ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

SHIRAWTA OFF-STREAM OPEN LOOP PUMPED STORAGE PROJECT (1800 MW)

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

Executive Summary

SEPTEMBER, 2024

Prepared for:

M/s. The Tata Power Co. Ltd.

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

1. INTRODUCTION

The Tata Power Co. Ltd. plans to explore the possibility of building pumped storage plant near Shirawta dam in Mawal Taluka of Pune District in Maharashtra, taking advantage of the increased demand for peak power generation and surplus power availability during off-peak hours. **The proposed Shirawta Off-stream Open Loop Pumped Storage Hydro Project** (**1800 MW**) would utilize the existing Shirawta reservoir as lower reservoir and construct a new upper reservoir to harness approximately 327 m of gross head.

The Shirawta Off-stream Open Loop Pumped Storage Project (PSP) is envisaged with a proposed installed capacity of 1800 MW is located near Shirawta Dam, Mawal (Maval) Taluka in Pune District of Maharashtra State. It is situated at about 22 km from Lonavala town (**Figure 1**).

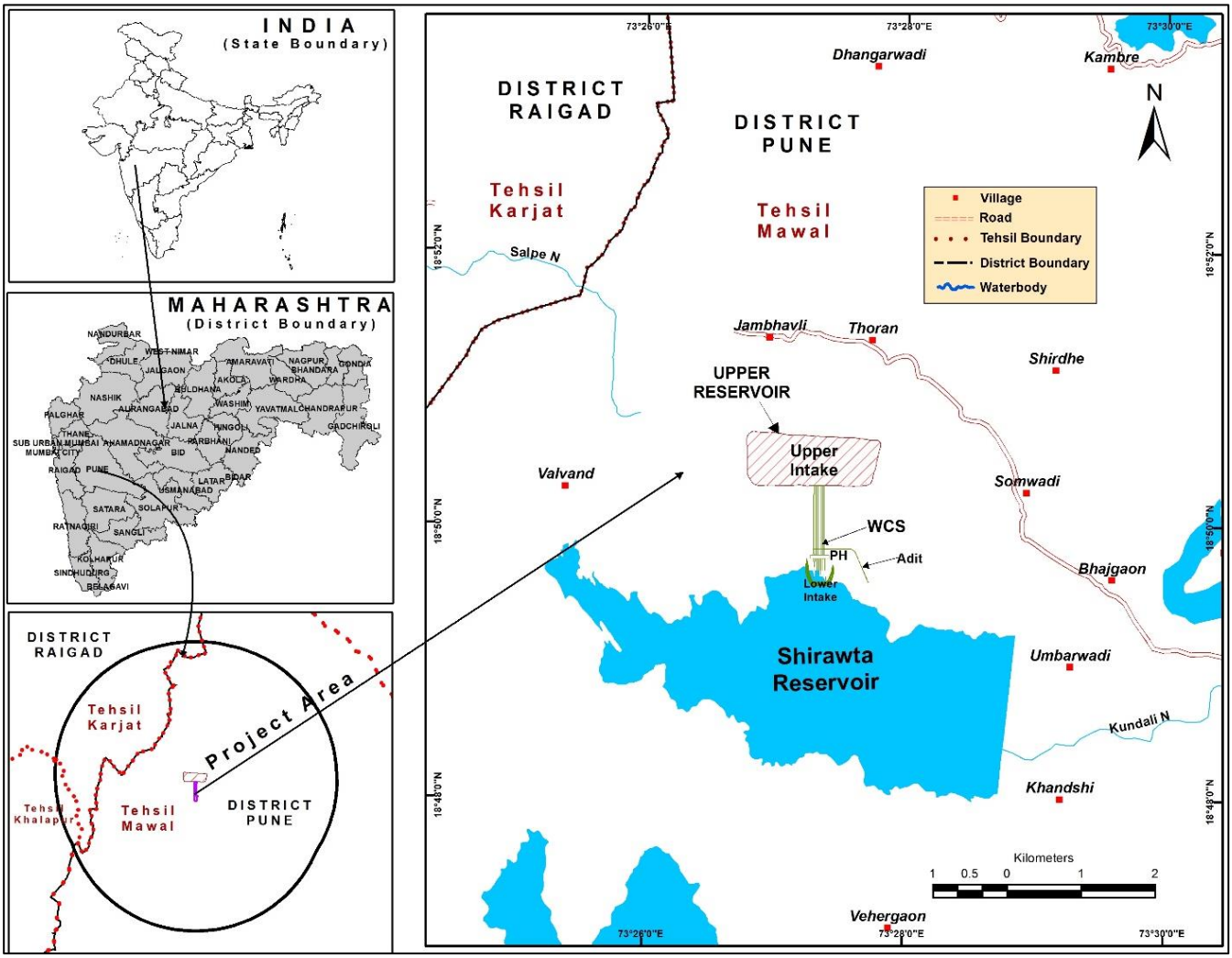

Figure 1: Location Map of Shirawta Pumped Storage Project

The Shirawta Off-stream Open Loop Pumped Storage Hydro Project (Shirawta PSP) 1800 MW envisages major civil structures as upper reservoir (combination of GFRD & concrete gravity dam), upper intake (diffuser type), penstock/pressure shaft, deep pit powerhouse, transformer deck, tailrace tunnel, lower intake & pothead yard. The lower reservoir (existing Shirawta reservoir), one across Kundali river, a tributary of Bhima River in Krishna Basin is approachable by 22 km black top road from Lonavala town.

The purpose of the Environment Impact Assessment (EIA) report prepared for Shirawta Pumped Storage Project (PSP) with installed capacity of 1800 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.

2. PROJECT DESCRIPTION

The lower reservoir named Shirawta Dam is existing one across Kundali river, a tributary of Bhima River in Krishna Basin & upper reservoir is proposed to be constructed at top of Jambhavli-Thoran hillock ranges. Both reservoirs will be used cyclically for water storage & energy generation. The initial filling and the annual make up water towards the tank losses shall be sourced from the existing Shirawta reservoir.

The 2316.48 m long and 38.71m high Shirawta dam is already constructed and is under operation since 1920. The catchment area up to Shirawta Dam is 28.47 sq. km, in addition to inflow and precipitation from its own catchment, the Shirawta reservoir collects water from Uksan reservoir through tunnel and diverts it to Valvhan Dam through a tunnel to feed Khopoli Hydro Power Station (72 MW).

The total installed capacity of proposed Shirawta PSP is 1800 MW (5 x 300 MW + 2 x 150 MW) and envisages non-consumptive reutilization of 14.97 MCM (Maximum requirement) of water per day for recirculation among two reservoirs upper reservoir & lower reservoir (Shirawta reservoir).

Existing Shirawta Reservoir - Lower Reservoir: The project proposes to utilize the water of existing Shirawta reservoir serving as the lower reservoir (existing). The gross storage of the existing lower reservoir is 195.48 MCM with live storage as 179.19 MCM at FRL of 656.84 m which is much more than the water requirement for reutilization between the two reservoirs for power generation purposes. The reservoir belongs to Tata Power and the water in this reservoir has been protected under the Krishna Water Disputes Tribunal (KWDT) allocation. The water use for the proposed alternative shall be within the KWDT entitlement and hence no additional State water resource shall be required to be allocated.

Proposed Upper Reservoir: The upper reservoir is proposed to be located on flat / gradually sloping land which is suitable for creating the desired gross storage capacity of 16.86 MCM. Out of 16.86 MCM, the live storage capacity is 15.15 MCM and the dead storage capacity is 1.71 MCM by keeping FRL & MDDL at EL 965.00 m & EL 948.00 m respectively. For creating this storage, it is proposed to construct Geo-membrane Faced Rockfill Embankment for the average height of around 21 m for the length of 4262.35 m and 178.40 m concrete gravity dam.

The salient features of the Project are as shown in Table 1.

Table 1: Salient features of Shirawta PSP

S. No.	Item	Description
1	**Name of the Project**	**Shirawta Pumped Storage Hydro Electric Project**
2	**Location**	
a	Country	India
b	State	Maharashtra
c	District	Pune
3	**Geographical Co-ordinates**	
a	Shirawta PSHEP co-ordinate	
b	Latitude	18° 50' 26.26" N
b	Longitude	73° 27' 15.78" E
4	**Access to Project Site**	
a	Airport	Mumbai, Pune
b	Rail head	Lonavala
c	Road	NH-48 (Mumbai to Pune)
d	Port	Mumbai
5	**Project**	
a	Type	Pumped Storage Hydro Electric Project
b	Rating	Total Capacity - 1800 MW (5 x 300 MW + 2 x 150 MW)
c	Storage capacity	10800 MWH
d	Generation duration	6 hours
e	Pumping Hours	6 hours 52 minutes
f	Cyclic Efficiency	79.44%
6	**Upper Reservoir (Proposed Reservoir)**	
a	Full Reservoir level (FRL)	EL 965.0 m
b	Min. Draw Down Level (MDDL)	EL 948.0 m
c	Type of Embankment	Geomembrane Faced Rockfill Dam (GFRD) & Concrete Gravity Block for Intake
d	Height of Embankment	Avg. height (21 m)
e	Length of GFRD Embankment	4262.35 m
f	Length of Concrete Dam	178.40 m
g	Live Storage	15.15 MCM
h	Gross Storage	16.86 MCM (At EL 965.0 m)
7	**Lower Reservoir (Existing Reservoir)**	
a	Live Storage	179.19 MCM
b	Gross Storage	195.48 MCM
c	Full Reservoir level (FRL)	EL 656.84 m
d	Min. Draw Down Level (MDDL)	EL 638.0 m
e	Type of Embankment	Gravity Dam facing in crushed rubble masonry & hearting in random rubble
f	Height of Embankment	38.71 m
8	**Upper Intake Structure**	
a	Type	Diffuser Type
b	Size of Intake (Single Intake)	26.40 m (W) x 8.20 m (H)
c	No. of intakes	6
d	Elevation of Intake Invert	EL 922.40 m
e	Design Discharge of intake	112.06 cumec
f	Trash rack type	Fixed
g	Number of Trash Rack Openings	6
h	Size of Trash Rack	(6.8 m x 8.20 m) each panel, 3 Panels in each intake

S. No.	Item	Description
i	Numbers & Size of Intake Service Gate (W x H)	6 Nos., 7.0 m x 4.80 m
j	Numbers & Size of Intake Maintenance Gate (W x H)	1 No., 7.0 m x 4.80 m
k	Elevation of penstock centre line	EL 924.80 m
9	**Penstock /Pressure Shafts**	
	Main Penstock	
a	Type	Steel Lined, Circular
b	Number of Penstock/Pressure Shaft	Total Penstocks -6 Nos.
c	Diameter of Penstock/Pressure Shaft	4.80 m each
d	Length of main Penstock/Pressure Shaft	1126.06 (Average Length)
e	Design Discharge of each pressure shaft	112.06 cumec
	Unit Pressure Shaft (Bifurcated from One 4.8 m penstock)	
a	Type	Circular
b	Number of Penstock	2
c	Diameter of unit penstock	3.40 m each
d	Design Discharge of each pressure shaft	56.30 cumec
10	**Powerhouse**	
a	Type	Surface Powerhouse (Pit Type)
b	Centre line of Unit	EL 590.0 m
c	Dimensions (L x W x H)	255.0 m (L) x 28.0 m (W) x 70.1 m (H)
d	Size of Service Bay (L x W)	39.60 m x 28 m
e	Size of Contril Room Bay (L x H)	25.0 m x 28.0 m
f	Service bay Level	EL 610.60 m
11	**Transformer Hall**	
a	Type	Surface
b	Dimensions (L x W x H)	255.0 m (L) x 17.0 m (W) x 24.60 m (H)
c	Transformer Floor Level	EL 610.60 m
d	GIS Floor Level	EL 621.60 m
12	**Tail Race Tunnels**	
	Main Tail Race Tunnels	
a	Type & Shape	Circular Shaped, Steel Lined
b	Number of Tunnels	Total TRT - 6 Nos.
c	Dia. of Tunnel	6 Tunnels- 5.50 m dia.
d	Length of the Tunnel	156.93 m (Average Length)
e	Design Discharge	112.06 cumec
	Unit Tail Race Tunnels	
a	Type & Shape	Circular Shaped, Steel Lined
b	Number of Tunnels	Total TRT - 2 Nos.
c	Dia. of Tunnel	2 Tunnels- 3.90 m dia.
d	Length of the Tunnel	57.98 m
e	Design Discharge	56.30 cumec
13	**Lower Intake**	
a	Type	Diffuser Type
b	No. of intakes	6
c	Size of Intake	6 Intakes - 26.40 m (W) x 8.20 m (H)
d	Elevation of Intake Invert	EL 621.50 m
e	Design Discharge of intake	6.40 m dia. TRT – 112.06 cumec
f	Trash rack type	Fixed

S. No.	Item	Description
g	Number of Trash Rack Openings	6
h	Size of Trash Rack (W x H)	6 Openings - 6.8 m x 8.20 m, each bay
i	Numbers & Size of Intake Service Gate (W x H)	6 Nos. – 7.0 m x 5.50 m
j	Numbers & Size of Intake Emergency Gate (W x H)	1 Nos. – 7.0 m x 5.50 m
k	Elevation of tunnel centre line	EL 624.25 m
14	**Electro-mechanical Equipment**	
	Turbine	
a	Type of Turbine	Reversible Francis, Vertical Shaft
b	Number of turbines	7
c	Capacity of each turbine	5 units of 300 MW each
		2 units of 150MW each
d	Rated Head for each turbine	300MW unit - 301.13 m
		150MW unit - 299.69 m
e	Rated Discharge for each turbine	300MW unit - 112.06 cumec
		150MW unit - 56.30 cumec
f	Turbine efficiency	92%
g	Synchronous Speed	300MW Unit - 250 rpm
		150 MW unit - 375 rpm
	Generator	
a	Type of Generator	Vertical shaft, Synchronous generator, Suspended type
b	Rated Power of Generator	300 MW
c	Generator Voltage	300MW unit - 18 kV
		150 MW unit - 18 kV
d	Generator efficiency	98.50%
e	Frequency	50 Hz
f	Transmission Voltage	400 kV
g	Generator Step up Transformer	300MW unit - 130 MVA, 1 Phase, 18kV/400 kV for (total 16 Nos)
		150MW unit - 65 MVA, 1 Phase, 18kV/400 kV for (total 7 Nos)
	Pump	
a	Capacity of each pump	5 Units - 330 MW
		2 Units – 165 MW
b	Pump Efficiency	93%
c	Rated Head in pumping	300MW unit - 314.57 m
		150MW unit - 315.68 m
d	Rated Discharge for each pump	300MW unit - 97.96 cumec
		150MW unit - 48.81 cumec
15	**Energy Generation/Pumping**	
a	Operating Condition	Average Reservoir Level for Lower Reservoir
b	Generation Hours	6 Hours
c	Pumping Hours	6 hours 52 minutes
d	Energy Generation (with 95% Plant Availability)	For 1800 MW - 3744.90 MU
e	Energy Required for Pumping (with 95% Plant Availability)	For 1980 MW - 4714.41 MU
f	Cyclic efficiency (Avg. Condition)	79.44%

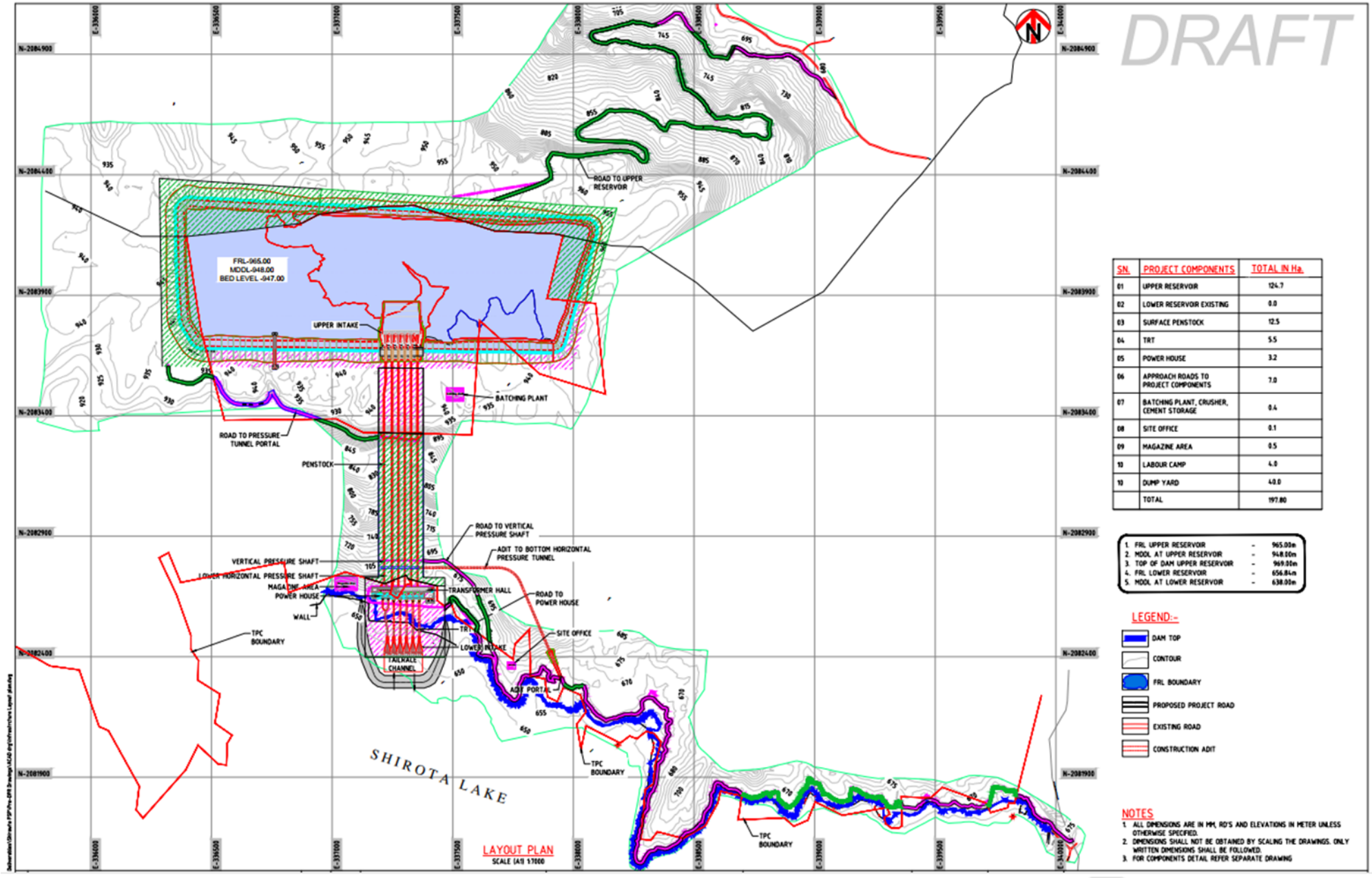

Figure 2: Layout map of Shirawta Pumped Storage Project

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 the proposed Shirawta Pumped Storage Project works out to approximately 197.797 ha of which 160.783 ha is forest land while 37.014 ha is non-forest land. Out of total 160.783 ha forest land, 3.626 ha is private forest and 157.157 ha is Reserve Forest.

The required 37.014 ha non-forest land belongs to Tata Power. The land under possession of Tata Power land was acquired around 100 years back for a specific purpose of 'generation of electricity & associated activities' and is under right, title, interest & possession of Tata Power till today for the same purpose.

3. DESCRIPTION OF THE ENVIRONMENT

Since, proposed Shirawta PSP, as per 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/ information have been used to understand the present setting of the environment at the project site. The base line status is described briefly in the following sections.

3.1 Physiography

The study area lies between 56 m to 1039 m elevation. About 34.53% of the project study area lies between 650 to 850 m elevation band and about 33.7% of the study area lies in 450 m to 650 m elevation band. The elevation of proposed upper reservoir is above 850 m, whereas areas around water conducting system and Shirawta reservoir are falling in the 450 m to 650 m and 650 m to 850 m elevational range, respectively.

Topographically, about 30.67% of the area is Slightly Sloping (0-2 degree) category, followed by Moderately Steep (15-30 degree) and Gently Sloping (0-2 degree), which are about 23.63% and 23.31%, respectively, of the total study area. The proposed upper reservoir is mainly slightly sloping, whereas the site proposed for water conducting system is falling under Moderately Steep to Steep 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.

Project will be located over Deccan Volcanic Province (DVP) in Pune district, Maharashtra. The Deccan Volcanic Province (DVP) has been considered as one of the largest magmatic regions, with an aerial coverage of about 5 lakh sq km. It is subdivided into four sub-provinces and holds a unique position in global tectonic models for understanding earth's geodynamics and the impact of voluminous eruptions on the contemporary biosystem and climate system. The project and surrounding area expose basaltic flows of nine Formations of Sahyadra Group belonging to Deccan Trap Supergroup of Upper Cretaceous to Paleocene, Lateriate of Cenozoic and alluvium of Quaternary age.

3.3 Hydrology

The proposed Shirawta Pumped Storage Project (PSP) envisages generation of power for peaking purposes by recycling of water between existing Shirawta reservoir (lower reservoir) and proposed new upper reservoir. Since the scheme proposes to utilise the water from existing Shirawta 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. Project envisages nonconsumptive reutilization of about 15.03 MCM (0.53 TMC) of water per day for 6 hours generation for recirculation among two reservoirs named as upper reservoir (15.33 MCM live storage) & lower reservoir (179.91 MCM live storage).

The annual losses due to the evaporation from the lower reservoir work out to 2.5 MCM. It will be recouped periodically from Lower Reservoir.

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

3.4 Land Use/ Land Cover

In the study area of Shirawta PSP, Evergreen Forest (32.95 %) comprises of most of the study area, followed by Agricultural Crop Land (22.78%) and Scrub Land (14.86%). The area in the vicinity of existing Shirawta Reservoir (Lower reservoir), is mostly represented by Evergreen & Deciduous Forest and Scrub Land. The forest area in and around proposed upper reservoir and Water Conducting System is mainly represented by Evergreen Forest and scrub forest. Whereas a few patches of deciduous forest can also be seen around these areas.

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 $PM_{2.5}$, PM_{10}, SO_2, and NO_2 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 $PM_{2.5}$, PM_{10}, SO_2, and NO_2 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 $PM_{2.5}$, PM_{10}, SO_2, and NO_2 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

- Out of four surface water samples collected, three from the Site SW1, SW2 and SW4 are falling under Class 'B' i.e. Outdoor bathing (Organised). The sample collected from one Site SW3 is falling under Class 'D' i.e., designated best use of Propagation of Wildlife and Fisheries according to CPCB, Water Quality Criteria.
- Based upon the classification of Irrigation water suitability and SAR and EC, the suitability of water for irrigation is Low to Medium.
- Based upon CPCB guidelines as well the WQI calculated above the water in the study area lies in '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 out of 10 ground water samples collected, groundwater is under "Moderately Hard Water" category at GW1 & GW2 locations in both seasons, and 'Very Hard Water in the Site GW5, GW7 & GW8. The water was found to be under "Hard Water" category in 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 131 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 272 species of angiosperm plants, belonging 103 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, 49 species of shrubs, 54 species of herbs, 33 species of climbers and 24 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 (23 species), Lamiaceae (15 species), Acanthaceae (14 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 *Adelocaryum coelestinum, 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. During the faunal survey, Sambhar (Rusa unicolor), Bonnet Macaque (Macaca radiata) and Hanuman langur (Semnopithecus entellus) were the only mammalian species spotted in the study area. However, the local people have also confirmed the presence of the species like Leopard, Bison, Wild Boar, Hare and Golden Jackal near forest area, agriculture fields and settlements. 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 from the concerned forest working plan 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 Indrayani River. Giant Danio (*Devario malabaricus*) and The Gangetic Mystus

(*Mystus cavasius*) were the only fish species captured during the survey. Other than these, the local fishermen and secondary literature published by Dahanukar et al. (2012), who have documented the fish species from Indrayani River and its tributaries, were consulted. According to this list, 18 species are reported in the study area

Conservation Status

According to the Wildlife Protection Amendment Act, 2022, 10 species of mammals, one species of bird, 4 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. Nearest Protected Area to the Project Components is Bhimashankar Wildlife Sanctuary which is at a distance of around 19.70 km from proposed upper reservoir.

3.12 Social Environment

The entire study area of Shirawta PSP (1800 MW) falls under two districts, namely Pune and Raigad. The project covers a total of 69 villages in the study area. Among the 69 villages, 50 are located in Mawal (Maval) tehsil of Pune district, and the remaining 19 are in Raigad district (16 villages in Karjat tehsil and 3 villages in Khalapur tehsil).

The total population of the study area is 50461, of which 26306 (52.13%) are males and 24155 (47.86%) are females. The Sex ratio was found to be 918 females per 1000 males. There are 3183 scheduled castes in the study area, accounting for 6.30% of the total population and 11207 scheduled tribes in total, accounting for 22.20% of the total population.

The literacy rate in the project area villages is 75.28% (of the total population above 6 Year). As per the 2011 census, out of a total of 22,315 (44.22%), 48.07% of the working population are engaged in agriculture and allied services, out of which 32.01% are cultivators and 16.06% are agricultural laborers. Only a small percentage of the population engaged in household industry 2.92%, and 48.99 % 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 has primary schools in 60 villages, middle schools in 21 villages, secondary schools in 6 villages and senior secondary schools in 4 villages. There are 3 degree colleges in the study area. In the study area, 9 villages have primary health centers, and 7 villages have primary health sub-centers. The primary health center is located 5-15 km away from most villages. For emergency medical care, people depend on district and tehsil hospitals, which are more than 10 km away from the villages. Major hospitals are located in Lonavala and Karjat, which are more than 10 km away from the villages

In the study area, villages are connected by gravel roads, paved roads, and footpaths. Tap water, handpump and wells are the main source of drinking water. Power supply for domestic use and agricultural use is 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 9 villages were covered. In the survey villages, there are total population of 6,896 with 4% individuals belonging to Scheduled Castes and 21.32% to Scheduled Tribes.

Tourism, Agriculture and allied activities are the primary activities in the villages of the project area and the local residents depend mainly on rain and river water for cultivation. Apart from farming, the villagers also go to the forest to collect firewood, mangoes, berries and honey. They sell these products in the Lonavla market for their livelihood.

It was noted that there are some good educational institutions in the villages. There were primary schools in every village, while six villages have a middle school and only one village have high school. Students from other villages have to travel more than 10 km for high school and higher secondary school facilities. There are 2 numbers of degree colleges available in the surveyed villages. Additionally, degree colleges are accessible in Lonavala, which is 10+ km away from the project area villages.

There are two primary health sub-centers available in Govitri and Khandashi villages and only one village namely Karla have primary health center. 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.

3.13 Historical, Religious and Archaeological Importance Places

The proposed project will not affect any important cultural, historical or religious sites in the vicinity. However, there are many tourist, religious and historical sites near project area such as Lonavala-Khandala Hill Station, Valvhan Lake, Uksan Lake, Karla Caves, Adishakthi Aai Ekavaira Temple which are more than 5 km away from the project components.

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 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 Shirawta PSP will comprise of two reservoirs, of which lower reservoir is an existing Shirawta reservoir, whereas upper reservoir is proposed to be newly constructed. The water will remain in circulation from existing Shirawta reservoir to upper 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 160.78 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. 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.

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 4 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. 211.20 lakh** have been allocated to implement various activities envisaged under the Environmental Monitoring Programme.

7. ADDITIONAL STUDIES

7.1 Resettlement & Rehabilitation Plan

For the development of Shirawta PSP, land requirement has been worked out as 197.797 ha of which 160.78 ha is forest land while 37.014 ha is non-forest land. The required 37.014 ha non-forest land belongs to Tata Power. The land under possession of Tata Power land was acquired around 100 years back for a specific purpose of 'generation of electricity & associated activities' and is under right, title, interest & possession of Tata Power till today

for the same purpose.

No private land is required for the construction of various components of proposed Shirawta PS. Hence, preparation of Resettlement & Rehabilitation Plan is not required in case of Shirawta PSP.

7.2 Corporate Environmental Responsibility

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 have been identified and set of development activities have been proposed under each focus area for the benefit of the local people under the Project. The activities proposed under the Local Area Development Plan (LADP) shall be refined after the Public Consultation/ Public Hearing meeting. A list of activities shall be prepared based on the concerns raised and discussion during the public hearing and in consultation process with the local competent authorities.

The provisional budget allocated for implementing the various local area development activities and programs envisaged under above focus areas under LADP in affected area around the project is Rs. 10.00 Crore.

8. PROJECT BENEFITS

Employment Generation: Shirawta 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.

CER Activities: Total project cost is Rs 7027.72 crore; an investment of this magnitude in the area will improve the local infrastructure in the region. A provisional amount of Rs. 8.00 crore has been earmarked for local area development with a view of improving 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. The activities proposed under the Local Area Development Plan (LADP) shall be refined after Public Consultation/ Public Hearing meeting.

9. 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.

9.1 Catchment Area Treatment Plan

The upper reservoir is proposed as a closed embankment on a plateau and no stream contributes to the supply of water. The upper reservoir will receive water from rainfall directly falling into the proposed reservoir and pumping from the lower reservoir; the inflow receipt from the precipitation shall be released to downstream side through the appropriate arrangement. The reservoir plan area at top of the embankment itself will be the catchment area for the upper reservoir. Area of upper reservoir has been worked out as 130.67 ha as per land requirement for the project and no land area drains into the proposed reservoir.

Since there is no landward catchment area of the upper reservoir, no CAT plan can be prepared. Also, since lower reservoir is already existing hence CAT plan preparation is not applicable. In view of above, CAT plan in proposed Shirawta PSP is not applicable and has not been prepared.

9.2 Compensatory Afforestation Plan and Net Present Value

The Shirawta Pumped Storage Project is being constructed in the jurisdiction of Pune Forest Division. The total land required for the construction of proposed project activities is 197.797 ha with 160.78 ha of forest land and 37.014 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. 1607.80 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. 2309.88 lakh.**

The total cost of the compensatory afforestation plan, NPV, compensation of trees and cost of damage to fence and infrastructure is **Rs. 3917.68 lakh**.

9.3 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:

Conservation measures

i. Habitat Improvement by development of vegetation cover by plantation with suitable species.
ii. Biological fence (Bamboo species, *Euphorbia* sp., *Agave americana*, etc.) around the

habitation and around the agriculture fields adjoining to forest area to control human wildlife conflict

iii. Farm Forestry
iv. Maintenance of existing nurseries of state forest department
v. Development and Management of Grasslands
vi. Removal of Invasive Species
vii. Awareness for Shifting Cultivation and Conservation of Natural Resources

Management measures

viii. Prevention of Forest Fire: Training and Infrastructure facilities
ix. Construction and filling of water holes and ponds in wildlife habitat.
x. Support/Provision of veterinary care, cages, recuse centers, etc.
xi. Training and capacity building for volunteers and officials of forest department

The estimated cost of implementation of various activities envisaged in the Biodiversity Conservation and Management Plan would be **Rs. 223.00 lakh**.

9.4 Fisheries Development Plan

Fishing is one of the occupations under the allied sector of Agriculture of the district. The proposed Shirawta PSP is Off-stream Open loop Pumped Storage Project. The proposed project has not any significant impact on the habitat of fish fauna.

As per baseline data collected during field survey and supplemented with secondary data collected from published literature and public consultation a total of 20 species of fish fauna are reported from the study area. Although there is no organized commercial fishery practiced in the project area as the existing Shirawta reservoir is under control of Tata Power and fishing is prohibited in the reservoir.

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. 114.00 lakh.**

9.5 Muck Management Plan

The total quantity of muck generated from soil and rock excavation is about 6,79,251 cum soil and 39,39,448 cum rock. About 4,07,551 cum of excavated soil and 23,63,669 cum excavated rock are expected to be utilized for Rockfill and aggregate for construction. After considering swelling factor (0.83 for soil and 0.70 for rock) it is proposed to dispose off the remaining quantity i.e. 25,78,463 cum at a one pre-identified muck disposal site of 20.246 ha area. The site will be fully rehabilitated and restored on completion of muck dumping.

The estimated cost of the relocation and rehabilitation of excavated material including

engineering and biological measures will be **Rs. 1281.53 lakh.**

9.6 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 **Rs 209.80 lakh.**

9.7 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. 50.50 lakh.**

9.8 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. 258.00 lakh.**

9.9 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 (2 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.
- Provision for regular health checkup and registration of workers
- Budget for strengthening existing medical facilities.
- Budget for Health Awareness/ Vaccination Camps for 4 years.

Budgetary estimates for public health delivery system to be implemented have been worked out as **Rs. 263.00 lakh.**

9.10 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. 346.00 lakh** have been proposed under the Energy Conservation Plan.

9.11 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. 93.00 lakh** for labour management have been proposed under EMP.

9.12 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. 250.00 lakh.**

10. WATERSHED DEVELOPMENT PLAN

Preparation of watershed development plan involves identification of watershed problems and formulation of development and management plan to be prepared in 10 km radius of the project area in consultation with Government Institutions/Indian Council of Agriculture Research (ICAR). Accordingly, Watershed Development Plan of Shirawta PSP is being prepared by Department of Water Resources Development & Management, Indian Institute of Technology, Roorkee to comply with the Specific Terms of Reference (ToR) for (River

Valley/ Irrigation Projects) issued by Ministry of Environment Forests and Climate Change (MoEF&CC), dated: 23.09.2023 for carrying out the EIA/ EMP studies of the project.

The plan shall include Soil and Water Conservation biological and engineering measures, sustainable agriculture, livelihood improvement, training/capacity building and community participation, implementation mechanism and regular audits and reviews including cost estimates of implementation of watershed development and management plan for the study area.

11.1 SUMMARY OF COST

The capital and recurring costs involved for implementation of the Environmental Management Plan for Shirawta Pumped Storage Project is **Rs 7287.71 lakh** as 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	00.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Compensatory Afforestation Plan & NPV*	3917.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3917.68
3	Biodiversity Conservation & Wildlife Management Plan	223.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	223.00
4	Fisheries Conservation and Management Plan	50.00	16.00	16.00	16.00	16.00	0.00	0.00	0.00	114.00
5	Muck Dumping and Management Plan	943.90	84.12	140.18	88.33	11.00	5.00	5.00	4.00	1281.53
6	Landscaping, Restoration of Quarry, and Construction Sites	96.25	68.21	27.40	14.94	1.50	0.50	0.50	0.50	209.80
7	Green Belt Development Plan	0.00	5.00	5.35	18.70	12.45	4.00	2.00	3.00	50.50
8	Sanitation and Solid Waste Management Plan	147.00	33.00	33.00	26.00	19.00	0.00	0.00	0.00	258.00
9	Public Health Delivery System	126.00	35.00	34.00	34.00	34.00	0.00	0.00	0.00	263.00
10	Energy Conservation Measures	56.00	72.50	72.50	72.50	72.50	0.00	0.00	0.00	346.00
11	Labour Management Plan	35.00	7.00	17.00	17.00	17.00	0.00	0.00	0.00	93.00
12	Disaster Management Plan	210.00	10.00	10.00	10.00	10.00	0.00	0.00	0.00	250.00
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	52.80	52.80	52.80	52.80	0.00	0.00	0.00	211.20
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	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
	Total	**5814.83**	**398.63**	**423.23**	**365.27**	**261.25**	**9.50**	**7.50**	**7.50**	**7287.71**

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

** No acquisition/ procurement of private land involved.