

EXECUTIVE SUMMARY

Poringalkuthu SHEP Stage – II (1x24MW)

1 Project Description

The proposed “PORINGALKUTHU SMALL HYDRO-ELECTRIC PROJECT-stage II (1x24MW)” envisages utilization of the excess water which otherwise spill from the existing Poringalkuthu reservoir, with integrated operation of other power stations drawing water from the same reservoir viz., Poringalkuthu Left Bank Scheme (4x9MW), Poringalkuthu Left Bank Extension Scheme (PLBE) (1x16MW) and Poringalkuthu SHEP Stage I (1x24MW). The proposed scheme will draw water from the penstock common for the proposed scheme and Poringalkuthu SHEP Stage I (1x24MW) up to the bifurcation point located upstream of Valve house. From the bifurcation, new penstocks and valve house have to be constructed to convey water to the surface powerhouse common for Stage I & II schemes thus the water proposed to be used for Stage–II will also be discharged in to the same river through a tailrace. The power generation for Stage–II is proposed by employing a Vertical Francis turbine with generator of 24MW capacity and an average annual generation of 53.8473 MU in 75% dependable year (monsoon) and peak hour generation in summer utilizing an average net head of 170m which incidentally is slightly more than the computed 33-year annual average energy (49.26MU).

Kerala, with significant hydropower potential, has tapped only a third of its resources. Due to environmental and forest clearance challenges, small hydroelectric projects are being prioritized. The Poringalkuthu SHEP Stage – II is a 24 MW extension of Stage I, utilizing excess spill water from the Poringalkuthu reservoir. Located in Athirapilly, Thrissur, it shares infrastructure with Stage I, minimizing costs and environmental impact.

The Kerala State Electricity Board (KSEBL) is responsible for the project, which will operate as a base load station in the monsoon and a peaking station in the summer. The project is being assessed through an Environmental Impact Assessment (EIA) to ensure compliance with national and state regulations. It is expected to generate 54 MU annually.

The project follows the EIA Notification 2006 and requires public hearings and clearances from the State Environment Impact Assessment Authority (SEIAA).

Kerala's power consumption has risen significantly, with over 70% of the daily demand met through imports. Given the lack of fossil fuel reserves and challenges with nuclear power, increasing local hydroelectric generation is crucial. Small hydro

**Proposed “PORINGALKUTHU SMALL HYDRO-ELECTRIC PROJECT (2x24MW)”
at Athirapally Panchayat, Chalakudy Taluk, Thrissur District, Kerala**

projects are being prioritized due to environmental and land acquisition challenges with larger projects.

The site is located at Poringalkuthu, which is about 42 Km from Chalakudy. The existing roads can be used as the access to the various components of the scheme. The scheme is located on the left bank of the tailrace of the existing 1 x 16MW Poringalkuthu Left Bank Extension Scheme. Only small connecting links are required to the proposed project.

Salient Features of the Project are given below in Table 1.

Table 1: Salient Features of the Project

Project name	Proposed “Poringalkuthu Small Hydro-Electric Project-Stage II (1x24 MW)” by M/s Kerala State Electricity Board Ltd, Kerala
Location	The proposed Project is located in Athirapally Panchayat, Chalakudy Taluk, Thrissur district of Kerala state
Latitude & longitude	Latitude : 10°18'45"N Longitude: 76°38'10"E
Toposheet number	58 B/11 & 58 B/12
Capacity	2 x 24 MW
Total Storage under the scheme	32 MCM
FRL(Full Reservoir Level) (existing)	424 m
Average Rainfall	3666.42 mm
Nearest railway station	Chalakudy Railway Station (approx. 32 km)
Nearest air port	Cochin International Airport (approx. 30 km)
Seismic zone	Zone-III (As per 1893:2002)
Project Cost	Rs. 8014.13 lakh

**Proposed “PORINGALKUTHU SMALL HYDRO-ELECTRIC PROJECT (2x24MW)”
at Athirapally Panchayat, Chalakudy Taluk, Thrissur District, Kerala**

Summary of Poringalkuthu SHEP Stage-II Project Requirements

Land: The project will be built on land already owned by KSEBL, leased from the Forest Department. No new land acquisition is required.

Water: 10 KLD of water needed during construction, sourced from the nearby river. Power generation will use water from the existing Poringalkuthu reservoir.

Power & Manpower: 1700 units/month of electricity required during construction. The project will need 1080 man-days per year during operation and 2400 man-days during construction.

Materials & Blasting: Blasting will require 6000 m³ of material, and construction materials include cement, sand, and stone, all sourced on-site.

Transmission: Power will be fed into the existing 110 kV transmission system after necessary expansion at the switchyard.

Timeline: Construction is expected to be completed in 24 months.

Cost & Benefits:

Total cost: ₹8014.13 lakh (₹8070.23 lakh with IDC).

Expected annual generation: 53.85 MU.

Levelized tariff: ₹1.73/kWh.

Payback period: 3 years.

Financial metrics: NPV of ₹38,954 lakh, IRR of 35.7%.

The project is designed to increase power generation with minimal environmental impact, using existing infrastructure, and promises a quick financial return.

2 Description of Environment

Topography & Location

- **Location:** The project is situated in Thrissur District, Kerala, with the area between elevations of 200m to 500m above MSL.
- **Boundaries:** Bordered by Malappuram, Palakkad, Ernakulam, and Idukki districts, and touches the Lakshadweep Sea on the west.
- **Geological Context:** The site is within KSEBL's leased land from the Forest Department for implementing the PLBE scheme.

Physiography

- The area lies in Mukundapuram Taluk, known for its diverse physiography (lowlands, midlands, and highlands).
 - **Lowlands:** Coastal plains with elevations near sea level.

**Proposed “PORINGALKUTHU SMALL HYDRO-ELECTRIC PROJECT (2x24MW)”
at Athirapally Panchayat, Chalakudy Taluk, Thrissur District, Kerala**

- Midlands: Rolling plains and valleys with elevations from 20m to 300m.
- Highlands: Eastern hilly regions with higher elevations.

Drainage

- Chalakudy River is the primary river system, originating from the Anamala ranges and fed by four tributaries: Sholayar, Parambikulam, Thekkadi, and Karapara rivers.
- The region receives rainfall from both the Southwest and Northeast monsoons. Key falls include Poringalkuthu and Athirapally.

Geology

- Regional Geology: The district lies in a high-grade metamorphic terrain with prominent rock types including charnockite and gneiss.
- Site Geology: The project area features hornblende biotite gneiss and migmatite, intruded by pegmatite. The regional foliation trend varies with a southerly dip.

Geomorphology

- The region is divided into three main zones:
 - Coastal Plain: Depositional landscape with marine and fluvial landforms.
 - Midland Region: Gently rolling terrain with laterite mesas.
 - Hilly Region: High, resistant hills in the east, including notable peaks such as Pappatapara hill (1160m).
- The project area is located in low dissected hills and valleys.

Seismo-Tectonics & Earthquake History

- Seismic Activity: The area is classified under Seismic Zone III, with occasional mild tremors recorded, including events in 1994, 2016, 2023, and 2024.

Land Use/Land Cover

- The project area falls mainly within a dense forest zone, covering 92.25% of the land.
- Other land uses include agriculture, settlements, plantation, scrubland, and water bodies.

Climate

- Kerala's tropical climate is characterized by:
 - Average Annual Rainfall: 3198 mm, with 71.24% of the rainfall from the Southwest Monsoon.

**Proposed “PORINGALKUTHU SMALL HYDRO-ELECTRIC PROJECT (2x24MW)”
at Athirapally Panchayat, Chalakudy Taluk, Thrissur District, Kerala**

- Temperature: Ranges from 19.8°C to 36.7°C, with the hottest months in March-April.
- Humidity: High during the monsoon months, averaging 93% in the morning.

Sensitive Areas

- The area has several protected zones within 25 km, including:
 - Parambikulam Tiger Reserve (8.26 km).
 - Chimmony Wildlife Sanctuary (14.28 km).
- These areas are ecologically sensitive and house diverse flora and fauna.

Environmental Sensitivity

- The district hosts a variety of medicinal plants, mammals, and birds, and supports an ecologically rich environment due to its evergreen forests.

In conclusion, the Poringalkuthu SHEP Stage-II project site is located in a geologically stable and ecologically sensitive area, surrounded by important wildlife reserves and diverse land uses. The project aims to utilize existing infrastructure without significant new land acquisition, while considering environmental sensitivity in its design.

Baseline Data Generation

Baseline studies for the Poringalkuthu SHEP Stage-II project are conducted to gather comprehensive environmental data across physical, biological, and socio-economic components. These studies are carried out over three seasons: Winter, Pre-monsoon, and Monsoon, with socio-economic data collected year-round.

- Winter Season: December 2023 to February 2024
- Pre-monsoon Season: March 2024 to May 2024
- Monsoon Season: September 2024 to November 2024

Data were collected for following Environmental Components

1. Physical Environment: Data collected on soil, air, noise, and water quality using standard methods and instruments.
2. Biological Environment: Flora and Fauna: Field surveys and standard ecological methods are used to assess terrestrial and aquatic biota, including species diversity and other significant ecological features. Land Use/Land Cover: Identified using topographic sheets and ground truthing techniques.
3. Socio-economic Environment: Socio-economic data is collected irrespective of the seasons, focusing on the local communities and their dependence on the project area.

Soil Quality Assessment

Soil samples from various locations in catchment area and study area were collected. The sample locations have been selected to represent the area characteristics based on geology, land use and floristic pattern. The samples have been collected from eight locations for soil quality in project area various 18 parameters were selected for soil quality assessment.

Air Quality Assessment

The baseline status of the ambient air quality has been assessed through a scientifically designed ambient air quality monitoring network. The design of monitoring network in the air quality surveillance programme has been based on Meteorological conditions on synoptic basis; Topography of the study area; Representatives of regional background air quality for obtaining baseline status; and Representatives of likely impact areas. Ambient Air Quality Monitoring (AAQM) stations were set up at six locations with due consideration to the above mentioned points. Sampling at each of the 06 stations was done and data for ambient air environment was generated for the parameters - Suspended Particulate Matter (SPM), PM_{10.0}, PM_{2.5}, Sulphur dioxide (SO₂) and Nitrogen oxide (NO₂).

Water Quality Assessment

For water quality assessments 16 samples were collected in total out of which 8 were for ground water and 8 samples were from surface water. 39 parameters were selected for surface water quality assessment and 35 parameters were selected for ground water quality assessment.

Biological Environment

Flora

The primary baseline survey was conducted to assess the nature of the existing habitat and species composition. The study was carried out in 10 km radius of the project site. The floral species were identified with the help of plant taxonomy manual, published literatures, reports and websites (BSI and State/District Forest Departments etc.). In addition, information was also collected with vernacular names of plant species from local inhabitants. Eco-sensitive area in 10km radius are Parambikulam Tiger Reserve, Athirapilly Reserved Forest, Kodasseri Reserved Forest, and Malayattur Reserved Forest.

Detailed phyto-sociological attributes of various locations (TE1, TE3, TE4, TE5) have been presented with data on different tree species, including their scientific names, total number of individuals, basal area (BA), relative frequency (RF), relative density (RD), relative basal area (RBA), and Importance Value Index (IVI).

Fauna

**Proposed “PORINGALKUTHU SMALL HYDRO-ELECTRIC PROJECT (2x24MW)”
at Athirapally Panchayat, Chalakudy Taluk, Thrissur District, Kerala**

During the survey, animals observed in the area have been identified and recorded. Information on wild animals has been collected from the secondary literature, forest departments and from local residents. Lists of mammals, birds, reptiles, amphibians, butterflies and fish species with their common names, family, their status as per IUCN and Wildlife (Protection) Act, 1972 (Amendment 2022) is presented.

Socio-economic Environment

The study area defines the circle, radius of 10 km around the project site-Poringalkuthu Small Hydro Electric Project Stage-II, Thrissur District in Kerala by M/s Kerala State Electricity Board Ltd. (KSEBL). There are 4 identified habitations in the study area all of which are villages. The habitations of the study area are spread over the sub district Chittur of Palakkad district; sub district Mukundapuram of Thrissur district and sub districts Aluva and Kothamangalam of Ernakulam district of Kerala State. There are no uninhabited villages in the study area according to the Census of India, 2011.

3 Anticipated Environmental Impacts and Mitigation Measures

The key activities to be undertaken are as follows:

- **Construction Phase:**
 - Site preparation and excavation for the powerhouse.
 - Construction of penstock bifurcation, powerhouse, and tailrace tunnel.
 - Waste management, including muck disposal and construction waste.
 - Operation of construction equipment, power generation, and labor camp waste disposal.
- **Operation Phase:**
 - Equipment maintenance and restoration.
 - Waste management from project colonies, including sewage and solid waste disposal.

In summary, this project is designed to enhance local power generation capacity, efficiently use existing water resources, and mitigate potential environmental impacts throughout its lifecycle.

Sewage Management during Construction and Operation

- **Construction Phase:** Temporary labor colonies will be set up with facilities like toilets, drinking water, shelters, and first-aid. Sewage from these camps will be treated using a Sewage Treatment Plant (STP) before disposal into the river.
- **Operation Phase:** Only a small number of O&M staff will reside in the project colony. The sewage will be treated through biological treatment facilities, ensuring no impact on the receiving water body.

**Proposed “PORINGALKUTHU SMALL HYDRO-ELECTRIC PROJECT (2x24MW)”
at Athirapally Panchayat, Chalakudy Taluk, Thrissur District, Kerala**

Waste and Muck Disposal

- Construction Waste: Municipal solid waste, scrap materials, packaging, and other construction debris will be separated at source, stored in bins, and transported to disposal sites via covered trucks. Disposal will include landfills or incineration.
- Muck Disposal: Excavated materials will be transported to designated dump sites. Useful materials will be separated for re-use in construction. The muck will be disposed of according to specifications and environmental norms.

Water and Effluent Management

- Construction Effluent: Wastewater from construction activities will contain suspended solids. It will be treated using settling tanks/clarifiers before discharge.
- Operation Effluent: No major water pollution is anticipated during operation, as the sewage from the project colony will be treated to meet disposal standards, avoiding impact on water bodies.

Extraction of Construction Materials

- Construction materials like stones, pebbles, and sand will be sourced from the riverbed. This extraction may cause disturbances to the riverbed, affecting benthic organisms and fish breeding. Precautions will be taken to minimize ecological impact, including selecting areas with minimal aquatic life.

Impacts on Riverbed and Soil Erosion

- Riverbed Stability: Extracting materials from the riverbed could disrupt the aquatic ecosystem, including fish breeding. Care will be taken to select low-impact areas for material extraction.
- Soil Erosion: Runoff from construction sites could increase sediment levels in the river, reducing light penetration and affecting photosynthesis in aquatic plants. Measures will be implemented to reduce soil erosion and mitigate this impact.

Air Pollution

- Construction Phase: Air pollution mainly arises from the operation of construction equipment, vehicular emissions, and dust from muck disposal. Emissions such as SO₂ and SPM from diesel-powered equipment are expected to be minimal, with no significant impact on air quality. Green belt development will help mitigate air pollution.
- Vehicular Movement: Increased vehicular movement during construction will contribute to local emissions, but no major adverse impacts are anticipated.

Safety Measures

- With increased construction activities, safety protocols are critical to prevent accidents. The project authorities will ensure the implementation of safety standards for all construction activities, providing protective measures for workers to minimize accidents.

Impact on Terrestrial Ecology

The movement of vehicles and construction equipment will cause noise pollution, which in turn will disrupt animal movement, as the project site falls within the buffer zone of the Parambikulam Tiger Reserve and the Reserve Forests of the Vazachal Division. The transportation of construction materials, manpower and equipment will be carried out along the Chalakudy-Malakkappara route (SH-21). There are wild animal movement hotspots identified in pockets along the highway. The vehicular movement could cause disturbance to their movement.

Impact on Aquatic Ecology

In the proposed Poringalkuthu Small Hydro Project, water is drawn from the reservoir. For this purpose, penstock will be constructed. Screens and filters are added in the entrance of the water intake structure, which prevents the waste and debris to enter the water intake structure. The screens and filters prevent the fishes entering the water intake structure. The large fishes can be saved by the use of screen but the screens and filter cannot prevent smaller fishes, phytoplanktons, macro-invertebrates entering the water intake structure.

- Construction equipment- Machines & equipment which produces less noise should be used for the construction purposes.
- No construction in dry season – The animal movement is always high around the year, during the dry months, animals move in search of water and food. Construction during dry season is not advisable during that season.
- Construction Timing- The construction activities should be carried out at a particular time of the day. The ideal time for construction activity is 10 AM to 4 PM.
- Clearing of vegetation – Unwanted clearing of vegetation should be avoided.

Conclusion

The EMP outlines the key strategies for managing sewage, waste, air pollution, and environmental impacts from construction activities. Measures will be taken to mitigate soil erosion, protect aquatic life, and manage the extraction of riverbed materials responsibly. The operational phase is expected to have minimal environmental impact, with no significant pollution risks anticipated due to proper treatment of sewage and effluents. Safety measures will be strictly enforced during construction to protect workers from hazards.

4 Environmental Monitoring Programme

Monitoring Importance: Continuous monitoring is essential to assess the impact of water resource projects on the environment. It helps in detecting changes and guiding corrective measures to protect the environment during construction and operation phases.

**Proposed “PORINGALKUTHU SMALL HYDRO-ELECTRIC PROJECT (2x24MW)”
at Athirapally Panchayat, Chalakudy Taluk, Thrissur District, Kerala**

Environmental Monitoring Plan: Overall Strategy: The environmental monitoring plan includes monitoring of air quality, noise levels, water quality, and muck disposal, focusing on parameters that may have temporary impacts during construction and operation.

Air Quality Monitoring and Management

Pollutants: Construction activities may cause temporary increases in pollutants like SO₂, NO_x, SPM, PM₁₀, and PM_{2.5}.

Monitoring Plan: Air quality will be monitored quarterly during the construction phase (excluding monsoon).

Noise Quality Monitoring and Management

Noise Sources: Increased noise from construction activities, including equipment operation and vehicular movement.

Monitoring Plan: Noise levels will be monitored quarterly during both the construction and operation phases at the same locations listed for air quality monitoring. Noise will primarily be generated by construction equipment, diesel generators, and traffic.

Water Quality Monitoring and Management:

Concerns: The primary water pollutants during construction are suspended solids, biodegradable matter, pathogens, and nutrients from sewage waste. Water quality may degrade if proper sanitation facilities are not provided to workers.

Monitoring Plan: Water quality will be monitored quarterly during both construction and operation phases, focusing on physico-chemical and bacteriological parameters at key locations

Measures: Sewage from labor camps and colonies will be treated before discharge into the river. Sediment-laden water from construction sites will be collected in sedimentation tanks before release.

Muck Disposal Monitoring:

Muck Disposal: Small amounts of excavated material will be generated and reused on-site. The disposal process will be regularly monitored and reported monthly to the State Pollution Control Board.

Minimum Flow Monitoring:

Flow Monitoring: The minimum flow of 30% during the lean season will be monitored daily by the project authorities. Monthly reports will be submitted to the State Pollution Control Board, with surprise inspections by the board.

Sharing of Monitoring Results:

Transparency: Monitoring results will be shared with the project authorities, State Pollution Control Board, and relevant government agencies. The monitoring agency can disseminate the findings in other forms as necessary.

Conclusion

The Environmental Monitoring Plan for the Poringalkuthu Stage – II Project is comprehensive, focusing on key environmental parameters such as air quality, noise levels, and water quality. The plan ensures that any adverse impacts during construction and operation are identified and mitigated effectively, with continuous monitoring and corrective actions in place for the project's entire lifespan. The project will also adhere to proper disposal methods for muck and maintain the minimum river flow to protect the aquatic ecosystem.

5 Additional Studies

The following additional studies were conducted for Poringalkuthu SHEP Stage –II.

- Hydrological studies for water availability
- Design flood studies
- Sedimentation Studies
- Fixation of storage and reservoir levels, maximum water level (MWL), full reservoir level (FRL), minimum draw down level (MDDL), flood cushion etc.
- Power potential & installed capacity
- Assessment of power potential (firm power and 75% dependable energy, secondary energy) of the scheme.
- Bathymetric Survey
- Ecological Flow
- Cumulative Impact Assessment of Hydropower Projects on River Flow, Forests, and Biodiversity in the Chalakkudy River Basin
- Wildlife Conservation Plan
- Dam Break Analysis

6 Project Benefits

The development of Poringalkuthu SHEP Stage –II will accrue the following benefits.

- Economic Benefits
- Socio-Economic Benefits
- Ecological Benefits
- Fisheries Conservation

7 Environmental Management Plan

The following aspects have been covered under the Environmental Management Plan.

- Catchment Area Treatment Plan
- Wildlife Conservation and Management Plan
- Development of Greenbelt
- Fisheries Conservation
- Dam Break Analysis and Disaster Management Plan
- Muck Disposal Plan
- Restoration of Quarry sites
- Public Health Delivery System
- Labour Management Plan for their Health and Safety
- Sanitation and Solid Waste Management Plan
- Energy Conservation Measures
- Environmental Safeguards during construction activities including Road Construction

A Provision of **Rs. 384.59 lacs** has been made for Implementation of Environmental Management Plan.