

Study of Lake Tapping Technology for Sustainable Hydropower Development and Irrigation at Kalamawadi Dam

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Abstract- Lake tapping is a sustainable technique for utilizing stored water for hydropower generation and water management. This study focuses on the possible application of lake tapping technology at Kalamawadi Dam, Maharashtra, to improve the use of available water resources. The technique can help generate clean electricity by directing water through an underground tunnel towards a hydroelectric power plant. It can also support irrigation and groundwater recharge by Productively utilizing excess water. The study also considers the utilization of dead storage, which can help make better use of water that normally remains stored below the regular operating level. Proper geological investigation, tunnel design, and safety measures are important for successful implementation. The study aims to explore lake tapping as a sustainable solution for improving energy generation and water management at Kalamawadi Dam.

I. INTRODUCTION

Lake tapping is a sustainable technique for utilizing stored water for hydropower generation and water management. This study focuses on the possible application of lake tapping technology at Kalamawadi Dam, Maharashtra, to improve the utilization of available water resources. The technique can help generate clean electricity by directing water through an underground tunnel towards a hydroelectric power plant. It can also support irrigation and groundwater recharge by Productively utilizing excess water. A major focus of the study is the dead storage of Kalamawadi Dam, which represents the portion of reservoir storage that normally remains below the minimum operating level and is not readily available for conventional water utilization. The study explores the Viability of utilizing a suitable portion of this stored water through lake tapping, thereby improving the overall

utilization of the reservoir without significantly affecting its primary functions. Proper assessment of the dead-storage volume, reservoir bathymetry, geological conditions, hydraulic head, and tunnel alignment is essential for determining the Viability of the proposed system. The study also emphasizes the importance of geological investigation, tunnel design, hydraulic analysis, and safety measures for successful implementation. Overall, the study aims to explore lake tapping as a sustainable solution for utilizing the dead storage of Kalamawadi Dam while improving energy generation and water management.

II. OBJECTIVES

1. To assess the Viability of implementing lake tapping technology at Kalamawadi Dam for sustainable hydropower generation.
2. To investigate the potential utilization of dead storage water of Kalamawadi Dam for power generation without affecting the existing the irrigation requirements.
3. To evaluate the hydraulic and geological conditions, including available hydraulic head, water availability, and tunnel alignment, for the proposed lake tapping system.
4. To develop a preliminary concept for an underground tunnel system to convey reservoir water for hydropower generation.
5. To assess the potential benefits of lake tapping for sustainable water management, including hydropower generation, irrigation support, and groundwater recharge.

III. COLLECTION OF EXISTING DATA

Collect relevant data related to Kalamawadi Dam, including reservoir capacity, dead storage, live storage, water levels, inflow and outflow, irrigation requirements, rainfall, sedimentation, and existing dam operation data.

A. Assessment of Dead Storage

Study the reservoir characteristics and determine the available dead-storage volume and its variation with reservoir water levels. The possibility of utilizing a suitable portion of dead storage for hydropower generation will be examined without affecting the primary irrigation function.

B. Hydrological and Hydraulic Analysis:

Analyze the available water quantity and hydraulic head to estimate the potential discharge through the proposed lake tapping system. The theoretical hydropower potential will be estimated using the available water discharge, hydraulic head and expected system efficiency.

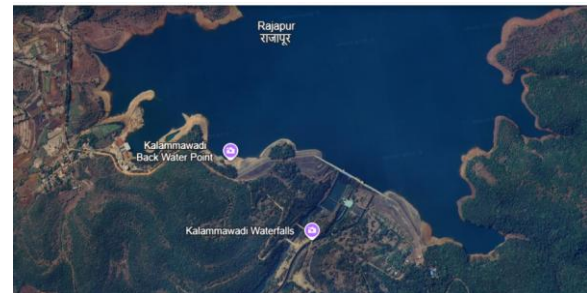
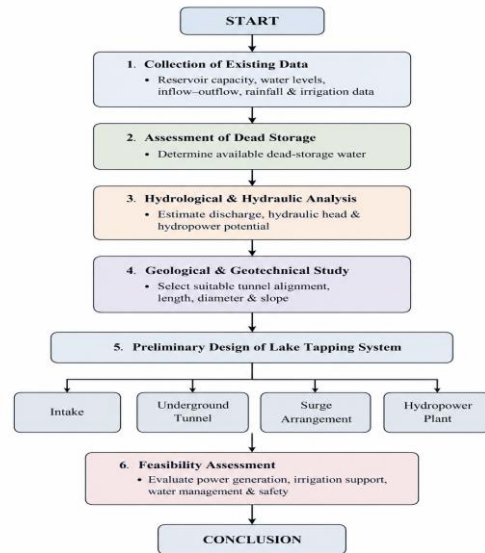
C. Geological and Tunnel Viability Study:

Study the geological and geotechnical conditions along the proposed underground tunnel alignment. Suitable tunnel alignment, tunnel length, diameter, slope, and construction Viability will be considered based on available geological and topographical information.

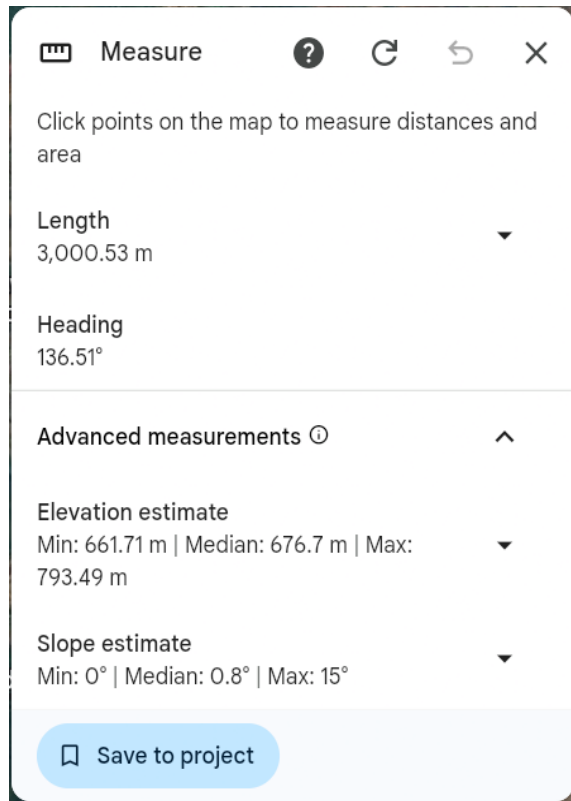
D. Preliminary Design and Viability Assessment:

Develop a preliminary layout of the lake tapping system, including the intake, underground tunnel, surge arrangements and hydropower plant. The technical Viability, expected power generation, water management benefits, and safety requirements will then be evaluated to determine the suitability of lake tapping at Kalamawadi Dam.

IV. METHDOLOGY



Proposed Tunnel Work



Dimensions

V. CONCLUSION

The study concludes that lake tapping technology at Kalamawadi Dam has potential for sustainable hydropower generation and productive utilization of stored water. The suitable use of dead storage can improve water utilization without significantly affecting existing irrigation requirements. The Viability of the system depends on water availability, hydraulic head, geological conditions, reservoir bathymetry, sedimentation, and suitable tunnel alignment. With proper investigation, design and safety measures, lake tapping can provide clean energy, support irrigation, and improve overall water-resource management. Further detailed field studies are required to confirm its technical and economic viability.

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