



MATHEMATICAL MODEL STUDIES FOR SURGE ANALYSIS OF WARDHA BARRAGE (HADGAON) LIFT IRRIGATION SCHEME-1 TALUKA: BABHULGAON; DISTRICT: YAVATMAL, MAHARASHTRA



STUDY OVERVIEW

The Wardha Barrage Lift Irrigation Scheme-1, located near Yarandgaon in Yavatmal district, Maharashtra, aims to irrigate 7,855 hectares by pumping water from the Wardha barrage. Four vertical submersible centrifugal pumps are installed at the intake structure, pumping water through a 1040 mm diameter, 5850 m long rising main. The total discharge is 1.75 m³/s, with a static lift of 36.33 m and a total pump head of 53.97 m.

APPROACH

- **Evaluate Transient Pressure Responses:** Assess system reactions to sudden flow changes, focusing on high and low transient pressures.
- **Analyze Worst-Case Scenarios:** Identify severe conditions without surge protection.
- **Effectiveness of Surge Protection Devices:** Evaluate how surge protection devices mitigate transient pressures under worst-case conditions.

Transient Modeling:

- **Without Surge Protection:** Baseline simulations were conducted to assess transient pressures under critical scenarios.
- **With Surge Protection:** Simulations incorporated surge protection devices to evaluate their effectiveness in reducing transient pressures

KEY FINDINGS

Based on transient modeling simulations, the study recommends two surge protection options for mitigating transient pressures during pump tripping due to power failure:

1. **Option 1:** A 55 m³ compressed air vessel near the pump, paired with Six 100 mm double-acting kinetic air valves.
2. **Option 2:** A 50 m³ bladder-type air vessel near the pump, also paired with six 100 mm double-acting kinetic air valves.

IMPACT

Surge protection studies in lift irrigation projects are crucial for improving safety, effectiveness, and sustainability. Implementing these measures enhances economic and environmental outcomes, contributing to the long-term sustainability of irrigation systems. A well-designed surge protection system supports agricultural productivity and efficient water conservation.

