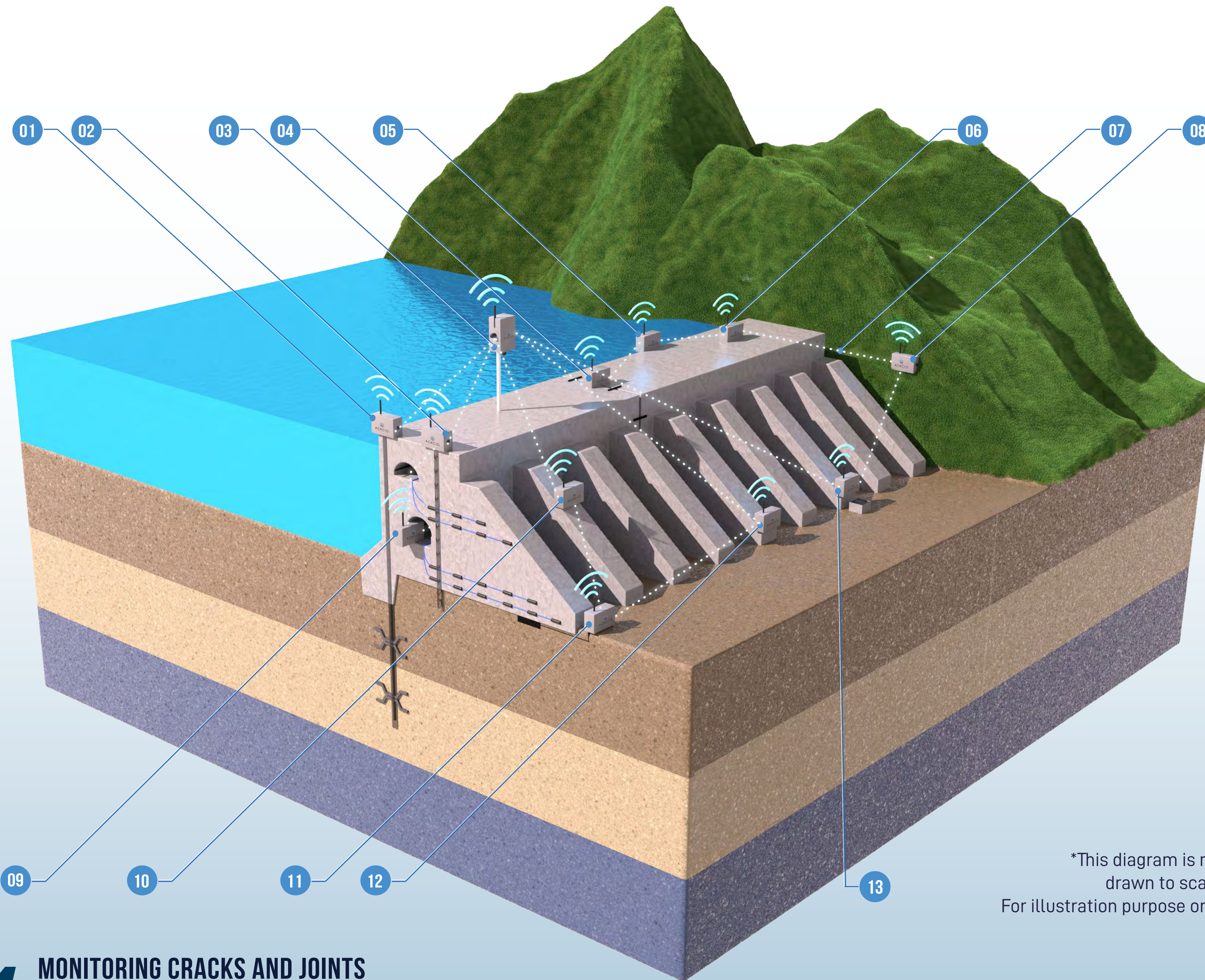


Remote Monitoring Solutions for Dams

Dams are critical infrastructures classified as a high-hazard-potential, not because they have an increased risk of failure but because if failure were to occur, the impacts of it would be catastrophic, with direct loss of human life and extensive damages on the property and the environment. Therefore, monitoring the health of a dam during the construction and all its operational life is critical to ensure the good maintenance and integrity of the infrastructure, and to safely predict potential failures ahead of time. Ackcio Beam fully automates this process by providing real-time data from sensors monitoring these key parameters.



*This diagram is not drawn to scale. For illustration purpose only.

01 SETTLEMENT DISPLACEMENT MONITORING

Settlement/lateral displacement of the dam is monitored by leading brands of digital in-place-inclinometers (IPI's)/MPBX/extensometers/SAA's in real-time using Ackcio **BEAM-DG** Nodes.

02 PORE WATER PRESSURE MONITORING

Piezometers measuring the uplift and underground pore water pressure are monitored in real-time using Ackcio **BEAM-VW-S1** (1 channel) and **BEAM-VW-S8** (8 channels) Nodes.

03 ACKCIO GATEWAY

The Ackcio **BEAM-GW** receives sensor data from the Nodes within the network. Ackcio's Snape software that runs on the Ackcio Gateway is used to configure and manage the project. It also provides the option to push the data via FTP/API to a selected server and/or software of your choice.

04 MONITORING CRACKS AND JOINTS

Ackcio's Vibrating Wire Nodes (**BEAM-VW-S1** and **BEAM-VW-S8**) and Analogue Nodes (**BEAM-AN-S1** and **BEAM-AN-S4**) connect to Crackmeters and Joint meters to monitor movement on structural joints and cracks in concrete dams.

05 MONITORING WATER LEVEL AND QUALITY

Ackcio **BEAM-DG** Nodes are equipped to read water level and water quality sensors from leading brands.

06 ACKCIO NODES

Each battery-operated Node acquires data from multiple sensors and transmits the sensor data wirelessly through the Ackcio Mesh network to the Ackcio Gateway.

07 ACKCIO MESH

Ackcio's patented long-range wireless **MESH** network connects the Ackcio Nodes to the Ackcio Gateway. The mesh network is self-healing, enhancing the transmission reliability. The ability to 'hop' up to 12 times significantly increases the reliability in complex environments and offers the ability to increase aggregate range if required. The system is highly flexible and scalable.

08 SLOPE STABILITY MONITORING

Ackcio Beam automates the slope stability monitoring program around the dam that use a mixture of instrumentation including, **BEAM-TM** Nodes, **BEAM-DG** Nodes to monitor IPIs, SAA's or extensometers and **BEAM-VW-S1** (1 channel) and **BEAM-VW-S8** (8 channels) Nodes to automate the monitoring of piezometers measuring porewater pressure.

09 MONITORING INSIDE THE GALLERIES

Many parameters are monitored from inside the galleries of the dam including joint and crack movements, dynamic stress, tilt, seepage, temperature profile and pore water pressure. Ackcio Beam, powered by the Ackcio **MESH** network allows for reliable and scalable, remote monitoring deep inside the galleries.

10 MONITORING STABILITY OF DAM ABUTMENT

Ackcio **BEAM-TM** Nodes bundle Ackcio's long-range wireless mesh technology with Sisgeo's trusted bi-axial self-compensated MEMS inclinometer, measuring the horizontal and vertical tilt movement of dam, surrounding structures and dam abutment.

11 MONITORING TOTAL PRESSURE

Ackcio **BEAM-AN-S1** (1 channel) Nodes automate the monitoring of a pressure cell which measures total earth pressure under the dam.

12 REPEATER NODES

If deployment challenges reduce the range of Ackcio Nodes, Ackcio **BEAM-RN** Nodes assist in extending the wireless range of other Ackcio Nodes within the network.

13 SEEPAGE MONITORING

Ackcio **BEAM-VW-S1** and **BEAM-DG** Nodes monitor seepage leakage by the water head developed over the V-notch weir.