ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

BHIVPURI OFF-STREAM OPEN LOOP

PUMPED STORAGE PROJECT (1000 MW)

(Sector 1(c); Cat "A")

Executive Summary

Februauy, 2024

Prepared for:

M/s The Tata Power Co. Ltd.

Prepared by:

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AGSS Analytical and Research Lab (P) Ltd.	NABL Accredited Certificate No. TC-12115
Baseline Data Monitoring Period	Pre-Monsoon (April-May 2023) Winter (December 2023)

1. INTRODUCTION

Tata Power plans to explore the possibility of building pumped storage plants at the Bhivpuri hydroelectric stations, taking advantage of the increased demand for peak power generation and surplus power availability during off-peak hours. The **Bhivpuri Off-stream Open Loop Pumped Storage Hydro Project (Bhivpuri PSP)** is located near Bhivpuri town, Karjat Taluka in Raigad District of Maharashtra State. It is situated about 20 km from Karjat town. The project site is well connected and accessible throughout the year. Both Upper (existing Thokarwadi reservoir) and Lower reservoirs are accessible from Mumbai and Pune and situated about 80 km from Mumbai and 115 km from Pune in Maharashtra State. The nearest international airport is in Mumbai. Bhivpuri hydel station is located near Bhivpuri town, Karjat Taluka in Raigad District of Maharashtra State. It is situated about 20 km from Karjat town. The location of the project is shown in **Figure 1**.

The purpose of the Environment Impact Assessment (EIA) report prepared for Bhivpuri Pumped Storage Project (PSP) with installed capacity of 1000 MW is to ensure that decision-makers consider the environmental impacts during project design, construction, and operation. Therefore, the EIA document is prepared to present the pre-project environment quality status of various environmental parameters in project surrounding, to predict the impacts of the project on the surrounding area and to suggest mitigation and management measures to minimize such impacts. EIA study for such projects is mandatory as per EIA Notification of September 2006, which describes the environment clearance procedure.

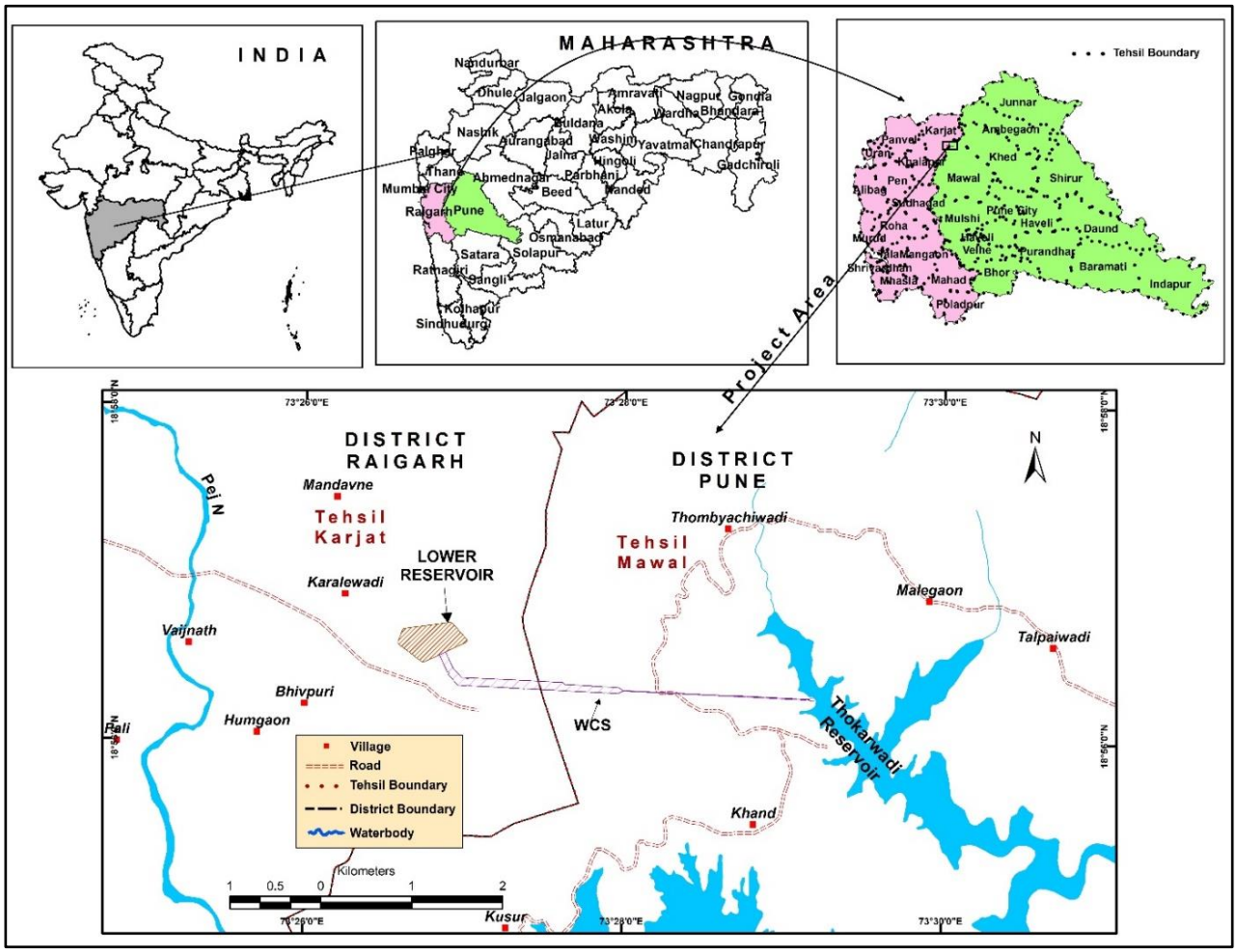


Figure 1: Location Map of Bhivpuri Pumped Storage Project

2. PROJECT DESCRIPTION

The Bhivpuri Off-stream Open Loop Pumped Storage Hydro Project (Bhivpuri PSP) located near Bhivpuri town in Raigad district of Maharashtra envisages the construction of temporary cofferdam, upper Intake system, water conducting systems, surge shaft, pit powerhouse, lower Intake system, and lower reservoir (equipped with bottom outlet). The scheme will involve the usage of the existing Thokarwadi reservoir as an upper reservoir with 12.485 TMC gross storage capacity and will involve construction of 1899.0 m long Geomembrane faced rockfill embankment dam for creation of lower reservoir with 0.163 TMC gross capacity. The complete scheme envisages utilization of design discharge of 216.7 cumec for generation of 1000 MW (4X200+2X100). A rated net head of 520.40 m with design discharge of 173.20 cumec shall be used for generation of 800 MW (4 units of 200 MW each) and a rated head of 516.60 m with design discharge of 43.60 cumec shall be used for generation of 200MW (2 units of 100 MW each). The salient features is given in **Table 1** and Layout map of proposed Bhivpuri PSP is given at **and Figure 2.**

Table 1: Salient features of Bhivpuri PSP

1	**Location**	
	Country	India
	State	Maharashtra
	District	Raigad
2	**Access to the Project**	
	Road	Accessible from Highway 80 Km from Mumbai
	Nearest Airport	Mumbai Airport
3	**PROJECT**	
	Type	Pumped Storage Project
	Installed Capacity	1000 MW [2 x 100 MW + 4 x 200 MW]
	Peak Generation duration	6 Hours
	Pumping Operation duration	6 Hours 42 Minutes
4	**RESERVOIR LEVELS & STORAGE DETAILS**	
4.1	**Upper Reservoir (Existing)**	
	Latitude/ Longitude	18^0 56’ 9.34” N/ 73^0 29’ 14.59” E
	FRL	667.17 m
	MDDL	646.18 m
	Live Storage	353.52 MCM at FRL
4.2	**Lower Reservoir (New proposed)**	
	Latitude/ Longitude	18^0 56’ 35.36” N/ 73^0 26’ 39.81” E
	FRL	132.0 m
	MDDL	99.00 m
	Total Storage	4.613 MCM
	Live Storage	4.577 MCM
5	**CIVIL STRUCTURE**	
5.1	**Lower Dam (New Proposed)**	
	Type	GFRD
	Top of Dam	135.0 m
	Maximum Height	28.0 m
	Length	1899.00 m
5.2	**Upper Intake**	
	Type	Diffuser Type

	Number of Intake Structure	1 Nos
	Nos of Trash rack bay	4 Nos.
	Size of Trash rack bay	6.20 m (w) x 12.30 m (H)
	Size of Trash rack Panel	20 Nos. [6.70 m (W) x 2.66 m (H) each] 05 Nos. in each bay
	Sill Level of trash rack	629.00 m
	Invert level of Intake Conduit	629.00 m
	Nos. and size of Service Gate	1 Nos.- 6.5 m (W) x 8.3 m (H)
	Nos. and size of Stoplog Gate	1 Nos.- 6.5 m (W) x 8.3 m (H)
	Design Discharge (Each intake)	216.80 Cumec
5.3	**Lower Intake**	
	Type	Diffuser Type
	Number of Intake Structure	5 Nos.
	Nos of Trash rack bay	4 Nos. per Intake (Total 20 nos. Trash rack bays)
	Size of Trash rack bay	4.10 m (w) x 5.0 m (H)
	Size of Trash rack Panel	Size 4.60 m (W) x 2.0 m (H)
	Sill Level of trash rack of Intake	75.0 m
	Invert level of Intake Conduit	74.60 m
	Nos and size of Service Gate	5 Nos.- 3.40 m (W) x 4.50 m (H)
	Nos and size of Stoplog Gate	1 Nos.- 3.40 m (W) x 4.50 m (H)
	Rated Pumping Discharge (each intake)	43.30 m^3/s
5.4	**Head Race Tunnel [HRT]**	
	Finish Shape and Size	Circular Finish - 8.3 m Diameter, Concrete Lined
	Length	1981.70 m
	Design Discharge	216.80 Cumec
5.5	**Surge Shaft**	
	Finish Shape and Size	Circular Finish – 20.0 m Diameter
	Maximum Up surge	689.50 m
	Minimum Down surge	609.50 m
	Top Elevation of Surge shaft	691.50 m
	Bottom Elevation of Surge shaft	566.42 m
	Diameter of Orifice	4.50 m
5.6	**Surface/Buried Penstock & Pressure Tunnels (Left bifurcation)**	
5.6.1	Surface Penstock	1 Nos
	Size and Type	5.30 m Diameter, Circular shape, steel lined
	Design Discharge (each shaft)	144.53 Cumec
	Length	678.40 m
5.6.2	Surface Penstock	1 Nos
	Size and Type	4.3 m Diameter, Circular shape, steel lined
	Design Discharge (each shaft)	96.35 Cumec
	Length	529.0 m
5.6.3	Surface Penstock	2 Nos
	Size and Type	3.0 m Diameter, Circular shape, steel lined
	Design Discharge (each shaft)	48.18 Cumec
	Length	768.94 m
5.6.4	Surface Penstock	1 Nos
	Size and Type	3.0 m Diameter, Circular shape, steel lined
	Design Discharge (each shaft)	48.18 Cumec
	Length	1245.22 m
5.6.5	Unit Pressure Shaft	2 Nos.

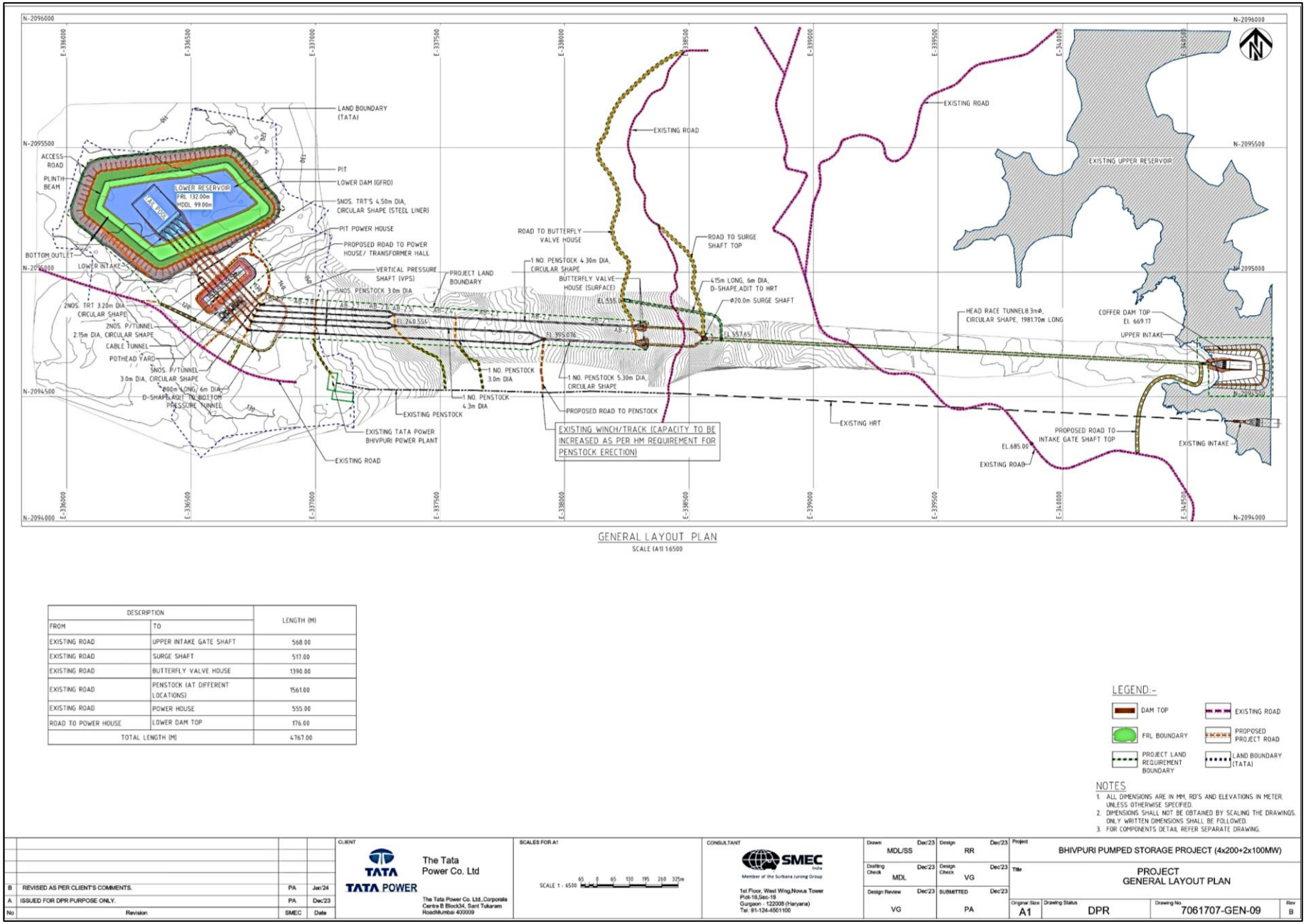
	Size and Type	3.00m Diameter, Circular shape, steel lined
	Design Discharge	48.18 Cumec
	Length	182.70 m
5.6.6	Pressure Shaft	1 Nos.
	Size and Type	3.00m Diameter, Circular shape, steel lined
	Design Discharge	48.18 Cumec
	Length	182.70 m
5.6.7	Unit Pressure Shaft	2 Nos.
	Size and Type	2.15m Diameter, Circular shape, steel lined
	Design Discharge	24.09 Cumec
	Length	52.72 m
5.7	**Surface/Buried Penstock & Pressure tunnels (Right bifurcation)**	
5.7.1	Surface Penstock	1 Nos
	Size and Type	4.30 m Diameter, Circular shape, steel lined
	Design Discharge (each shaft)	96.36 Cumec
	Length	1293.50 m
5.7.2	Surface Penstock	2 Nos
	Size and Type	3.00 m Diameter, Circular shape, steel lined
	Design Discharge (each shaft)	48.18 Cumec
	Length	605.76 m
5.7.3	Unit Pressure Shaft	2 Nos.
	Size and Type	3.00m Diameter, Circular shape, steel lined
	Design Discharge	48.18 Cumec
	Length	172.50 m
5.8	**POWERHOUSE**	
	Latitude	18^0 56’ 19.65” N
	Longitude	73^0 26’ 56.73” E
	Type	Pit-type Powerhouse
	Installed capacity	1000 MW [4 x 200 + 2 x 100]
	Number of units	6 Nos
	Type of turbine	Reversible Francis, Vertical Shaft
	Centre line of generating unit	56.00 m
	Powerhouse size	207.50 m long x 24 m wide x 52
	Design Head (generation)	520.40 m for 200MW unit; 516.60 m for 100MW unit
	Design Head (Pumping)	553.80 m for 200MW unit; 556.30 m for 100MW unit
	Service bay level	70.00 m
5.9	**ACCESS ROAD TO POWERHOUSE**	
	Width	7.0 m
	Length	1200.00 m
	Start Elevation	126.00 m
	End Elevation	70.00 m
5.1	**TRANSFORMER CUM GIS Hall**	
	Type	Surface
	Transformer Bay Size	207.55 m x 17.0 m x 23.0
5.11	**TAIL RACE TUNNEL**	
5.11.1	Unit TRT	2 Nos, (From 100 MW Unit)
	Size and Type	3.20 m Diameter, Circular shape, Steel Lined
	Design Discharge	24.09 Cumec
	Length	77.87 m
5.11.2	Main TRT	5 Nos

	Size and Type	4.50 m Diameter, Circular shape, Steel Lined
	Design Discharge	48.18 Cumec
	Length	191.41 (Connected with Small Units) 230.21 m (Connected with Big Unit)
5.12	**POTHEAD YARD**	
	Type	Surface
	Size	135.0 m (L) x 51.0 (W)
6	**ELECTRO-MECHANICAL EQUIPMENT**	
6.1	**Generating Mode**	
	Turbine Type	Reversible Francis, Vertical Shaft
	Max Net Head	549.37 m for 200MW unit; 545.57 m for 100MW unit
	Min Net Head	495.38 m for 200MW unit; 491.58 m for 100MW unit
	Rated Net Head	520.37 m for 200MW unit; 516.57 m for 100MW unit
	Design Head	531.37 m for 200MW unit; 527.57 m for 100MW unit
6.2	**Pumping Mode**	
	Max Net Head	582.87 m for 200MW unit; 585.27 m for 100MW unit
	Min Net Head	528.88 m for 200MW unit; 531.28 m for 100MW unit
	Rated Net Head	553.87 m for 200MW unit; 556.27 m for 100MW unit
	Design Head	564.87 m for 200MW unit; 567.27 m for 100MW unit
	Design Discharge per unit	For 6 Units
	Generating Mode	43.23 cumec for 200MW unit; 21.78 cumec for 100MW unit
	Pumping Mode	38.78 cumec for 200MW unit; 19.30 m for 100MW unit
6.3	**Generator Motor**	
	Generator Type	Vertical shaft, Synchronous generator, Suspended type
	Turbine Efficiency (Generation)	0.92
	Turbine Efficiency (Pumping)	0.93
	Generator Efficiency	98.50%
	Synchronous Speed	375 rpm for 200MW Unit; 500 rpm for 100 MW unit
7	**ANNUAL ENERGY**	
	Annual Energy for Generation	2079.42 MU
	Generation Duration (Peaking)	6 Hours
	Annual Energy for Pumping	2578.97 MU
	Pumping Duration	6 Hours 42 Minutes

The proposed project is planned to be completed within the time duration of 48 Calendar months (excluding 17 months of 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 Bhivpuri Pumped Storage Project works out to approximately 117.41 ha of which 20.15 ha is forest land while 97.26 ha is non-forest land. Out of 97.26 ha Non-Forest Land, 93.82 ha land belongs to Tata Power and 3.44 ha land is private land required for Road and HRT.



GENERAL LAYOUT PLAN
SCALE (A1) 1:6500

DESCRIPTION		LENGTH (M)
FROM	TO	
EXISTING ROAD	UPPER INTAKE GATE SHAFT	568.00
EXISTING ROAD	SURGE SHAFT	517.00
EXISTING ROAD	BUTTERFLY VALVE HOUSE	1390.00
EXISTING ROAD	PENSTOCK (AT DIFFERENT LOCATIONS)	1561.00
EXISTING ROAD	POWER HOUSE	555.00
ROAD TO POWER HOUSE	LOWER DAM TOP	176.00
TOTAL LENGTH (M)		4767.00

LEGEND:-
- DAM TOP
- FRL BOUNDARY
- PROJECT LAND REQUIREMENT BOUNDARY
- EXISTING ROAD
- PROPOSED PROJECT ROAD
- LAND BOUNDARY (TATA)

NOTES
1. ALL DIMENSIONS ARE IN MM, RD'S AND ELEVATIONS IN METER. UNLESS OTHERWISE SPECIFIED.
2. DIMENSIONS SHALL NOT BE OBTAINED BY SCALING THE DRAWINGS. ONLY WRITTEN DIMENSIONS SHALL BE FOLLOWED.
3. FOR COMPONENTS DETAIL REFER SEPARATE DRAWING.

No	Revision		Date
B	REVISED AS PER CLIENT'S COMMENTS.	PA	Jan'24
A	ISSUED FOR DPR PURPOSE ONLY.	PA	Dec'23

CLIENT: The Tata Power Co. Ltd, The Tata Power Co. Ltd, Corporate Centre B Block34, Sant Tukaram RoadMumbai 400009
SCALES FOR A1: SCALE 1 : 6500
CONSULTANT: SMEC India, Member of the Surbana Jurong Group, 1st Floor, West Wing,Novus Tower Plot-18,Sec-19 Gurgaon - 122008 (Haryana) Tel: 91-124-4601100

Drawn	MDL/SS	Dec'23	
Drafting Check	MDL	Dec'23	
Design Review	VG	Dec'23	
Design	RR	Dec'23	
Design Check	VG	Dec'23	
SUBMITTED	PA	Dec'23	

Project: BHIVPURI PUMPED STORAGE PROJECT (4x200+2x100MW)
Title: PROJECT GENERAL LAYOUT PLAN
Original Size: A1 | Drawing Status: DPR | Drawing No.: 7061707-GEN-09 | Rev: B

Figure 2: Layout map of Bhivpuri Pumped Storage Project

3. DESCRIPTION OF THE ENVIRONMENT

Since, proposed Bhivpuri PSP, as per latest specific TOR for PSPs issued through OM dated 14th Aug 2023 by MoEF&CC, EIA is based on two season data (other than monsoon). Accordingly, the field surveys for the collection of primary data on the existing environmental parameters in the study area delineated carried out in April-May 2023 and December 2023 as per the approved Terms of Reference (TOR) for EIA studies by Ministry of Environment, Forests & Climate Change (MoEF&CC) covering pre-monsoon/summer season and winter season data have been used 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.**

3.1 Physiography

The study area of the proposed project lies between 36.0 m to 1098 m elevation. about 41.5% of the project study area lies in below 200 m elevation band and about 20% of the study area lies in 600 m to 700 m elevation band and about 32% of the study area lies in 600 m to 800 m elevation band. Most of the area near to the existing Thokarwadi reservoir and Water Conducting System is falling under 601-700 m elevational range. The lower reservoir area is at the elevational range of 101-200 m.

Topography is Gently Sloping (0-2 degree) to Moderately Sloping (2-8 degree) as about 62.39% of the area is falling in this category.

3.2 Geology

The district forms part of Western Ghat and Deccan Plateau. the physiography of the district has given rise to four major characteristic landforms namely.

(1) The hills and ghats
(2) The foothills
(3) The plateau and
(4) The plains.

The present area lies at the western precipitous edge of the Deccan plateau subprovince viz. the Western Ghat Escarpment Zone, the western precipitous edge of the Deccan Plateau. The project area lies in Indrayani Fm. (of Lonavala subgroup), Upper Ratangarh Fm., Lower Ratangarh Fm. and Salher Fm. (of Kalsubai subgroup) belonging to the Sahyadri Group of Deccan Basalts.

3.3 Hydrology

The proposed Bhivpuri Pumped Storage Project (PSP) envisages generation of power for peaking purposes by recycling of water between existing Thokarwadi reservoir (Upper reservoir) existing due to construction of Thokarwadi dam and proposed new lower reservoir within the premises of Tata power (Private Land). Since the scheme proposes to utilise the water from existing Thokarwadi reservoir and due to the fact that there is no consumptive use of water (including evaporation and running losses), water availability and design flood is not an issue. The annual losses due to the evaporation from the lower reservoir work out to 0.43 MCM. It will be recouped periodically from Upper Reservoir.

The precipitation falling on the water surface of the proposed lower reservoir shall be channelized downstream suitably. The running and maintenance losses shall be made up from existing upper reservoir.

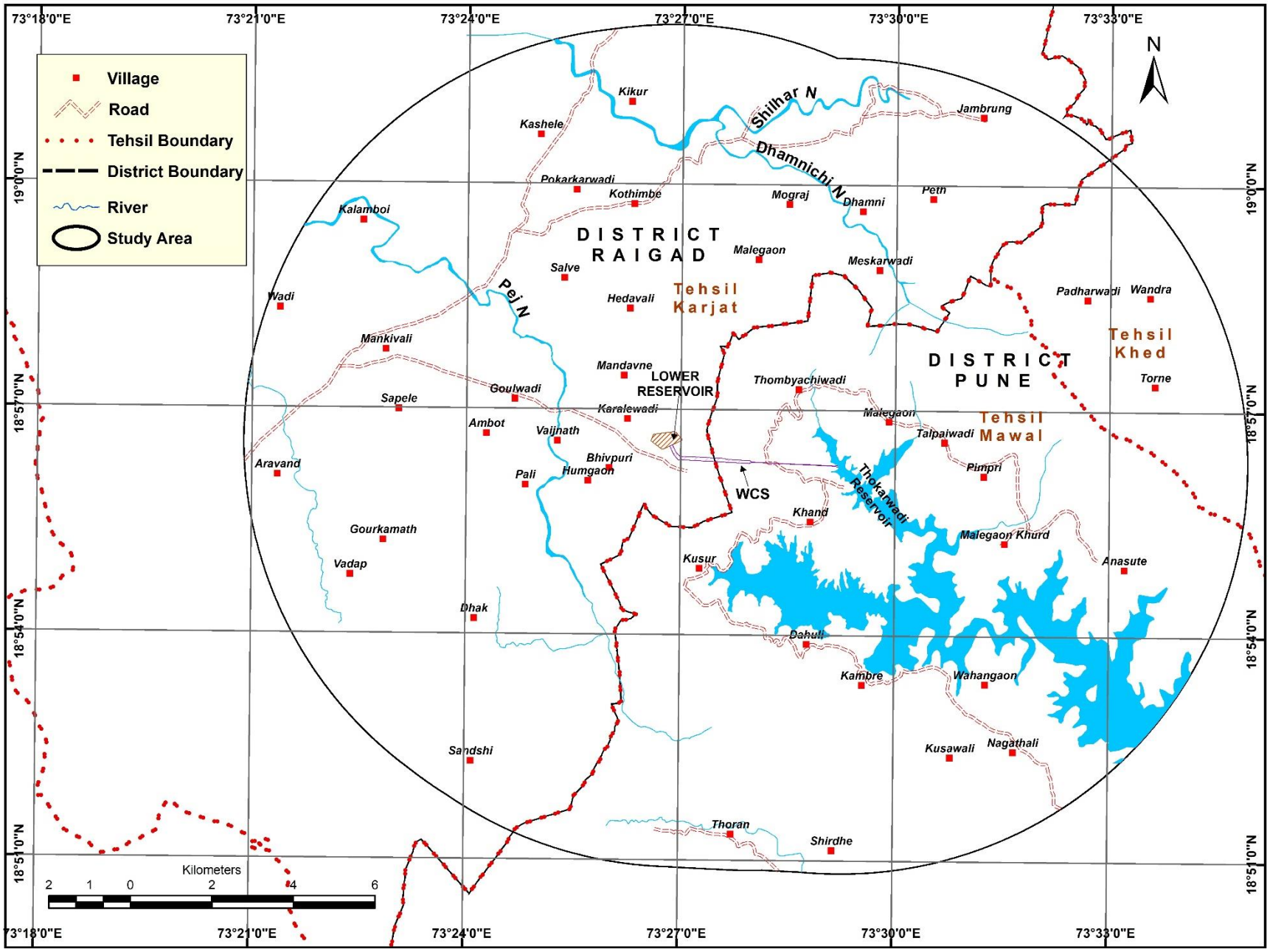


Figure 3.3: Map Showing Study Area

3.4 Land Use/ Land Cover

In the study area of Bhivpuri PSP, Evergreen/ semievergreen, Deciduous and Scrub Forest constitute a major part of the study area accounting for 38.83% of the area. Majority of forest area is comprised of Evergreen/ Semi- Evergreen Forest which cover 21.90%, while 9.04% and 7.89%, of the study area is comprised of Deciduous Forest and Scrub Forest respectively. While 27.34 % of the study area is under agriculture (crop field and agriculture plantation).

3.5 Meteorology

The study area of the project lies in the Pune and Raigad district, which experiences mostly hot summer and dry climate except in the monsoon season. Average maximum temperature of 35.9°C was recorded during April. The average minimum temperature of 17.6°C was recorded during January. The area receives maximum rainfall during south-west monsoon i.e. between June and September. The Humidity is generally low throughout the year, except during monsoon month when the average humidity in the study area is close to 91%. The average maximum wind speed of 5.0 m/s is observed during May.

3.6 Soil

Soil of the study area is Clay, Clay Loamy and Sandy Clay Loam in nature. 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'. Whereas Phosphorus and Potassium are having '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. Traffic movement is the source of air pollution in the area. However, concentrations of PM2.5, 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 PM2.5, 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 PM2.5, 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

- All the samples fall under Class 'D' i.e., designated best use of Propagation of Wildlife and Fisheries according to CPCB, Water Quality Criteria. This is because of higher Biochemical Oxygen Demand i.e., >3mg/l even though count of total coliform is less than 500 MPN/100 ml, pH is between 6.5 and 8.5 and Dissolved oxygen is more than 5 mg/l
- Based upon the classification of Irrigation water suitability and SAR and EC, the suitability

of water for irrigation is Medium.

- Based upon CPCB guidelines as well the WQI calculated above the water in the study area lies in 'Good' to 'Medium' 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' water quality class.
- In general, Groundwater is under "Soft Water" category at site GW7 located near Goulwadi Village during winter season sampling, and 'Moderately Hard' to 'Hard Water' category in the remaining sites.

3.9 Floristic Diversity

The project area falls in the Pune and Alibag Forest Divisions of Maharashtra Forest Department. According to 'A Revised Survey of the Forest Types of India' by Champion and Seth (1968) the major forest area falls under Group 2: Tropical Semi-evergreen Forest and Group 5: Tropical Dry Deciduous.

During field surveys 123 species of angiosperm were 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 267 species of angiosperm plants, belonging 75 families, was compiled which includes plant species growing in forested areas, scrub land, near agricultural fields and settlements, abandoned land, etc. This list includes 109 species of trees, 49 species of shrubs, 51 species of herbs, 33 species of climbers and 25 species of grasses. Most of the vegetation is found mainly in the forest area. Most of the vegetation is found mainly in the forest area. Poaceae (24 species), Lamiaceae (15 species), Acanthaceae (13 species), Rubiaceae (12 species), Combretaceae (10) 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. 2023-1, 2 plant species viz. 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. 2023-1. 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. Sambhar (*Rusa unicolor*), 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 17 species of mammals reported from the study area of proposed project was compiled.

Avifauna: A total of 19 species of bird species 9 Order were recorded during the field survey from the study area. Commonly found birds like White-breasted Kingfisher, Asian Green Bee-eater, Red-wattled Lapwing, Rock Dove, Greater Coucal, Red-vented Bulbul, Indian Pond

Heron and Little Cormorant etc. are most frequently sighted bird species in the study area.

Herpetofauna: After consulting forest working plan of concerned forest divisions and local people, a list of 13 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, 6 species of Nymphalidae family, and 1 species of Papilionidae family, were sighted during the field survey.

Fish: For the documentation of fish fauna in the project area, experimental fishing was carried out in Andhra & Indrayani River. 2 species of fish viz. Giant Danio (*Devario malabaricus*) and The Gangetic Mystus (*Mystus cavasius*) and 03 species of 3 species of crabs were the only fish species captured during the survey species was captured during the survey. After public consultation and secondary literature by Dahanukar et al. (2012), a list of 18 species of fish are reported in the study area.

Conservation Status: According to Wildlife Protection Amendment Act, 2022, 10 species of mammals, one species of bird, 04 species of herpetofauna are listed under Schedule I.

As per the IUCN Red List of Threatened Species, Version 2023-1, Leopard, Sloth Bear, Sambar Deer, Indian Bison and Bonnet Macaque under Vulnerable (VU) category and Striped Hyaena is listed under Near Threatened (NT) category.

3.11 Proximity to Protected Area

No project component falls in any notified protected area. The nearest Protected Area to the Project Components is Bhimashankar Wildlife Sanctuary which is at a distance of around 10.70 km from the project area.

3.12 Social Environment

The entire study area of Bhivpuri PSP (1000 MW) falls under two districts, namely Pune and Raigad. The project covers a total of 91 villages in the study area. Among the 91 villages, 67 are located in Karjat tehsil of Raigad district, and the remaining 24 are in Pune district (5 villages in Khed tehsil and 19 villages in Mawal tehsil).

The total population of the study area is 69068, with 35214 (50.98%) males and 33854 (49.01%) females. The sex ratio was found to be 961 females per 1000 males. There are 2844 scheduled castes in the study area, accounting for 4.11% of the total population and 22446 scheduled tribes in total, accounting for 32.49% of the total population.

The literacy rate in the project area villages is 75.13% (of the total population above 6 Year). As per the 2011 census, out of a total of 31584 (45.72%), 68.4% of the working population are engaged in agriculture and allied services, out of which 35.35% are cultivators and 33.05% are agricultural laborers. Only a small percentage of the population engaged in household industry 3.49%, and 28.09 % 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. the study area comprises primary

schools in 88 villages, middle schools in 46 villages, secondary schools in 13 villages, and senior secondary schools in 4 villages. There are no colleges in the study area. The nearest colleges are in Karjat town which are 10+ km from the study area villages. In the study area, only one village have primary health centre, and 16 villages have primary health sub-centres. Also there is one dispensary working under Tata Power Co. Ltd. In the study area.

In the study area, villages are connected by gravel roads, paved roads, and footpaths. Tap water, handpump and wells are the major source of drinking water. Power supply for domestic use and agricultural use are available in all the villages in the study area.

Socio-Economic profile of the villages adjacent to the proposed project site A socio-economic survey of some of the nearest villages located in the proposed project area was carried out on a sample survey basis. A total of 11 villages were covered. In the survey villages, there are total population of 11,589 with 381 individuals belonging to Scheduled Castes and 4,649 to Scheduled Tribes.

Agriculture and allied activities are the primary activities in the villages of the project area, and local residents depend mainly on rain and river water for farming. Apart from agriculture, villagers also go to the forest to collect firewood, mango, berries, and honey.

It was noted that there are some good educational institutions in the villages. There were primary schools in every village, while seven villages have a middle school, 2 villages have high school. Students from other villages have to travel more than 5-15 km to high school and higher secondary school facilities. There are no colleges available in the area.

There is only one primary health sub-center available in Vajianath village, with no primary health centers or hospitals in the surveyed area. In the surveyed villages, tap water connections are available in most of the households, while some villages have hand pumps for drinking. All the villages in the project area have access to electricity. However, during the field survey, villagers express their requirement of solar panels as it was noted that some of the villages have erratic power supply.

3.13 Historical, Religious and Archaeological Importance Places

The proposed project will not impact any significant cultural, historical, or religious sites in its vicinity.

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, blasting activity 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 a 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 Bhivpuri PSP will comprise of two reservoirs, of which Upper reservoir is an existing Thokarwadi reservoir which is already constructed as part of storage reservoir for Bhivpuri Hydropower Station, whereas Lower Reservoir is proposed to be newly constructed. The water will remain in circulation from existing Thokarwadi reservoir to lower 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 and Landscaping and Restoration of Construction Sites 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 proposed project 20.15 ha of forest land will be diverted for the construction of various project components. This shall lead to loss of vegetation cover of that area. Also, considering the dependency of villagers on natural resources in the area, However, magnitude of these impacts will be reduced/ mitigated by implementation of Compensatory Afforestation Plan, Green belt, Biodiversity Conservation and Wildlife Management Plan, etc.

4.6 Flora and Fauna

Construction Phase

Impact on Terrestrial Flora: Due to construction activities major impact on the flora in and around the project area would be due to increased level of human interferences. Increase in human interference could have an impact on terrestrial ecosystem. The workers may cut trees to meet their requirements for fuelwood, construction of houses, furniture etc. *Tectona grandis* and *Terminalia tomentosa* are the important trees species in the area. Thus, 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 the area. No private land will be acquired for the 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 the construction phase.
ii) Developers 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 developers 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 4 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 metaled.

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 a period of 4 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. 153.76 lakh** have been allocated to implement various activities envisaged under the Environmental Monitoring Programme.

7. Resettlement & Rehabilitation Plan

For the development of Bhivpuri PSP, land requirement has been worked out as 117.41 ha of which 20.15 ha is forest land while 97.26 ha is non-forest land. Out of 97.26 ha Non-Forest Land, 93.82 ha land belongs to Tata Power and 3.44 ha land is private land required for Road and HRT.

The entire private land identified for the project falls in revenue villages namely Bhivpuri,

Humgaon, Vaijinath, Mandawane, Potal, Bhilawadi-Gaulwadi, Pali-Saidongar, Hedavali, villages of Kajrat tehsil of Raigad District . Khand and Sawale villages of Maval Tehsil of Pune District of Maharashtra. None of them is getting displaced due to the project from the above land procurement. Private land identified for the project will be purchased through private negotations.

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 for the benefit of the local people of the villages located in the surrounding of project area. An amount of **Rs. 8.00 crore** has been earmarked for local area development activities.

9. PROJECT BENEFITS

Employment Generation: Bhivpuri PSP Project is planned to be completed in 48 Calendar months, at the time of peak construction work in the project, around 1200 persons may be engaged. Out of 1200 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 4743.59 crore; an investment of this magnitude in the area will improve the local infrastructure in the region. An amount of Rs. 8.00 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.

In the present study, CAT Plan has been formulated for the free draining catchment till the dam of Lower reservoir site. The lower reservoir is proposed on catchment of Khadki nala, the total catchment area of the Khadki nala at the proposed lower reservoir is only 1.43 sq km. 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 CAT plan including monitoring and evaluation is **Rs. 121.25 lakh**.

10.2 Compensatory Afforestation Plan and Net Present Value

The Bhivpuri Pumped Storage Project is being constructed in the jurisdiction of Alibag Forest Division and Pune Forest Division. The total land required for the construction of proposed project activities is 117.41 ha with 20.15 ha of forest land and 97.26 ha as non-forest land.

The Compensatory Afforestation is proposed to be undertaken on non-forest land identified in consultation with the State Forest Department and District administration. The estimated cost of the Compensatory Afforestation Programme with the cost of non-forest land acquired for afforestation programme is **Rs. 201.50 lakh**. This is a budgetary estimate, and the actual cost will be determined by the forest department during the Forest Clearance (FC) process.

Forest in the project area fall in the Eco Class I as being of type Tropical Semi Evergreen Forests with dense forest type, therefore NPV @ Rs. 14,36,670/ha would be required to be deposited in the Compensatory Afforestation Fund. The total cost of NPV has been estimated as **Rs. 289.49 lakh.**

The total cost of the compensatory afforestation plan, NPV, compensation of trees and cost of damage to fence and infrastructure is **Rs. 490.99 lakh**.

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. 210.00 lakh**.

10.4 Fisheries Development Plan

Fishing is one of the occupations under the allied sector of Agriculture of the district. The proposed Bhivpuri PSP is Off-stream Open loop Pumped Storage Project. The proposed project has not any significant impact on the habitat of fish fauna. However, considering the fact that fisheries as an important source of livelihood 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. 109.00 lakh.**

10.5 Muck Management Plan

The construction would involve about 50,07,191 cum soil and rock. About 30.0 lakh 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 **27,84,642 cum**.

Keeping the above requirement and topography of the area, two dumping sites have been identified covering an area of 41.0 ha area with a total capacity of 33,73,000 cum muck. The estimated cost of the relocation and rehabilitation of excavated material will be **Rs. 3399.62 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 **151.50 lakh.**

10.7 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. 39.80 lakh.**

10.8 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. 243.00 lakh.**

10.9 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. 249.00 lakh.**

10.10 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. 302.00 lakh** have been proposed under the Energy Conservation Plan.

10.11 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. 82.00 lakh** for labour management have been proposed under EMP.

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 Bhivpuri Pumped Storage Project is summarized in **Table 2**.

Table 2: Cost for Implementing Environmental Management Plan

S. No.	Component of EMP	Capital Cost (Rs. In lakh)	Recurring Cost (Rs. In lakh)							Total Cost (Rs. In Lakh)
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	
1	Catchment Area Treatment Plan	121.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	121.25
2	Compensatory Afforestation Plan & NPV*	490.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	490.99
3	Biodiversity Conservation & Wildlife Management Plan	210.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	210.00
4	Fisheries Conservation and Management Plan	50.00	14.75	14.75	14.75	14.75	0.00	0.00	0.00	109.00
5	Muck Dumping and Management Plan	86.50	508.00	900.20	925.17	925.00	18.25	18.25	18.25	3399.62
6	Landscaping, Restoration of Quarry, and Construction Sites	20.00	15.00	20.00	30.25	25.75	20.25	10.25	10.00	151.50
7	Green Belt Development Plan	0.00	3.40	6.40	10.00	5.00	5.00	5.00	5.00	39.80
8	Sanitation and Solid Waste Management Plan	142.00	25.25	25.25	25.25	25.25	0.00	0.00	0.00	243.00
9	Public Health Delivery System	110.00	34.75	34.75	34.75	34.75	0.00	0.00	0.00	249.00
10	Energy Conservation Measures	40.00	65.50	65.50	65.50	65.50	0.00	0.00	0.00	302.00
11	Labour Management Plan	30.00	13.00	13.00	13.00	13.00	0.00	0.00	0.00	82.00
12	Disaster Management Plan	275.00	31.25	31.25	31.25	31.25	0.00	0.00	0.00	400.00
13	Control of Air, Noise and Water Pollution	0.00	15.00	15.00	15.00	15.00	0.00	0.00	0.00	60.00
14	Environmental Monitoring Programme	0.00	38.44	38.44	38.44	38.44	0.00	0.00	0.00	153.76
15	Rehabilitation and Resettlement Plan***	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	Local Area Development Plan	800.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	800.00
	Total	**2375.74**	**764.34**	**1164.54**	**1203.36**	**1193.69**	**43.50**	**33.50**	**33.25**	**6811.92**

*Cost of CA and NPV shall be finalized as part of diversion proposal.

**Cost of private land acquisition (R&R) will be part of DPR cost.