074.50 m	1078.50 m
	c. Shape	Circular	Circular
	d. Diameter	7.6 m	6.2 m
	e. Lining	Steel	Steel
	Unit		
	a. Number	3 nos.	2 nos.
	b. Length	508.0 m	510.0 m
	c. Shape	Circular	Circular
	d. Diameter	4.4 m	4.4 m
	e. Lining	Steel	Steel
8	POWERHOUSE		
	a. Type	Pit type Powerhouse	
	b. Installed Capacity	5 x 300 MW	
	c. Size	161.834 m x 22 m x 34 m (Height from M/C floor to EOT Corbel Top)	
	d. C/L of Unit	RL 634.00 m	
	e. Service Bay level	RL 652.00 m	
9	TAILRACE TUNNEL		
	a. Number	5 nos.	
	b. Length	113.5 m	
	c. Shape	Circular	
	d. Diameter	5.40 m	
	e. Lining	Concrete	
10	ELECTRO-MECHANICAL EQUIPMENT		
	<u>Pump Turbine</u>		
	a. Type	Vertical Reversible Francis Pump Turbine	
	b. Number	Five (5) - Fixed speed units	
	c. Rated Head,	380.43m Generation mode	
		394.33 m Pumping mode	
	d. Rated discharge	90.18 m ³ /s per turbine (Generation mode)	
		78.57 m ³ /s per turbine (Pumping mode)	
	e. Annual average daily hours of generation	6.47 Hours	
	f. Annual average daily hours of pumping	7.45 Hours	
	g. Ratio of length of water conductor system to design head	5.94	
11	ANNUAL POWER		
	a. Annual average generation (95% machine availability)	3365.48 MU	
	b. Annual average pumping (95% machine availability)	4240.24 MU	
	c. Cycle efficiency	79.32%	

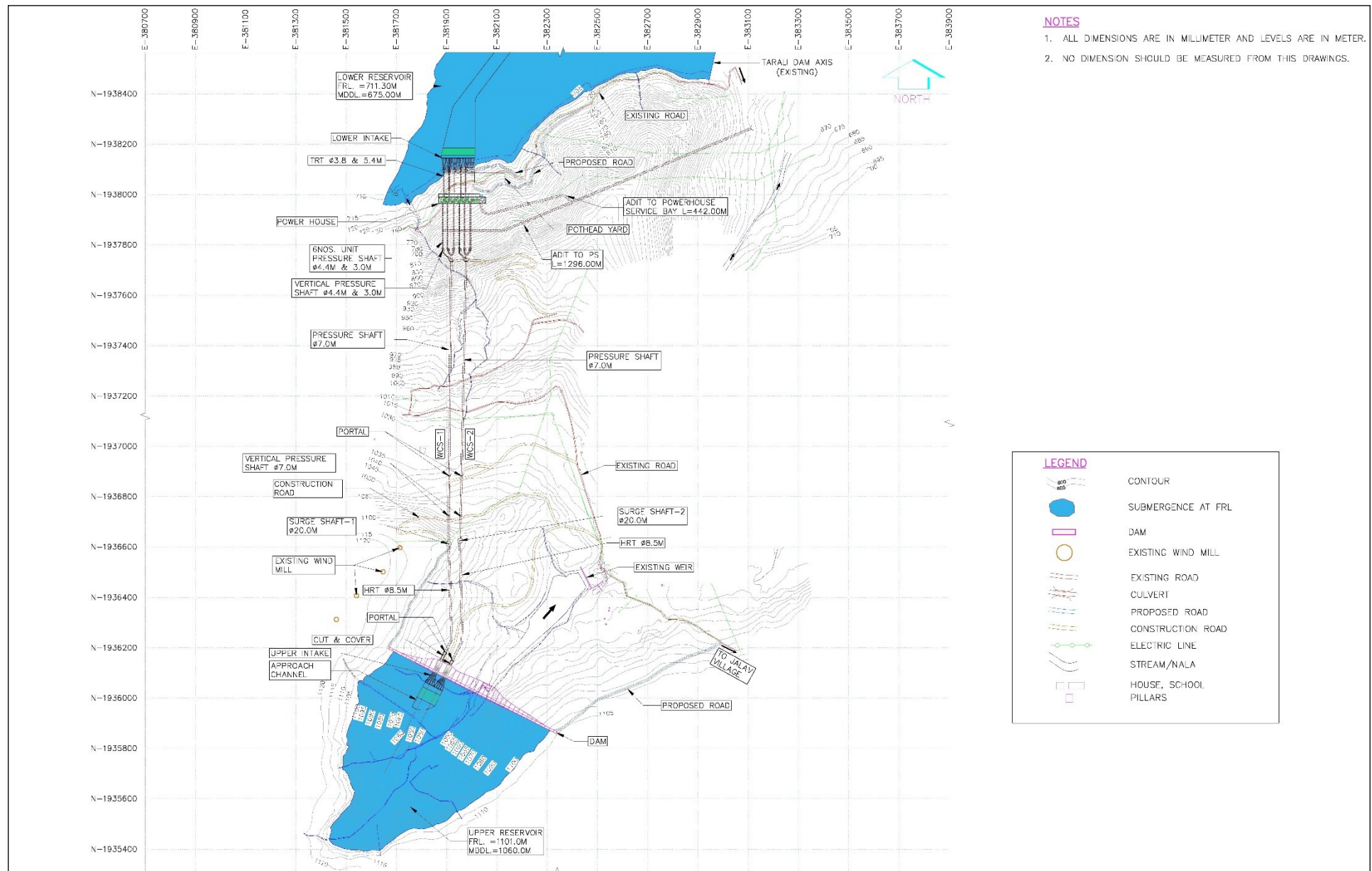


Figure 2: Layout map of Tarali Pumped Storage Project

The proposed project is planned to be completed within the time duration of 36 Calendar months (excluding pre-construction activities) after award of works. The work of tendering, evaluation & award will be carried out expeditiously so that the contractor mobilizes by the start of working period.

2.1 Land Requirement

The total land requirement for Tarali Pumped Storage Project works out to approximately 150.74 ha. Entire land is non-forest land and diversion of forest land is not involved.

Based on studies carried out, the full reservoir level of upper reservoir has been fixed at RL 1101.00 m. The water spread area of upper reservoir at FRL has been found to be about 51.93 Hectares. The land submerged under the upper reservoir area entirely falls within the forest area.

A total of 150.74 hectares of land will be acquired for construction of various components of the project. A total of 51.93 ha of the land is submerged under water and there is no habitation coming in the submergence area. As such no population is affected by the submergence.

3. DESCRIPTION OF THE ENVIRONMENT

Data on the existing environmental parameters in the study area delineated as per the approved Terms of Reference for EIA studies by Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India were collected to understand the present setting of the environment at the project site. A map of the study area prepared based on the above criteria is given in **Figure 3**. The base line status is described briefly in the following sections.

3.1 Physiography

The study area of the proposed project lies between 594 m to 1175 m elevation. about 35% of the project study area lies upto 1000 m elevation band and about 20% of the study area lies in 600 m to 700 m elevation band. Topography is moderately sloping to strongly sloping as about 62% of the area is falling in this category.

3.2 Hydrology

Tarali project is a pumped storage project and hence no consumptive use of water has been envisaged for power generation except some water losses due to evaporation and seepage. The upper reservoir initial filling up to MDDL can be done within 2 years from yield generated from self-catchment area of Reservoir whereas remaining reservoir filling will be done from existing lower reservoir. The annual water requirement for recuperating losses in upper reservoir storage due to evaporation, transit etc. has been estimated to be about 0.46 Mm will be replenished from the self-yield of upper reservoir. The water to be recycled daily between upper and lower reservoirs will be used from existing lower reservoir. Thus, water requirement for the upper reservoir initial filling up to MDDL (one-time) is about 0.94 Mm³ and water required from the existing lower reservoir for operation of PSP is 10.42 Mm³. The annual water requirement for recuperating losses in upper reservoir storage due to evaporation, transit etc. has been estimated to be about 0.46 Mm.

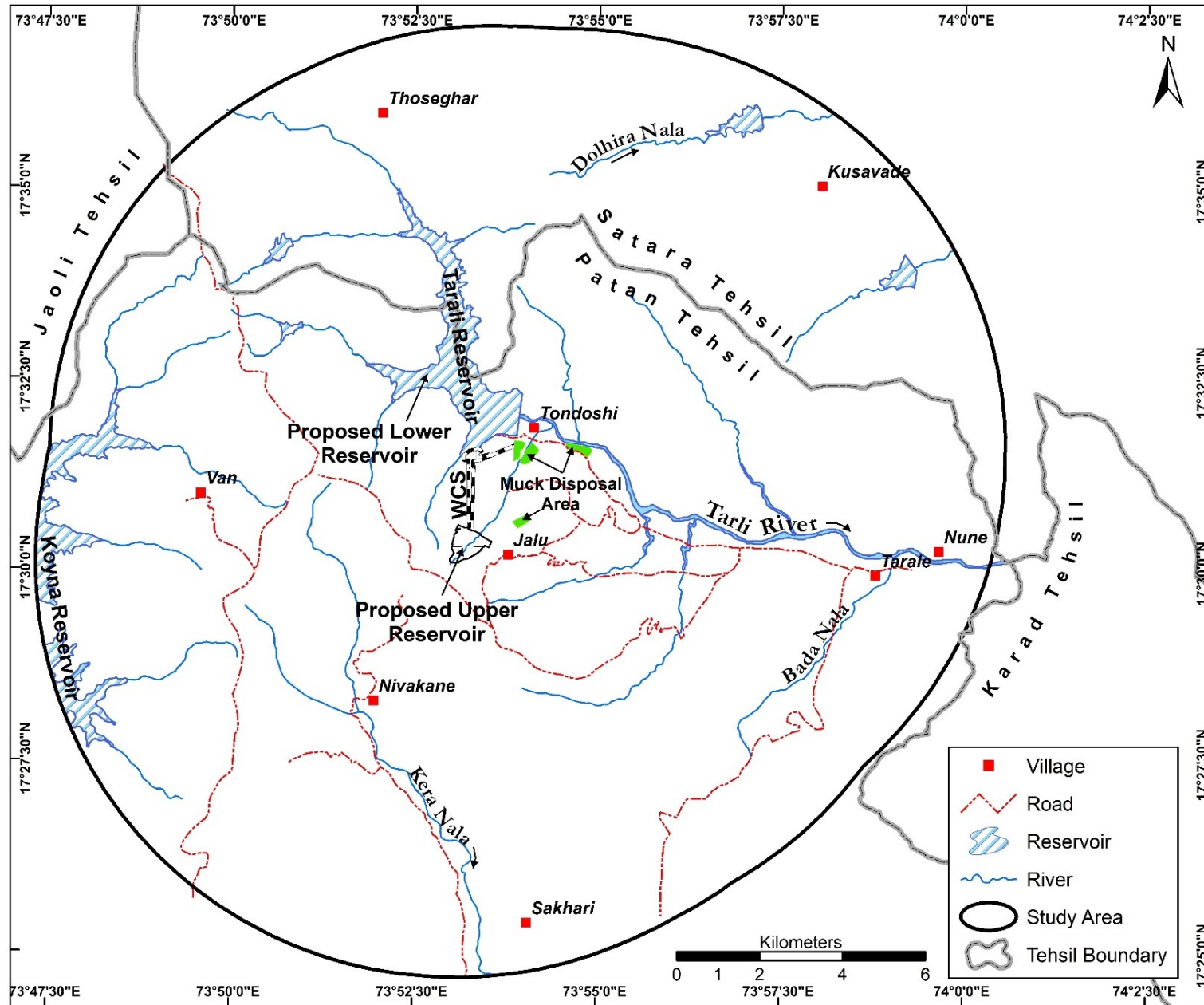


Figure 3.3: Map Showing Study Area

3.3 Geology

Satara district is covered with basaltic and amygdule lava (spreads in the form of horizontal sheets or beds). Deccan trap occupies about 95% of the area of the district. It occurs as basaltic lava flows which are normally horizontal and deposited over wide stretch and give rise to tabular type of topography also known as plateau. These flows occur in layered sequence ranging in thickness from 4 to 66 m. Flows are represented by massive portion at bottom and vesicular portion at top and are separated from each other by marker bole bed. Thickness of weathering varies widely in the district from 5 m to 20 mbgl. The weathered and fractured flows occurring in topographic lows form the main aquifer in the district. Some parts of the district are also rich in Bauxite, which is the chief ore of aluminium. Bauxite is usually associated with lateritic soil, and it is prominent at Yeruli plateau, north of Panchgani.

3.4 Land Use/ Land Cover

In the study area of Tarali PSH Project, scrub land and agriculture constitute a major part of the study area accounting for 30.52% and 24.38%, respectively, of the area. Majority of forest area is comprised of Evergreen/Semi-Evergreen forest which cover 4.65%, while 17.66% of the study area is comprised of Deciduous forest.

3.5 Meteorology

The study area of the project lies in the Satara district, which experiences mostly hot summer and dry climate except in the monsoon season. The average maximum temperature of 36.6°C was recorded during April. The average minimum temperature of 16.8°C was recorded during December. The area receives maximum rainfall during south-west monsoon i.e. between July and October. The Humidity is generally low throughout the year, except during post monsoon month when the average humidity in the study area is close to 30%. The average maximum wind speed of 5.79 m/s is observed during July.

3.6 Soil

Soil of the study area is Clay, Clay Loamy and Loamy. In general, all the physical and chemical soil quality indicators reflect the good quality of the soil. The soil fertility based upon Nutrient Index in terms of NPK shows that Nitrogen is 'Low' and Potassium is 'High,' whereas Phosphorus is having 'Low' to 'Medium' Nutrient Index.

3.7 Ambient Air and Noise Quality

The Ambient Air Quality monitoring was carried out conforming to the National Ambient Air Quality Standards for Industrial, Residential, Rural & Other Areas and Ecologically Sensitive Areas. Penna Cement Factory located adjacent to the proposed project area and traffic movement is the source of air pollution in the area. However, the concentrations of PM_{2.5}, PM₁₀, SO₂, and NO₂ at all the sites were well within the Residential & Rural area permissible limits prescribed by National Ambient Air Quality Standard 2009 notified by CPCB.

The results of monitoring show that PM_{2.5}, PM₁₀, SO₂, and NO₂ levels at all the sites are well within the Residential & Rural area permissible limits prescribed by National Ambient Air Quality Standard 2009 notified by CPCB. Air quality was also assessed using 24h averages of PM_{2.5}, PM₁₀, SO₂, and NO₂ levels in the AQI calculator of CPCB and calculated AQI values shows the AQI values fall under 'Satisfactory' and 'Good' category in the study area.

3.8 Water Quality

The data on water quality has been collected to evaluate surface and ground water quality in study area.

Surface water

- Surface water quality of sample collected from Site SW3/ Tarali River near Dhamakwadi Village and SW4/ Existing Lower Reservoir samples fall under Class 'A' with Drinking-Water Source without conventional treatment but after disinfection.
- SW1/ Stream near Khivashi Village and SW2/ Stream near Proposed Upper Reservoir Sample fall under Class 'B' i.e; designated best use of outdoor bathing (organized). This is due to total coliform less than 500 MPN/100 ml, DO of more than 5 mg/l and BOD less than 3 mg/l.
- Based upon CPCB guidelines as well the WQI calculated above the water in the study area lies in 'Good' category.

Groundwater

- According to BIS standards for Drinking Water (2012), all the Groundwater samples collected from the study area fall within permissible limits of the same.
- According to DWQI all the samples of groundwater fall in 'Excellent' to 'Good' water quality class.
- In general, Groundwater is under 'Moderately Hard Water' to 'Very Hard' category and water from hand pumps or bore wells can be fit for drinking after conventional treatment.

3.9 Floristic Diversity

The project area falls in the Satara Forest Division under Maharashtra Forest Department. As seen from the land use map of the study area, a large part of the vegetation is comprised of forests especially in the surrounding of proposed project components. These forests in the study area can be classified following the 'A Revised Survey of the Forest Types of India' by Champion and Seth (1968) and fall Group 2: Tropical Semi-evergreen Forest and Group 5: Tropical Dry Deciduous.

During field surveys 104 species of angiosperm was recorded from the study area. The detail inventory of plant species reported from the study area has been done based on primary survey and same has been supplemented with available secondary data. A list of 250 species of angiosperm plants, belonging 70 families, was compiled which includes plant species growing in forested areas, scrub land, near agricultural fields and settlements, abandoned land, etc. This list includes 112 species of trees, 44 species of shrubs, 40 species of herbs, 30 species of climbers and 24 species of grasses. Most of the vegetation is found mainly in the forest area. Fabaceae was found to be the most dominant family with 36 plant species, which was followed by Poaceae (23 species), Lamiaceae (14 species), Rubiaceae (12 species), Combretaceae (11) and Malvaceae (10).

As per the Red list of Indian Plants published by Botanical Survey of India, no Endemic or RET species among was recorded from the study area. As per the IUCN Red List of Threatened Species Version. 2022-2, 2 plant species viz. *Tectona grandis* and *Syzygium zeylanicum* are

listed under Endangered (EN) category, *Strobilanthes ciliata*, *Garcinia indica*, *Actinodaphne hookeri*, *Dalbergia latifolia* and *Santalum album* under Vulnerable (VU) category and *Dalbergia horrida*, *Pterocarpus marsupium* and *Aegle marmelos* are listed under Near Threatened (NT) category of IUCN ver. 2022-2. While other species are listed either under the Least Concern (LC) or Data deficient (DD) category.

3.10 Faunal Diversity

Mammals: The sighting of mammals in the project area is quite rare. Bonnet Macaque (*Macaca radiata*) and Northern Plain Gray Langur (*Semnopithecus entellus*) were the only mammalian species spotted in the study area. Based on field survey and information collected from villagers and forest working plan, a list of 20 species of mammals reported from the study area of proposed project was compiled.

Avifauna: A total of 33 species of bird species 5 Order were recorded during the field survey from the study area. Commonly found birds like White-eyed Buzzard, White-breasted Kingfisher, Asian Green Bee-eater, Red-wattled Lapwing, Common Sandpiper, Western Koel, Rock Dove, Greater Coucal, Asian Woolly-necked Stork, Long-tailed Shrike, Common Stonechat, House Sparrow, Black Drongo, Common Myna, White-throated Fantail, Brahminy Starling, Red-vented Bulbul, Blue Rock-thrush, Large-billed Crow, Pied Bushchat, Wire-tailed Swallow, Indian Pond Heron, Little Egret, White-cheeked barbet and Little Cormorant etc. are most frequently sighted bird species in the study area.

Herpetofauna: During the surveys, no reptile and amphibian species were sighted during the survey. After consulting from the concerned forest working plan and local people, a list of 14 species of reptiles and 4 species of amphibians has been prepared.

Butterflies: The area is rich in the diversity and density of butterflies. During survey, 4 species of Nymphalidae family, and 1 species of Papilionidae family, were sighted during the field survey.

Conservation Status

According to Wildlife Protection Amendment Act, 2022, 12 species of mammals, two species of bird (White-eye Buzzard and Indian Peafowl), 05 species of herpetofauna (Bengal Monitor Lizard, Asian Chameleon, Indian rat Snake, Indian Cobra and Russel's Viper) are under Schedule I.

As per the IUCN Red List of Threatened Species, Version 2022-2, Indian Pangolin is listed under Endangered (EN) category, whereas Common Leopard, Sloth Bear, Four-horned Antelope, Sambar Deer, Indian Bison and Bonnet Macaque under Vulnerable (VU) category and Striped Hyaena is listed under Near Threatened (NT) category. Asian Woolly-necked Stork is listed under Near Threatened (NT) category. All other birds have been listed under Least Concern (LC) category. Bengal Monitor Lizard is listed under Near Threatened (NT) category. All other herpetofauna species are listed under Least Concern (LC) category.

Fish: For the documentation of fish fauna in the project area, experimental fishing was carried out in Tarali river. No fish species was captured during the survey. Owing to the lack of secondary literature on the fish diversity of Tarali river in the study area, the data on fish fauna was documented with the help of information collected through public consultation

and secondary literature by Pradnya et al (2020) and Patil & Gujar (2015), who have documented the fish species from Krishna River and its tributaries flowing in Satara District. According to this list, 20 species are reported in the study area.

3.11 Proximity to Protected Area

No project component falls in any notified protected area. The nearest protected area to the project components is Sahyadri Tiger Reserve and Koyna Wildlife Sanctuary, which is at a distance of 1.5 km and 3.2 km. All the project components are outside the notified ESZs of Sahyadri Tiger Reserve and Koyna Wildlife Sanctuary.

3.12 Social Environment

The Tarali PSH project (1500 MW) is proposed to be developed is located near near Dangistewadi village, Patan Taluka of Satara District of Maharashtra. It envisages construction of upper reservoir in Nivade village in Patan Taula of Satara District and use the existing Tarali lake as Lower reservoir in Bamnewadi near Murud Village of Patan Taluka, Satara District. The entire study area falls under Satara district. All project components as well as the entire study area fall under Patan and Satara tehsils in Satara district. There are 97 villages in the study area. Out of 97 villages, 75 are in Patan tehsil, and 22 are in Satara tehsil.

The total population of the study area is 74765, with 36357 (48.62%) males and 38408 (51.37%) females. The sex ratio was found to be 1056 females per 1000 males. There are 4942 scheduled castes in the study area, accounting for 6.61% of the total population. There are 543 scheduled tribes in total, accounting for 0.72% of the total population.

The literacy rate in the project area villages is 75.37% (of the total population above 6 Year). As per the 2011 census, out of a total of 36824 workers in the study area, 80.08% of the working population are engaged in agriculture and allied services, out of which 58.80% are cultivators and 21.28% are agricultural laborers. Only a small percentage of the population engaged in household industry 3.42%, and 16.49% of the population engaged in other services, viz., trade, commerce, business, transport, government, and private jobs.

Educational facilities play an important role in the overall development of an area. These facilities enhance economic growth and employment. There are a total of 341 educational institutions, both government and private, in the villages. There are 5 primary health centres and 17 primary health sub-centres in the study area. 3 villages have dispensaries. In the study area, there are five villages with family welfare centers and maternity & child welfare centers. 4 villages have an allopathic hospital. 3 villages have Veterinary hospitals.

Tap water, handpump and wells are the major source of drinking water. The locals also use spring and river water in addition to this.

The area was connected by a walkway, paved road, and gravel road. Whereas 78 villages are connected by black-topped/paved/pucca roads, 83 villages are connected by gravel roads, and nearly all of them are equipped with footpaths. post/sub post office services are available in all the villages. There are 29 Post/Sup-Post offices available in the study area. There are 11 Commercial/Co-Operative banks, 24 Agricultural Societies and 60 Self Help Groups available in the study area villages.

Socio-Economic Profile of the Project Affected Villages

Due to project construction, 3 villages, i.e., **Kalambe, Nivade, and Tondoshi**, are directly or indirectly affected by the project activities of the proposed project component of Tarali PSP. The affected villages come under Patan tehsil in Satara district. By the project, the landowner family may be losing part of their total land; none of the landowners is losing any house or any other assets such as borewells, cattle sheds, trees, etc. None of the landowner's family is displaced due to the proposed project. The socio-economic profile of these villages is discussed in the following text based on field survey and secondary source.

In the villages, the total population is 1450. It could be observed that the scheduled cast population in the villages is about 9.61. There is no scheduled tribe population in the villages. The sex ratio in the villages is observed to be 993 females per 1000 males. The literacy rate in the villages is 76.95% (above the 6-year-old population), with males and females having rates of 87.81% and 67.11%, respectively.

As per the survey, agriculture is the main activity in the project-affected families, but it is mostly dependent on rain and nearby river water. The few farmers have wells on their farms through which they can reap two crops. Major crops in the area are rice, sugarcane, kharif and rabi jower, ground nuts, wheat, etc. Few people go to the district's industries to work as laborers. Livestock play a significant role in farming activities in the project area. Most of the households keep hens, followed by goats and buffaloes. Animal sales and animal products were reported as an income source for the villages.

It was noted that there are some good educational institutions in the villages. Two villages, Kalambe and Nivade, have primary schools, while one village, Kalambe, has a middle school. In Kalambe village, secondary education is provided. For secondary education, the remaining village students travel to Kalambe village, which is around 5 kilometers away from the villages. **Kalambe village** has one primary health center. The settlements lack access to medical facilities, dispensaries, and community health centers. Villagers rely on the district-level hospital in Satara town as the primary government hospital

3.13 Historical, Religious and Archaeological Importance Places

There is a tourist place near the Tondoshi village named Taral Dam where people from the district and outside the district come to visit. In nearby project area there is an old temple called Jalav Jyotiba Temple, located at Jalu village, where people from all around come to this temple.

There are no significant sites bearing archaeological or heritage importance in the project area, and they are also not within the study area that will be impacted by the proposed project. Each village in the study area has some cultural sites or sites of religious significance, like temples, mosques, graveyards, etc. There are several religious temples and tourist places situated in the Satara district, namely Bhambavli Vajrai Waterfall, Bhambavli Flower Valley, Mahabaleshwar, Pratapgad, etc.

4. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 Ambient Air Quality

Construction Phase Impacts: The air environment around project site is free from any significant pollution source at present. The sources and activities that might affect air quality in the project area during construction phase are vehicular traffic, material handling and storage, dust arising from unpaved village roads, construction activities including operation of construction plant and machinery and domestic fuel burning.

Additionally, construction activities including operation of crushers, concrete batch plants, construction work and movement of vehicles along unpaved road will generate dust & gaseous emission and impact air quality. The burning of waste will also affect air quality. In absence of proper fuel, construction workers at the project site may use wood for fuel burning and space heating. This will also impact air quality. Therefore, needs to be managed properly.

Operation Phase Impacts: In pumped storage projects, no impacts are envisaged on air environment during operation phase.

4.2 Noise Environment

Construction Phase Impacts: Noise in and around the construction site may affect the wildlife in the nearby areas. Sources of noise will be increased vehicular traffic due to project construction on approach roads and at construction sites. Due to construction activity in the area, noise levels will increase during the period of construction, however, they will remain limited to the work area. Other sources of noise and vibration will be the operation of various equipment and use of explosives for blasting purposes for construction activities.

Operation Phase Impacts: No major impacts are envisaged on noise environment during project operation phase.

4.3 Water Environment

Construction Phase Impacts: Water is used in construction activities leading to wastewater generation with high suspended solids. Similarly, effluents due to washing from truck or equipment etc. would have high concentration of oil and grease. Assessment of quantum of wastewater from such activities is difficult, however, they can impact the nearby water bodies if surface run off with high suspended solid is discharged into them.

Domestic wastewater will be generated from project and worker's colony to be set up during construction phase, which can find its way to river/ ground water without any treatment will cause significant impact on water environment therefore needs to be managed properly.

Operation Phase Impacts: The Tarali PSP will comprise of two reservoirs, of which lower reservoir is an existing Tarali reservoir which is already constructed as part of Irrigation Project by Water Resource Department (WRD), Maharashtra, whereas Upper Reservoir (UR) is proposed to be newly constructed. The water will remain in circulation from Upper Reservoir to existing Tarali reservoir during power generation and pumped up during non-generation hours on daily basis. Therefore, no direct impact on natural water bodies during operation is envisaged.

4.4 Land Environment

Construction Phase: The following positive impacts are anticipated on Land environment during construction phase

- **Impact due to Land Requirement and change in land-use:** Major impact of land acquisition is permanent change of land use, which is irreversible impact. These impacts cannot be mitigated; however, compensation in terms of implementation of Compensatory Afforestation Plan, Biodiversity Conservation Plan, Green Belt Development Plan, etc. will help in managing and reducing the magnitude of such impacts.
- **Impact Due to Muck Generation:** Muck generation, transportation and disposal can significantly impact the land environment, if not managed properly.
- **Impact due to Waste Generation:** The main sources of waste generation can be categorized as:
 - i. Municipal waste (includes commercial and residential wastes, excluding industrial hazardous wastes and bio-medical wastes)
 - ii. Construction and demolition debris (C&D waste)
 - iii. Bio-medical waste
 - iv. Hazardous waste (generated from construction machinery and equipment)
 - v. e-Waste (computer parts, Printer cartridges, electronic parts, etc.,).
- **Impacts due to Road Construction:** The impacts likely to accrued because of the construction of the roads and widening of roads due to loss of vegetation and geological changes.

4.5 Impacts on Forests and Forest Land

For the development of Tarali PSP, land would be acquired for construction of project components, reservoir area, muck dumping, construction camps and colony, etc. Based on the project layout, land requirement has been worked out as 150.74 ha. Entire land is non-forest land; hence no impact of forest or forest land is envisaged. However, considering the dependency of villagers on natural resources in the area, Biodiversity Conservation and Wildlife Management Plan has been suggested in Environmental Management Plan of proposed Tarali PSP.

4.6 Flora and Fauna

Construction Phase

Impact on Terrestrial Flora: Major impact on the flora in and around the project area would be due to increased level of human interferences. Although entire area required for the project is non-forest category, however the construction activities have impact on vegetation cover around the project area. Workers and other population groups residing in the area may use fuel wood, if no alternate fuel is provided. It is necessary to provide alternative fuel, training and awareness, community kitchens, fencing of critical areas, maintain cooking fuel supply and adequate surveillance to mitigate the adverse impacts on terrestrial flora during project construction phase.

Impact on Terrestrial Fauna: Loss of forest cover leads to loss of wildlife habitat. Also, during the construction period, large number of machinery and construction workers shall be mobilized, which may create disturbance to wildlife habitat in the vicinity of project area, however, these will be temporary and last during the construction period. To minimize the impact of wildlife habitat around the project area, Biodiversity Conservation and Wildlife

Management Plan, including conservation Plan of Schedule-I species has been proposed in Environmental Management Plan.

Operation Phase

On completion of the construction of the project, the land used for construction activities will be restored. Construction workers who have resided in that area will move out of the project area. Operation phase impacts on flora and fauna will be positive due to green belt development, restoration of construction areas, etc. Increase of greenery in the area and creation of reservoir will have positive impact on faunal species.

4.7 Socio-Economic Environment

A project of this magnitude is likely to entail both positive as well as negative impacts on the socio-cultural fabric of area. No private land will be acquired for project. Therefore, project have not any negative impact on livelihood and agricultural land due to construction of project.

a) Positive Impacts on Socio-Economic Environment

The following positive impacts are anticipated on the socio-economic environment of the villages in vicinity of project area during the project construction and operation phases:

- i) A number of marginal activities and jobs opportunities with employment with contractors, new market ventures, etc. would be available to the locals during construction phase.
- ii) Developer bringing large scale investment to the area will also invest in local area development and will benefit the locals. Education, medical, transportation, road network and other infrastructure will improve.
- iii) The availability of alternative resources provided by developer in the rural areas will reduce the dependence of the locals on natural resources such as forest.

b) Negative Impacts on Socio-Economic Environment

In addition to positive impact on socio-economic environment development of such project also bring certain negative impact due to influx of outside population. This influx of people in otherwise isolated area may lead to various social and cultural conflicts during the construction stage. Developers need to take help of local leaders, Panchayat and NGOs to ensure minimum impact on this count.

Villagers in the area also depend on natural resources for fuelwood and fodder. Scrub forest in the area also used as grazing land for livestock's. Loss of forest and grazing land have impact on social environment of the area. Loss of natural habitat will also lead to human wildlife conflict by means of damage of agriculture crops, fruit orchards and loss of livestock's.

These impacts can be mitigated by implementing interventions proposed under biodiversity conservation and wildlife management plan along with green belt development plan and awareness programmes.

5. MITIGATION MEASURES FOR AIR, WATER AND NOISE POLLUTION

The proposed project involves construction of dam, powerhouse, reservoir, roads, and other associated infrastructure in a period of 3 years. Major construction activities have potential of pollution generation as discussed above. Impacts arising out of construction activities can be mitigated significantly by taking appropriate mitigation measures, as discussed below.

Control of Air Pollution: For the control of air pollution during construction phase of the project, it is suggested that it should be made mandatory for the contractor/s engaged in the construction works to ensure the implementation of pollution control measures as per CPCB guidelines with regular monitoring of ambient air quality in the project area. Vehicles should have valid PUC and all project roads should be metalled.

Control of Noise Pollution:

- Diesel Generator sets are to be placed in acoustic enclosures to reduce the noise.
- Proper and regular maintenance/lubrication of machines should be done.
- Noise producing machines (such as crushers, aggregate processing plants, etc.) should be provided with sound barriers.
- Quieter machines and vehicles with high quality silencers should be used.
- Ambient noise should be monitored periodically at different locations.

Control of Water Pollution:

- Provision of septic tank/ soak pit of adequate capacity for labour camp.
- Commission of suitable treatment facilities to treat the sewage generated from the colony & offices.
- Oil interceptors/ catchers will be provided and residue of petroleum products, batteries, e-wastes, etc. will be disposed in accordance with SPCB guidelines.
- Provision of sedimentation cum grease traps to prevent entry of contaminants to the water bodies.

A lump sum budget of **Rs. 15.0 lakh** per annum for period of 3 years has been proposed for the mitigation measures for control of air, noise and water pollution during project construction phase.

6. ENVIRONMENTAL MONITORING PROGRAMME

Environmental Monitoring shall be performed during all stages of the project (namely: construction and operation) to ensure that the impacts are no greater than predicted, and to verify the impact predictions.

The monitoring will be carried out by an NABL accredited laboratory for a period of 3 years during the project construction phase or extended if the project construction period gets extended. The monitoring program for the proposed project will be undertaken to meet the following objectives:

- To monitor the environmental conditions of the project area and nearby villages.
- To check on whether mitigation and benefit enhancement measures have actually been adopted and are proving effective in practice.

A total of **Rs. 116.32 lakh** have been allocated to implement various activities envisaged under the Environmental Monitoring Programme.

7. Resettlement & Rehabilitation Plan

For the development of Trali PSP, land requirement has been worked out as 150.745 ha. Entire land is non-forest land and diversion of forest land is not involved.

The entire private land identified for the project falls in two revenue villages namely Kalambe, Nivade, and Tondoshi villages of Patan Taluka of Satara District of Maharashtra. The private land identified for the projects belongs to landowner families who will be losing their partial agricultural land holding and none of the families will be losing any house or any other assets. None of them is getting displaced due to the project from the above land procurement. Private land identified for the project will be acquired as per **Section 2 and Part (a) of Sub-Section 3** of The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (RFCTLARR), 2013.

8. Local Area Development Fund

The aim of Local Area Development Activities is focused sustainable development to improve the quality of life of neighborhood communities through equitable and proactive smart initiatives in spheres of education, health, rural development, environment, and livelihoods resulting in improvement of the overall social and economic conditions of locals as well as improvement of environmental conditions of their surroundings.

Based on the local consultations in project affected villages, the focus areas covering many important components of the sustainable development such as social, economic, livelihoods and environment will be identified and set of development activities shall be proposed under each focus area for the benefit of the local people under the Project. An amount of **Rs. 10.00 crore** has been earmarked for local area development activities.

9. PROJECT BENEFITS

Employment Generation: Tarali PSP Project is planned to be completed in 36 Calendar months (excluding pre-construction activities), at the time of peak construction work in the project, around 1000 persons may be engaged. Out of 1000 nos., about 70% will be from the local population/surrounding Villages and balance persons will be skilled/ semiskilled from other area.

In addition, the project would lead to creation of direct and indirect employment opportunities as new factories would come up in and around the project due to reliable power supply/availability, contract works for the locals during construction and operation phase, etc.

Local Area Development: Total project cost is Rs 5675 crore; an investment of this magnitude in the area will improve the local infrastructure in the region. An amount of Rs. 10.00 crore has been earmarked for local area development with a view to improve the quality of life of local residents in the project vicinity. They will have opportunities of skill development, education, better medical and health care, improved local infrastructure, etc.

10. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Pollution generation mainly during construction phase will be in the form of air, water and noise pollution, which will be mitigated by adopting various mitigation measures and implementation of environment management plans.

The project level Environment Monitoring Cell (EMC) would coordinate with stakeholders for effective implementation of all environmental safeguard measures prescribed in the EMP & environment and forest clearance letters.

10.1 Catchment Area Treatment Plan

The Catchment Area Treatment (CAT) plan highlights the management techniques to control erosion in the catchment area of a water resource project. The life span of a reservoir is greatly reduced due to erosion in the catchment area. Adequate preventive measures are thus needed for the treatment of catchment for its stabilization against future erosion.

Both Upper and Lower reservoirs are proposed to be constructed on multiple streams which further downstream merges and is known as Pedda Vanka, a left tributary of Penneru River. The catchment area of these streams at the dam of both the reservoirs is **1.18 sq km**.

In view of above, in the present study CAT Plan has been prepared for the catchment of the lower dam only. The catchment area treatment involves:

- Understanding of the erosion characteristics of the terrain and,
- Suggesting remedial measures to reduce the erosion rate.

The estimated cost of implementation of Catchment Area Treatment Plan is **Rs. 1.15 lakh**.

10.2 Compensatory Afforestation Plan and Net Present Value

Since there is no requirement of any forest land diversion for construction of various components, therefore the requirement of preparation of Compensatory Afforestation Plan is not applicable in the present case.

10.3 Biodiversity Conservation & Wildlife Management Plan

Keeping in view of the anticipated impacts of proposed project on the biodiversity of area, the mitigation measures suggested for biodiversity conservation and wildlife management plan and conservation of Schedule-I species are as follows:

- i. Wildlife Habitat Preservation & Improvement
- ii. Establishment of Eco Park
- iii. Biological fencing
- iv. Prevention and Control of Forest Fire
- v. Development of Grazing land/ Pastures
- vi. Awareness promotion
- vii. Strengthening of Infrastructural Facilities of Forest Department
- viii. Biodiversity Management Committee (BMC)

The estimated cost of implementation of various activities envisaged in the Biodiversity Conservation and Management Plan would be **Rs. 257.50 lakh**.

10.4 Fisheries Development Plan

Fishing is one of the occupations under the allied sector of Agriculture of the district. The proposed Tarali Pumped Storage project is Off-stream Open loop Project. The proposed project has not any significant impact on habitat of fish fauna. Considering the fact that fisheries as an important source of income for the people in the area, the Fisheries management has been proposed under this plan. Proposed Fisheries Development Plan has been prepared with the following objectives:

- Conservation, Management and Stocking by Enrichment of riverine fish fauna
- Strengthen of fishing techniques and skills of fishermen/ women societies
- Upgradation of existing Govt. Fish farms.

The total budget for implementation of Fisheries Development Plan has been proposed as **Rs. 89.00 lakh.**

10.5 Muck Management Plan

The construction would involve about 36,69,903 cum soil and rock. About 29,89,569 cum of soil & rock excavation is expected to be used for producing coarse and fine aggregate for concrete production and in fillings for developing areas for construction facilities. After considering swelling factor, the total quantity of muck to be disposed is worked out as **8,19,680 cum.**

Keeping the above requirement and topography of the area, two dumping sites have been identified covering an area of 35.0 ha area with a total capacity of 17,77,530 cum muck. The estimated cost of the relocation and rehabilitation of excavated material will be **Rs. 1708.75 lakh.**

10.6 Landscaping and Restoration of Construction Sites

During construction phase of the project, number of temporary construction sites and working areas will come up. For the restoration of proposed project affected areas to its original landscape as much as possible and retain its aesthetic values. Various engineering and biological measures will be implemented for the restoration of proposed project affected areas. The estimated cost of restoration of construction is **347.84 lakh.**

10.7 Sanitation and Solid Waste Management

Solid waste generated from temporary and permanent colonies in construction as well as operation phase requires special management for disposal. The project authorities will ensure sewage generated from labour colonies and site office is treated and disposed as per the CPCB guidelines. It is proposed to provide adequate septic tanks with soak pits for treatment and disposal of sewage. Various aspects of solid waste management include:

- Reuse/Recycling
- Storage/Segregation
- Collection and Transportation
- Disposal

The waste generated from the project area will be collected, segregated and disposed off in line with the provisions laid down in Solid Waste Management Rules, 2016. The total budget in order to manage the solid waste generated from this population, has been proposed as **Rs. 270.0 lakh**.

10.8 Public Health Delivery System

Project construction and operation will bring about several changes in the socio-economic environment of the area including increased threats to health of the community.

- i. New Diseases due to Migratory Population
- ii. Chances of increase in water borne diseases as malaria, and dengue are high
- iii. Chances of increase in respiratory troubles due to increase in suspended particles during the construction phase.
- iv. Chances of occurrence of gastroenteritis, cholera and typhoid in the labour camps.

Medical services at secondary level play a vital and complimentary role to the tertiary and primary health care systems and together form a comprehensive district-based health care system. Following activities are proposed:

- Ambulance: 2 no. with all the basic Medicare facilities and small DG set, etc. to cater for villages in the project area.
- Budget for running the ambulances including driver, fuel and maintenance for 4 years.
- First aid posts (02 nos.) including sheds, furniture and basic equipment.
- Budget for running the first aid post including cost of medico, para-medico/Nurses and attendant, consumables, etc. for 4 years.
- Budget for strengthening existing medical facilities.
- Budget for Health Awareness/ Vaccination Camps for 4 years.
- Mitigation measures to avoid spread of infectious diseases among workforce

Budgetary estimates for public health delivery system to be implemented have been worked out as **Rs. 223.00 lakh**.

10.9 Energy Conservation Measures

The existing facilities will become insufficient for supply of kitchen fuel for the migrant population during the construction of the project. Therefore, the project authorities would make adequate arrangements such as Community kitchen, Supply of Kitchen fuel, efficient cooking facilities and solar lantern either directly by developer or through contractor to reduce the pressure on natural resources in the project area and minimize impacts on this count. A total budget of **Rs. 223.00 lakh** have been proposed under the Energy Conservation Plan.

10.10 Labour Management Plan for their Health and Safety

Construction work has many associated risks and health impacts for the workers who are directly exposed to such health and safety risks. Therefore, there is a need to prepare complete health and safety documents for workers either by project proponent/contractor and proponent shall ensure its implementation. A detailed plan will be prepared covering the above activities before start of construction work. A tentative budget of **Rs. 67.0 lakh** for labour management have been proposed under EMP.

10.11 Green Belt Development Plan

Green belt development will comprise of plantations at various places like periphery of alongside roads, powerhouse area and at different project offices and colonies. The green belt helps to provide habitat for faunal species and capture the fugitive emission and to attenuate the noise generated apart from improving the aesthetics environment in the area. The estimated cost for the plantations and creation of green belt around colony and working sites would be **Rs. 31.90 lakh.**

10.12 Disaster Management Plan

In order to visualize the worst-case scenario Dam Break Modeling exercise was undertaken and an inundation map was prepared. Based upon the outputs generated from this modeling, a Disaster Management Plan has been formulated. This plan presents warning and notification procedures to be followed in case of failure or potential failure of the embankments. The purpose is to provide timely warning to the population likely to be affected and alert key people who have to take respective actions in case of an emergency. The estimated total cost of execution of disaster management plan including the equipment would be **Rs. 400.00 lakhs.**

11. SUMMARY OF COST

The capital and recurring costs involved for implementation of the Environmental Management Plan for Tarali Pumped Storage Project is summarized in **Table 3.**

Table 2: Cost for Implementing Environmental Management Plan

S. No.	Component of EMP	Capital Cost	Recurring Cost (Rs. in lakh)					Total Cost (Rs. in lakh)
		(Rs. in lakh)	Year 1	Year 2	Year 3	Year 4	Year 5	
1	Catchment Area Treatment Plan	1.15	00.00	00.00	00.00	00.00	00.00	1.15
2	Compensatory Afforestation and NPV*	0	00.00	00.00	00.00	00.00	00.00	0.00
3	Biodiversity Conservation & Wildlife Conservation Plan	257.5	00.00	00.00	00.00	00.00	00.00	257.50
4	Fisheries Development Plan	89	00.00	00.00	00.00	00.00	00.00	89.00
5	Muck Dumping and Management Plan	100	320.25	282.5	540.5	465.5	0	1708.75
6	Landscaping, Restoration of Construction Sites	20	86.34	95.6	85.4	60.5	0	347.84
7	Sanitation and Solid Waste Management Plan	167	34	34	30	0	5	270.00
8	Public Health Delivery System	60	54.5	54.5	54	0	0	223.00
9	Energy Conservation Measures	40	61	61	61	0	0	223.00
10	Labour Management Plan	15	17.5	17.5	17	0	0	67.00
11	Green Belt Development Plan	2.4	1	5	12	7.15	4.35	31.90
12	Pollution Mitigation Measures		15	15	15	0	0	45.00
13	Environmental Monitoring Program	0	38.77	38.77	38.78	0	0	116.32
14	Rehabilitation and Resettlement Plan**	0	0	0	0	0	0	0.00
15	Local Area Development Plan	1000	00.00	00.00	00.00	00.00	00.00	1000.00
16	Disaster Management Plan	275	42	41.5	41.5			400.00
	Total	2027.05	670.36	645.37	895.18	533.15	9.35	4780.46

* No diversion of forest land is required for proposed project.

** Rehabilitation and Resettlement Plan: No private land will be acquired for the proposed project.