

SECTION-2

DETAILED ITEMWISE SPECIFICATION

DETAILED ITEMWISE SPECIFICATION

ITEM NO. 1: Supplying, installing, testing, and commissioning of an Automatic Total Station, integrated for real-time monitoring and live data acquisition, with 0.5 arc second angular accuracy, 0.1 arcsecond least count, reflectorless distance range ≥ 1000 m, distance with prism ≥ 4000 m, auto-lock with prism up to 2500 m, RS-232 communication, USBHost/ Device ports, laser/inbuilt optical plummet, single-side keyboard, supplied with all standard accessories, and compatible prism for 140–600 m measurement with ± 0.1 mm accuracy, complete in all respects as directed by the Engineer-in-Charge.

Sr. No.	Parameter	Specification
1	Instrument Type	Automatic Total Station
2	Angular Accuracy	0.5 arc-second
3	Least Count	0.1 arc-second
4	Reflector less Distance Range	Minimum 1000 meters
5	Distance Range with Reflector (Prism)	Minimum 4000 meters
6	Communication Interface	RS-232 interface
7	Connectivity Ports	USB-Host, USB-Device Ports
8	Plummet	Laser Plummet/Inbuilt optical Plummet
9	Auto-lock Range with Prism	2500 meters
10	Keyboard	Single Side Keyboard
11	Accessories	Supplied with all standard accessories

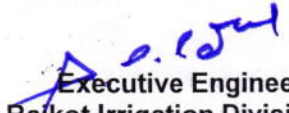
1. Select a stable location outside the deformation zone with clear visibility to all monitoring points.
2. Construct a permanent RCC pillar on hard rock or stable foundation for instrument installation.
3. Install a forced-centering plate and tribrach on the pillar for precise positioning.
4. Mount the robotic total station securely on the tribrach and perform centering and levelling.
5. Install weatherproof enclosure, lightning protection, and grounding system for instrument safety.

6. Provide continuous power supply (12 V DC), using UPS, and solar backup system.
7. Fix monitoring prisms on spillway piers, NOF section wall, embankment crest, d/s slopes, and other critical locations.
8. Establish stable reference control points and benchmarks outside the monitoring area.
9. Configure instrument settings, coordinates, prism constants, and observation intervals.
10. Install communication system such as fibre optic cable, GSM modem, or Ethernet for data transfer.
11. Install wireless monitoring nodes (IoT data nodes) at instrument and field locations for data collection and transmission.
12. Configure node IDs, communication protocol, sampling intervals, and network connectivity for real-time data transfer.
13. Integrate wireless nodes with monitoring software/central server for automatic data acquisition and processing.
14. Configure monitoring software for automatic observation, deformation analysis, and alarm generation.
15. Carry out calibration, baseline observation, and trial monitoring before regular operation.
16. Start real-time automatic monitoring and periodically verify system accuracy and stability.

MODE OF MEASUREMENT AND PAYMENT:

The payment of this item shall be made on Each Number basis of the completed work without proud.

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 2: Providing and fixing Circular Prism suitable for use with Total Station of 0.5" angular accuracy, capable of accurate distance measurement in the range of 140 m to 600 m, with measurement accuracy of ± 0.1 mm, complete with prism holder, mounting arrangement, and all accessories, as per specifications and direction of Engineer-in-Charge.

Prism		
Sr. No.	Parameter	Specification
1	Application Distance	Suitable for measurements 140 to 600 meters
2	Compatibility	Compatible with 0.5" accuracy Total Station
3	Measurement Accuracy	± 0.1 mm

1. Select stable and visible locations on dam pier, NOF, embankment crest, and downstream slope.
2. Provide suitable scaffolding at dam pier, NOF section, spillway wall, or downstream slope wherever safe access is not available.
3. Ensure scaffolding is stable, properly anchored, and capable of supporting workers and equipment.
4. Clean the surface and mark the prism installation point.
5. Drill holes as per anchor bolt size and depth.
6. Fix stainless steel anchor bolts or chemical anchors firmly.
7. Install prism mounting bracket securely on the structure.
8. Mount the monitoring prism on the bracket and tighten properly.
9. Align the prism toward the robotic Total Station for clear visibility.
10. Assign prism ID and record prism location details.
11. Observe and record initial coordinates for baseline monitoring.
12. Perform final inspection for stability, visibility, and proper alignment.

MODE OF MEASUREMENT AND PAYMENT:

The payment of this item shall be made on Each Number basis of the completed work without proud.

Signature of Contractor

Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 3: Providing, installing and commissioning permanent Ground Control Point (GCP) Settlement Marker comprising MS base plate (250×250×5 mm conforming to IS 2062), GI riser pipe 25 mm dia (medium class as per IS 1239), sand filling (clean river sand, loose), optional PVC/GI outer casing (min 100 mm dia), precast concrete cover (M20, 500×500×50 mm with central hole), MS/GI reference cap, and painting in black & white checkerboard pattern using weather-resistant enamel paint, complete with excavation, installation, alignment, and all materials, labour, tools, and accessories, suitable for survey works using Total Station / drone survey, complete as per specifications and direction of Engineer-in-Charge.

13 Providing, installing, protecting, and monitoring surface settlement markers in earthen dam embankment to measure vertical settlement of fill and foundation.

Sr. No.	Description	Specification
1.	Base Plate	Material: Mild Steel conforming to IS 2062 Size: 250 mm × 250 mm × 5 mm thick Finish: Anti-corrosive paint / galvanization Central coupling: Welded socket for 25 mm pipe
2.	Riser Pipe	Material: GI pipe (Medium class as per IS 1239) Diameter: 25 mm Length: As required (extendable with threaded couplers)
		Joints: Threaded with proper alignment
3.	Sand Filling	Type: Clean river sand Properties: Non-cohesive Silt content < 5% Free from organic matter Placement: Loose (no compaction)
4.	Outer Casing (Recommended)	Material: PVC / GI Diameter: 100 mm (min) Function: Protect sand column and pipe
5.	Precast Concrete Cover	Grade: Minimum M20 Size: 500 mm × 500 mm × 50 mm thick Central hole: 100 mm diameter (minimum)
6.	Paint	Top surface painted in black & white checkerboard pattern (4 squares) Weather-resistant enamel paint High contrast for drone visibility
7.	Annular Filling (Inside Cover)	Material: Clean loose sand Condition: No grout / mortar permitted

8.	Reference Cap	Material: MS / GI Fixed at top of riser pipe Marked point for leveling
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Installation Procedure

Pre-Installation Survey and Layout

Site Selection: Identify installation points on lines parallel to the dam center line at intervals of 50 m to 100 m.

Placement Strategy: Ensure lines are established at the edge of the dam's top width, at the edges of berms, or at suitable intervals along the slope.

Foundation Stability: If the foundation soil is not firm, markers must be placed at the toe of the dam and at distances of 50 m and 100 m from the toe.

Upstream/Downstream Distribution: Markers should be installed on both slopes, with the exception of upstream locations that remain submerged year-round.

Establishment of Reference Base Line

Control Line Setup: A reference base line must be established on firm ground completely outside the area of movement influenced by reservoir and embankment loads.

Positional Determination: The precise coordinates of all markers fixed on the embankment must be determined by survey with reference to this established base line.

Mechanical Installation

Sand Bedding: Prepare the base with 10–20 mm thick sand bedding.

Base Plate Installation: Place the MS plate horizontally, check the level using a spirit level, and record the initial RL (benchmark reference).

Riser Pipe Fixing: Connect the 25 mm GI pipe to the base plate, ensure vertical alignment (plumb), and secure the threaded connection properly.

Sand Column Formation: Provide casing if required. Fill the surrounding area with loose sand, ensuring no compaction, uniform filling, and no intrusion of embankment soil.

Embankment Construction: Place fill in layers and extend the riser pipe using couplers. Maintain verticality and avoid any bending or displacement.

Precast Cover Installation: Install the precast concrete block at crest level, ensuring the central hole aligns with the pipe and that there is no direct contact between the pipe and concrete.

Annular Sand Filling: Fill the gap between the pipe and the hole with loose sand; do not compact or grout.

Cap Fixing & Marking: Fix the reference cap and apply chainage marking along with the identification number.

Protection: Provide temporary barricading during construction and ensure clear visibility of the checkerboard marking.

Monitoring & Readings

Monitoring shall be carried out using an auto level or total station, with reference to a permanent benchmark.

Readings shall be taken weekly during construction. During the initial impounding stage, monitoring shall be conducted on a weekly or fortnightly basis.

For long-term observation, readings shall be recorded monthly or quarterly.

Measurement & Payment

Measurement shall be made on a per number (each) basis shall include the cost of the plate, pipe, sand, casing, and concrete cover, along with installation and initial readings.

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 4: Conducting detailed topographic and elevation survey for Settlement Markers by establishing and transferring precise Reduced Levels (RLs) from the approved permanent benchmark at dam site using Total Station, including necessary traverse survey, closure error adjustment, control point verification, checking of horizontal and vertical accuracy, recording of coordinates/elevations, preparation of field observations, and all allied works required for ensuring accurate reference elevation of settlement markers, complete in all respects as per site conditions and as directed by the Engineer-in-Charge.

- **Section [X]: Detailed Technical Specification for Topographic and Elevation Survey for Settlement Markers**

- **1. Scope of Work**

- The scope of work covers the execution of a precise topographic and elevation survey to establish and transfer accurate Reduced Levels (RLs) and horizontal coordinates for Settlement Markers. The survey shall originate from the approved Permanent Benchmark (PBM) at the dam site and include:
 - Establishing a closed traverse network.
 - Transferring precise elevations using a high-precision Total Station.
 - Closure error adjustment and control point verification.
 - Checking horizontal and vertical accuracy limits.
 - Recording, processing, and submitting all field observations, coordinates, and final survey reports as directed by the Engineer-in-Charge.

- **2. Instruments and Equipment**

- All instruments used for the survey must be in excellent working condition and possess valid calibration certificates from an approved/accredited laboratory (not older than six months).
- **Total Station:** Must have an angular accuracy of at least $\pm 1''$ (one second) and a distance measurement accuracy of at least $\pm (1\text{mm} + 1.5\text{ppm})$.
- **Prism & Targets:** High-precision retro-reflectors with stable, calibrated prism constants. Heavy-duty wooden or fiberglass tripods must be used to minimize vibration and thermal expansion errors.
- **Accessories:** Digital barometers and thermometers for atmospheric corrections, optical/laser plummets, and calibrated leveling staffs if required.

- **3. Execution Methodology**

- **3.1. Verification of Permanent Benchmark (PBM)**

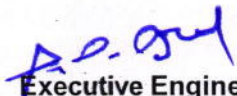
- Before commencing any survey work, the Contractor shall verify the physical condition and stability of the approved PBM at the dam site. The RL and coordinates of the PBM provided by the Department must be cross-checked against at least one other independent reference point to ensure absolute baseline consistency.

- **3.2. Traverse Survey and Control Network**

- **Network Design:** A closed-loop or link traverse shall be designed from the PBM to the settlement markers.
- **Line of Sight:** Every station point must be selected on firm, undisturbed ground with clear lines of sight, free from vegetation or atmospheric distortions (like heat shimmer).
- **Observations:** Angular measurements at each station must be taken in both Face Left (FL) and Face Right (FR) positions to eliminate instrumental collimation errors. A minimum of 3 sets of readings per station is mandatory.

- **3.3. Transfer of Reduced Levels (RLs)**
- Elevations must be transferred from the PBM using precise trigonometric leveling via the Total Station, applying strict curvature and refraction corrections.
- The maximum sight distance from the instrument to the prism shall not exceed **100 meters** to minimize environmental errors.
- **4. Error Distribution:** Field data adjustments and adjustments for closure errors must be performed using the **Least Squares Method** or the **Bowditch (Compass) Rule** for horizontal data, and equal distribution per station for vertical leveling data, subject to approval by the Engineer-in-Charge.
- **5. Settlement Marker Surveying & Recording**
- Each settlement marker must be clearly numbered and securely referenced.
- Coordinates (E, N, Z) shall be recorded only after the instrument has achieved perfect thermal and level equilibrium.
- For each marker, a minimum of three independent observations must be taken, and the mean value shall be adopted as the final reference elevation, provided the variation between readings does not exceed $\pm 1 \text{ mm}$.
- **6. Documentation and Submittals**
- The Contractor shall maintain clean, systematic records and submit the following deliverables to the Engineer-in-Charge:
 - **Raw Field Data:** Unedited electronic data log files directly extracted from the Total Station (.RAW, .IDX, or equivalent formats).
 - **Field Notes:** Certified copies of handwritten field books containing sketches, station descriptions, meteorological data, and raw observations.
 - **Calculation Sheets:** Documented closure error calculations, adjustment matrices, and quality control checks.
 - **Final Survey Report:** A comprehensive report containing:
 - Description of the PBM used.
 - Instrument calibration certificates.
 - Final adjusted coordinates (E, N) and Reduced Levels (RL) of all control points and settlement markers presented in a clear, tabular format.
 - As-built CAD drawings showing the traverse loop, control points, and settlement marker locations overlaid on the site topographic map.
- **7. Quality Assurance and Safety**
- The Engineer-in-Charge or their authorized representative reserves the right to check the instrument setups and witness any part of the field observations.
- **8. Measurement and Payment**
- **Unit of Measurement:** Payment shall be made on **Per Marker** successfully established, verified, and approved.

Signature of Contractor


 Executive Engineer
 Rajkot Irrigation Division
 Rajkot

ITEM NO. 5: Supplying, installing, testing, and commissioning of a mechanical flow measuring device (V-Notch & rectangular weir) for measuring low flow seepage in dams. The device shall have a notch angle of 22.5°, 45°, 60°, or 90° depending on discharge range, a stainless steel SS-304 / SS-316 plate with thickness of 3–5 mm, and be suitable for measurement ranges of approximately 0–100 L/s depending on notch angle. The weir shall have $\pm 1\%$ full-scale reading accuracy, operate under 5–100% humidity, temperature -20°C to $+60^{\circ}\text{C}$, and provide corrosion protection through anti-corrosion finish. Complete in all respects as directed by the Engineer-in-Charge.

V-Notch Wier

Parameter	Technical Specification
Instrument Name	V-Notch Weir (Triangular Weir)
Type	Mechanical Flow Measuring Device
Notch Angle	22.5°, 45°, 60°, or 90° depending on discharge range
Plate Material	Stainless Steel SS-304 / SS-316
Plate Thickness	Minimum 3 mm to 5mm
Measurement Range	Suitable for low flow seepage measurement (between 0.015 m ³ /s to 0.03 m ³ /s)
Corrosion Protection	Stainless steel plate with anti-corrosion finish

Installation Procedure

1. Site Selection: Select a suitable location at the downstream toe of the existing dam where seepage naturally emerges and can be easily collected.
2. Collection and Conveyance: Arrange a small channel or line from downstream toe drain/filter drain to collect the intercepted seepage and convey it safely to the measuring unit. Ensure seepage water is properly directed into the basin without turbulence or bypass flow.
3. Installation of Weir: Fix the V-notch/rectangular weir plate at the outlet of the chamber in a vertical position. Ensure it is properly aligned, level, and leak-proof.
4. Head Measuring Arrangement: Provide a hook gauge or point gauge

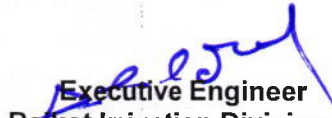
upstream of the weir (at a distance $\geq 4H$) with a stilling well for accurate measurement of head.

5. Sealing and Finishing: Seal all joints using cement mortar or waterproofing material so that no leakage or bypass flow occurs.
6. Calibration: Calibrate the setup using the Weir Discharge Equation to determine discharge accurately.
7. Protection Measures: Provide covers, screens, or housing to protect the setup from debris, damage, and weather effects.
8. Observation and Maintenance: Mark reference levels and maintain regular observations, inspection, and cleaning to ensure reliable performance.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 6: Supplying, installing, testing, and commissioning of a **Wireless MEMS Triaxial Tilt meter**, integrated for real-time monitoring, with $\pm 10^\circ \text{C}$ operating range, Tilt Range $\pm 90^\circ$, $0.0001^\circ / 0.00175 \text{ mm/m}$ resolution, $\pm 0.1\%$ F.S. Repeatability $\pm 0.0005^\circ$ ($\pm 0.0087 \text{ mm/m}$), insulated enclosure, Mounting stainless steel IP68/NEMA-4X enclosure, lightning protection, complete with mounting supports, cables, accessories, and full manuals in English, complete in all respects as directed by the Engineer-in- Charge.

Wireless Tilt Meter

Sr. No.	Parameter	Technical Specification
1	Instrument Type	Wireless MEMS Triaxial Tilt Meter for real-time monitoring of angular displacement and inclination
2	Sensor Technology	MEMS (Micro-Electro-Mechanical System), Triaxial
3	Measurement Axes	Three Axes (X, Y, Z)
4	Tilt Range	$\pm 90^\circ$
5	Resolution	0.0001° (0.00175 mm/m) or better
6	Accuracy	$\pm 0.1\%$ Full Scale (F.S.) or better
7	Repeatability	$\pm 0.0005^\circ$ ($\pm 0.0087 \text{ mm/m}$) or better
8	Operating Temperature	Suitable for operation within dam site environmental conditions (minimum $\pm 10^\circ \text{C}$ range or better)
9	Data Transmission	Wireless communication for real-time monitoring and data transfer to central data acquisition system
10	Power Supply	Long-life battery and/or solar-powered wireless node as specified
11	Enclosure Protection	Stainless Steel IP68 / NEMA-4X weatherproof enclosure
12	Mounting Arrangement	Stainless steel mounting bracket/supports suitable for permanent installation
13	Lightning Protection	Integrated surge and lightning protection system
14	Data Logging	Compatible with wireless data logger/gateway for continuous monitoring
15	Communication Protocol	Compatible with project SCADA/Monitoring Software and wireless network architecture
16	Installation Accessories	Complete with mounting fixtures, connectors, cables, junction accessories, and fastening hardware
17	Software Compatibility	Compatible with centralized monitoring and visualization software for real-time data acquisition
18	Documentation	Complete installation, operation, maintenance manuals, calibration certificates, and technical datasheets in English
19	Testing & Commissioning	Complete testing, calibration verification, installation, commissioning, and demonstration at site

20	Scope of Supply	Supplying, installing, testing, commissioning, integrating with wireless monitoring system, and making operational in all respects as directed by the Engineer-in-Charge
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Wireless Tilt Meter

1. Identify the installation location on spillway pier, abutment, or NOF wall as per requirement.
2. Erect safe and stable scaffolding at the installation point to provide working access at height.
3. Ensure scaffolding is properly anchored, levelled, and certified safe for working load.
4. Clean and prepare the dam surface at the marked tiltmeter location from the scaffolding platform.
5. Drill holes and fix anchor bolts or chemical anchors on the prepared surface.
6. Install and tighten the mounting base plate securely using bolts and epoxy grout.
7. Mount the wireless tiltmeter on the base plate from the scaffolding platform.
8. Align the tiltmeter according to reference axes (upstream-downstream / designed direction).
9. Install and configure the data logging from the wireless gateway and ensure Wireless RF communication is ok.
10. Set baseline readings and perform calibration as per design requirements.
11. Connect to monitoring software and verify real-time data transmission.
12. Provide protective housing and ensure environmental safety of the instrument.
13. Conduct trial readings and finally remove scaffolding after confirmation of stable operation.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 7: Supplying, installing, testing, and commissioning of an Infrared Camera SC-IT6420-HB V2, integrated for real-time monitoring and live data acquisition. The camera shall have a Vanadium Oxide Uncooled Focal Plane Microthermal infrared sensor with selectable resolutions of 256×192, 384×288, or 640×512, NETD ≤0.05°C @ F1.0 (256×192) and ≤0.04°C @ F1.0 (384×288 & 640×512). Spectral response shall be 8–14 μm with multiple lens options (3.2mm, 6mm, 7.5mm, 13mm, 25mm) and field of view as per lens selection. Visible light CMOS of 1/2.8" with 1920×1080 resolution, optional 4–6 mm lens, and 30 m light range. Temperature measurement shall cover -20°C to 180°C (First Gear) and 0–650°C (Second Gear) with ±2°C or ±2% accuracy, supporting 10 movable points, areas, and lines, emissivity correction, and unit adjustment (°C/°F). The system shall include high/low temperature alarms with I/O, H.264 video compression, optical 16X zoom, manual/auto corrections, image adjustment, flip/mirror/P.I.P, dual light fusion, color palette support, and OSD. Complete in all respects including calibration, testing, mounting, and documentation, as directed by the Engineer-in-Charge..

Infrared Camera

Specifications		SC-IT6420-HB V2	
Model	256	384	640
Infrared			
Image Sensor	Vanadium Oxide Uncooled Focal Plane Microthermal		
Max. Resolution	256x192	384x288	640x512
NETD	≤0.05°C @ F1.0, 300K	≤0.04°C @ F1.0, 300K	≤0.04°C @ F1.0, 300K
Spectral Response	8μm to 14μm		
Lens	3.2mm (Optional:	7.5mm (Optional: 13mm)	13mm (Optional: 25mm)
	6mm)		
Field of View	3.2mm: 50°x38°;	7.5mm: 49.8°x37.4°;	13mm: 48°x36°;
	6mm: 29.8x22.3°	13mm: 28.8°x21.6°	25mm: 25°x19°
Focusing Mode	Fixed Athermalized, waterproof design, hard carbon film		
Visible Light			

CMOS	1/2.8"
Resolution	1920x1080
Lens	4mm (Optional: 6mm)
Light Range	30Mtr.
Temperature Measurement	
Measurement Range	First Gear: -20°C to 180°C, Second Gear: 0°C -650°C
Measurement Accuracy	±2°C or ±2% (whichever is maximum)
Measurement Mode	10 movable points, 10 movable areas, 3 movable lines
Emissivity correction	Highest and lowest temperature capture, average temperature measurement,
	Support irregular box drawing
Temperature	0.01 to 1.0 emissivity adjustable
Temperature Correction	°C/°F
Frame Rate	Distance temperature correction, linear temperature correction
Alarm	
Alarm function	High temp alarm, Low temp alarm
Alarm Action	Alarm linkage buzzer, Alarm linkage light
Alarm I/O	1In/ 1 Out
Feature	
Video Compression	H.264
Image adjustment	Brightness, Gain, DDE, Filtering
Optical Zoom	16X

Correction function	Manual/ Auto after power on; Regular correction after normal operation
Flip	On/Off
Mirror	On/Off
P.I.P	On/Off
Dual Light Fusion	On/Off
Color Palette	Support
OSD	Support

Infrared Camera

1. Select a suitable stable location with clear line of sight to the spillway or dam surface to be monitored.
2. Install a rigid mounting structure such as a pole, wall bracket, or tower on a stable concrete foundation.
3. Fix the mounting bracket securely using anchor bolts and ensure vibration-free support.
4. Mount the infrared thermal camera on the bracket at the required height and viewing angle.
5. Align the camera field of view to cover the target surface area (spillway face, gate, or dam body).
6. Provide weatherproof enclosure (IP-rated housing) to protect against rain, dust, and sunlight.
7. Provide power supply 12 V DC along with UPS backup or solar-powered system.
8. Install communication system (Self adaptive Ethernet port, Wi-Fi, GSM, or fibre-based node) for data transmission.
9. Configure camera settings such as temperature range, emissivity, resolution, and sampling interval.
10. Connect the system to monitoring software for real-time temperature data visualization.
11. Perform calibration using reference temperature sources if required.
12. Conduct trial monitoring to verify accuracy, coverage, and data transmission.

Finalize installation and ensure periodic maintenance access for lens cleaning and system checks.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 8: Supplying, testing, and commissioning of portable Water Level Sounder (Electric Water Level Indicator) for accurate measurement of groundwater levels in boreholes, standpipe piezometers, and observation wells, complete with probe, graduated cable, reel, battery, and all accessories, as per specifications and as directed by the Engineer-in-Charge.

Range: Up to 100 m / 200 m / 300 m

Accuracy: ± 5 mm or better

Probe material: Stainless steel and ABS

Markings : at 1 m interval with mm graduations.

Dip Meter

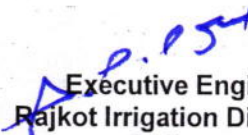
Sr. No.	Parameter	Technical Specification
1	Instrument Type	Portable Water Level Sounder (Electric Water Level Indicator)
2	Application	Measurement of groundwater level in boreholes, standpipe piezometers, observation wells, monitoring wells, and open tubes
3	Measurement Principle	Electrical contact type water level detection with audible and visual indication
4	Measurement Range	Up to 100 m / 200 m / 300 m as specified by the Engineer-in-Charge
5	Accuracy	± 5 mm or better
6	Resolution	1 mm or better
7	Probe Type	Submersible water level sensing probe
8	Probe Material	Stainless Steel and ABS construction
9	Probe Diameter	Suitable for use in standard piezometer and monitoring wells
10	Cable Type	Flat or round graduated measuring cable with high tensile strength
11	Cable Markings	Meter markings at 1 m intervals with millimeter graduations
12	Cable Material	Non-stretch, waterproof, abrasion-resistant cable
13	Reel Assembly	Portable hand-operated reel with winding mechanism
14	Indication System	Audible buzzer and visual LED indication upon contact with water surface
15	Power Supply	Internal replaceable/rechargeable battery
16	Battery Life	Suitable for extended field operation
17	Operating Temperature	0°C to +50°C or better
18	Environmental Protection	Suitable for outdoor field use under dam monitoring conditions
19	Housing Material	Rugged corrosion-resistant reel and instrument housing
20	Portability	Lightweight and easily transportable for field measurements

21	Calibration	Factory calibrated with calibration certificate
22	Measurement Units	Metric scale (meters and millimeters)
23	Accessories	Complete with probe, graduated cable, reel, battery, carrying case, connectors, and all necessary accessories
24	Documentation	Manufacturer's datasheets, operation manuals, calibration certificate, and maintenance instructions in English
25	Testing	Functional testing and verification before commissioning
26	Commissioning	Demonstration of proper operation and measurement accuracy at site
27	Scope of Supply	Supply, testing, calibration, commissioning, and making operational complete with all accessories as directed by the Engineer-in-Charge

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 9: Supplying, installing, testing, and commissioning of a Vibrating Wire Type Piezometer Measuring Instrument for dam instrumentation with an operating range of 0–10 Kg/cm² (or as per dam owner's requirement), integrated for real-time monitoring and live data acquisition. The instrument shall have 1.5× range over-capacity with $\pm 0.1\%$ F.S. effect, $\pm 0.1\%$ F.S. accuracy, 0.025% F.S. resolution, SDI-12/RS 485/4–20 mA output, IP68 stainless steel enclosure, lightning protection, including sensor mounting support, signal cables and all required accessories, complete with integration to Real Time Monitoring System (RTMS) / data logger for continuous monitoring, data acquisition and transmission to central monitoring system, , complete in all respects as directed by the Engineer-in-Charge..

B) Vibrating Wire Piezometer

Feature	Value
Operating range	0-10 Kg/Sq cm or as per requirement of dam owner
Over range	1.5 x Range
Over range effect	$\pm 0.1\%$ F. S. up to 150 %
Sensor Type	Vibrating wire
Accuracy	$\pm 0.1\%$ F. S.
Resolution	0.025% F. S (minimum)
Linearity	< 0.5% F.S.
Output Interface	SDI-12 / RS 485 /4-20 mA /Compatible with data
Lightning protection	Required
Operating humidity	5 to 100%
Operating Temperature Range	-20°C to +60°C
Altitude	0 to 2500 m

Enclosure	Stainless steel, IP 68
Accessories	Sensor mounting support, cables and other accessories as required
Protection	IP 68 or NEMA-4x
Manuals	Full documentation and maintenance manual in English

Vibrating wire Piezometer

1. **Selection of location and depth:** The installation location and required depth of the vibrating wire piezometer are decided based on seepage analysis and the hydraulic behaviour of the embankment dam. Instruments are generally placed in important zones such as the core (to monitor internal pore water pressure), the upstream side (influenced by reservoir water level), and the downstream side (critical for seepage exit and stability). The exact elevation is selected where pore water pressure measurement is necessary for proper dam performance assessment.
2. **Drilling of borehole:** A small-diameter borehole, typically about 50–100 mm, is drilled from the dam crest or slope using rotary or auger drilling methods. During drilling, care is taken to minimize disturbance to the dam material, avoid excessive use of water that may weaken the soil structure, and maintain stability of the borehole. This borehole provides access for placing the instrument at the required depth.
3. **Preparation of piezometer:** Before installation, the vibrating wire piezometer is checked for proper calibration and functionality. The sensor tip is saturated in water to remove trapped air and ensure accurate readings. A sand filter arrangement is also prepared around the sensing zone so that pore water pressure from the surrounding soil can be transmitted effectively to the instrument.
4. **Lowering and positioning:** The piezometer is carefully lowered into the borehole using a cable system. It is then positioned precisely at the predetermined depth or elevation where pore water pressure needs to be measured. Proper positioning is important to ensure that the instrument records accurate pressure from the intended soil layer.
5. **Filter and sealing system:** After positioning, a sand filter is placed around the sensing zone to allow free flow of pore water pressure to the piezometer. Above this, a bentonite seal is provided to prevent vertical seepage along the borehole. The remaining borehole is filled with bentonite-cement grout or other impervious material to restore the dam's integrity. Proper sealing is essential to avoid creating any new seepage path within the dam body.
6. **Installation of VW Node:** The VW Node shall be installed at the designated monitoring location, junction box, or instrumentation chamber as specified in the

approved drawings. The node shall be securely mounted and protected from mechanical damage, moisture ingress, and environmental exposure.

7. **Cable Routing and Connection:** The piezometer signal cable shall be routed through PVC/HDPE conduits, cable trenches, or cable trays as applicable. The cable shall be adequately protected, labelled, and terminated at the VW Node terminals in accordance with the manufacturer's wiring diagram.
8. **Power and Communication Connection:** The VW Node shall be connected to the DAM monitoring network and power supply system. All communication cables, grounding, and shielding arrangements shall be installed as per project specifications and manufacturer recommendations.
9. **Configuration of VW Node:** The VW Node shall be configured with the required sensor channel information, node address, communication parameters, and data acquisition settings. Configuration shall be verified before commissioning.
10. **Communication Verification:** Communication between the VW Node and the DAM Data Acquisition System shall be verified by checking successful sensor detection, data transmission, and network connectivity.
11. **Initial Readings and Calibration Check:** Initial baseline readings shall be recorded after installation. Sensor readings shall be reviewed for stability, consistency, and compliance with expected values. Any abnormal readings shall be investigated and rectified before commissioning.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


**Executive Engineer
Rajkot Irrigation Division
Rajkot**

ITEM NO. 10: Supplying, installing, testing, and commissioning of a Multi-Point Vibrating Wire Piezometer for dam instrumentation with an operating range of 0–10 Kg/cm² (or as per dam owner's requirement), integrated for real-time monitoring and live data acquisition. The instrument shall have 1.5 × range over-capacity with ±0.1% F.S. effect up to 150%, ±0.1% F.S. accuracy, 0.025% F.S. resolution, linearity <0.5% F.S., SDI-12/ RS 485 / 4–20 mA output compatible with data acquisition systems, lightning protection, operating humidity 5–100%, temperature range -20°C to +60°C, suitable for altitudes up to 2500 m, and stainless steel IP68 enclosure including sensor mounting support, signal cables and all required accessories, complete with integration to Real Time Monitoring System (RTMS) / data logger for continuous monitoring, data acquisition and transmission to central monitoring system, , complete in all respects as directed by the Engineer-in-Charge.

Vibrating Wire Multi Point Piezometer

Feature	Value
Operating range	0-10 Kg/Sq cm or as per requirement of dam owner
Over range	1.5 x Range
Over range effect	±0.1% F. S. up to 150 %
Sensor Type	Vibrating wire
Accuracy	±0.1% F. S.
Resolution	0.025% F. S (minimum)
Linearity	< 0.5% F.S.
Output Interface	SDI-12 / RS 485 /4-20 mA /Compatible with data
Lightning protection	Required
Operating humidity	5 to 100%
Operating Temperature	-20°C to +60°C

Range	
Altitude	0 to 2500 m
Enclosure	Stainless steel, IP 68
Accessories	Sensor mounting support, cables and other accessories as required
Protection	IP 68 or NEMA-4x
Manuals	Full documentation and maintenance manual in English

Multi-Point Vibrating Wire Piezometer

1. Select the borehole location as per requirement, preferably in zones representing the upstream shell, core, and downstream shell.
2. Drill a vertical borehole to the required depth covering all intended piezometer monitoring points.
3. Clean the borehole thoroughly using water or air flushing to remove cuttings, slurry, and debris.
4. Prepare filter sand, bentonite seals, and backfill materials in accordance with the design specifications to ensure proper hydraulic response and zone isolation.
5. Inspect the multipoint VW piezometer assembly, verify calibration details, and ensure all sensors and cables are in good condition.
6. Carefully lower the multipoint VW piezometer assembly into the borehole, avoiding twisting or damage to the sensor cables.
7. Position each sensing element at its designated depth corresponding to the required monitoring zones, such as the core, transition zone, and shell.
8. Place filter sand around each sensor zone to ensure accurate transmission of pore water pressure to the sensing elements.
9. Install bentonite seals between adjacent sensor zones to prevent vertical seepage interference and hydraulic cross-communication.
10. Continue staged backfilling of the borehole with approved materials up to ground level while maintaining proper separation of monitoring zones.
11. Route and protect all sensor cables through PVC or HDPE conduits up to the monitoring station or instrumentation chamber.
12. Install the VW Node at a safe, accessible, and protected location near the monitoring point or instrumentation chamber.
13. Connect the vibrating wire sensor cables to the designated VW Node channels and ensure proper cable identification and termination.

14. Connect the VW Node to the power supply and DAM data acquisition network as per the approved wiring diagrams.
15. Configure the VW Node with the required sensor parameters, channel assignments, communication settings, and node address.
16. Verify communication between the VW Node and the DAM monitoring system and confirm successful sensor detection.
17. Perform calibration checks and record baseline pore water pressure readings for all installed sensors.

Conduct trial monitoring to verify sensor performance, data transmission, and proper operation of the VW Node.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


**Executive Engineer
Rajkot Irrigation Division
Rajkot**

ITEM NO. 11: 100 mm Diameter Borehole Drilling in Earthen Embankment Dam as decided by Engineer-in-charge, including mobilization and demobilization charges of drilling machines, equipment, tools, tackles, and labour, complete as per site requirements and direction of Engineer-in-Charge. (up to 39 m depth)

Sr. No.	Particular	Technical Specification
1	Item Description	Drilling of 100 mm diameter borehole in Earthen Embankment Dam for geotechnical investigation, instrumentation, seepage study, or related dam safety works.
2	Borehole Diameter	100 mm nominal diameter.
3	Location of Drilling	On dam crest, upstream slope, downstream slope, berm, toe area, or other locations as specified by Engineer-in-Charge.
4	Drilling Method	Rotary drilling / auger drilling / wash boring method suitable for earthen embankment strata and approved by Engineer-in-Charge.
5	Depth of Borehole	As per approved drawing, investigation plan, or instruction of Engineer-in-Charge.
6	Equipment	Hydraulic/rotary drilling rig with necessary accessories, casing pipes, drilling rods, bits, pumps, and support equipment.
7	Mobilization & Demobilization	Includes transportation, shifting, installation, dismantling, and removal of drilling machinery, tools, equipment, and manpower from site.
8	Casing Arrangement	Temporary casing to be provided wherever required to prevent collapse of borehole and maintain stability during drilling.
9	Sampling	Collection of disturbed/undisturbed soil samples, if required, at specified intervals or strata changes as directed.
10	Borehole Logging	Preparation of bore log indicating depth, strata encountered, groundwater condition, sampling details, and other relevant observations.
11	Groundwater Observation	Recording of groundwater table/seepage level during and after drilling wherever encountered.
12	Safety Requirements	Proper barricading, safe operation of machinery, PPE for workers, and compliance with site safety norms.
13	Site Clearance	Removal of drilling waste, slurry, excavated material, and restoration of site after completion of work.
14	Measurement	Measurement shall be in running meter (RM) of completed borehole of specified diameter.
15	Rate Includes	Cost of labour, fuel, consumables, drilling fluid/water, machinery, tools & tackles, mobilization/demobilization, casing, handling, and all incidental charges.

16	Rate Excludes (if applicable)	Laboratory testing, instrumentation installation, grouting, or PVC pipe installation unless specifically mentioned in BOQ item.
17	Applicable Standards	IS 1892, IS 2131, IS 4968, relevant BIS codes, and guidelines for dam safety investigations.
18	Acceptance Criteria	Borehole completed to required depth and diameter with proper logging and as approved by Engineer-in-Charge.

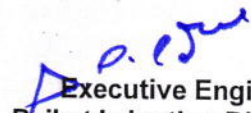
Borehole Drilling in embankment

A small-diameter borehole, typically about 50–100 mm (as per requirement), is drilled from the dam crest or slope using rotary or auger drilling methods. During drilling, care is taken to minimize disturbance to the dam material, avoid excessive use of water that may weaken the soil structure, and maintain stability of the borehole. This borehole provides access for placing the instrument at the required depth.

Measurement & Payment

Measurement shall be made on a per Meter of Completed Boring

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 12: Burden Tube pressure gauge Providing and installing pressure gauge for measurement range of 0-10 Kg/Sq or (As per requirement of Engineer-in-Charge), accuracy $\pm 0.1\%$ of full scale, over-range capacity up to 150% of rated range, suitable for operating temperature range from 0°C to $+70^{\circ}\text{C}$, constructed with stainless steel/IP 68 wetted parts for corrosion resistance, complete with required mounting accessories, fittings, testing, calibration and commissioning, complete in all respects as per approved specifications and as directed by the Engineer-in-Charge.

Bourdon pressure gauge

Sr. No.	Parameter	Technical Specification
1	Instrument Type	Bourdon Tube Pressure Gauge
2	Application	Measurement and monitoring of water pressure, uplift pressure, and hydraulic pressure in dams and associated structures
3	Measurement Principle	Mechanical Bourdon Tube Pressure Sensing
4	Pressure Range	0–10 kg/cm ² or as specified by the Engineer-in-Charge
5	Accuracy	$\pm 0.1\%$ of Full Scale (F.S.) or better
6	Over-Range Capacity	Up to 150% of rated pressure range without damage
7	Resolution	Suitable for precise pressure monitoring within specified range
8	Operating Temperature Range	0°C to $+70^{\circ}\text{C}$
9	Wetted Parts Material	Stainless Steel (SS-316 or equivalent corrosion-resistant material)
10	Case Material	Stainless Steel, weatherproof construction
11	Protection Class	IP68 rated for dustproof and waterproof operation
12	Dial Size	Minimum 100 mm diameter or as approved by the Engineer-in-Charge
13	Pressure Connection	Bottom or back entry connection as per site requirements
14	Connection Material	Stainless Steel compatible with hydraulic installations
15	Pressure Medium	Suitable for water and other non-corrosive fluids used in dam monitoring applications
16	Corrosion Resistance	Suitable for long-term outdoor and humid environmental conditions
17	Vibration Resistance	Designed to withstand normal field vibration and operational conditions

18	Calibration	Factory calibrated with traceable calibration certificate
19	Mounting Arrangement	Complete with wall, panel, or bracket mounting accessories as required
20	Fittings & Accessories	Complete with isolation valves, adapters, connectors, ferrules, fittings, and all necessary installation hardware
21	Environmental Suitability	Suitable for continuous outdoor installation in dam and hydraulic structures
22	Testing	Pressure testing, functional testing, and verification before commissioning
23	Documentation	Manufacturer's datasheets, calibration certificates, installation manuals, and O&M manuals in English
24	Commissioning	Complete installation, testing, calibration verification, and commissioning
25	Scope of Supply	Supply, installation, testing, calibration, commissioning, mounting accessories, fittings, and making operational in all respects as directed by the Engineer-in-Charge

Bourdon pressure gauge

1. Verify that the Bourdon pressure gauge range and connection are suitable for the expected drainage hole pressure.
2. Ensure the drainage hole outlet and pressure tapping point are clean and free from debris.
3. Install an isolation valve between the drainage hole connection and the pressure gauge.
4. Apply suitable thread sealant to all threaded connections to prevent leakage.
5. Mount the pressure gauge securely in a visible and accessible location within the dam gallery.
6. Connect the gauge to the drainage hole pressure line using the specified fittings and tubing.
7. Tighten all connections properly without applying force to the gauge case.
8. Slowly open the isolation valve to allow water pressure to reach the gauge gradually.
9. Check all joints and fittings for leakage after pressurization.
10. Observe the gauge reading and ensure the pointer movement is smooth and stable.
11. Compare the reading with expected values or previous records to verify proper operation.
12. Record the gauge reading, installation details, and date in the dam instrumentation logbook.

Periodically inspect, clean, and calibrate the gauge to maintain measurement accuracy.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 13: Cleaning and Drilling of Drainage Holes in Dam Gallery through Hard Rock/Concrete Layers as per requirement of Engineer-in-Charge, including removal of choke materials, flushing, drilling operations, and disposal of debris, complete with mobilization and demobilization charges of drilling machines, compressors, equipment, tools, tackles, and labour, as per site conditions and direction of Engineer-in-Charge. (upto 16.15 m depth or)

Cleaning and drilling of borehole

1. Obtain work permits and safety clearance before starting the activity in the spillway gallery.
2. Inspect the drainage hole location and assess its condition, accessibility, and any safety hazards.
3. Barricade the work area and display appropriate warning signs.
4. Ensure adequate lighting, ventilation, and communication facilities inside the gallery.
5. Wear the required personal protective equipment (helmet, safety shoes, gloves, goggles, dust mask, and hearing protection).
6. Remove any covers, caps, or obstructions from the drainage hole opening.
7. Measure and record the existing discharge condition and water flow before cleaning.
8. Insert cleaning rods or flexible cleaning tools to remove loose silt, debris, and mineral deposits.
9. Flush the drainage hole with clean water under controlled pressure to remove accumulated sediments.
10. Use compressed air where required to clear remaining obstructions and improve flow.
11. Check the hole depth and condition using suitable measuring equipment.
12. If the drainage hole is blocked or requires deepening, position the drilling machine securely over the hole location.
13. Confirm the drilling direction and depth to avoid deviation from the designed alignment.
14. Drill the hole using the specified drill bit diameter and approved drilling equipment.
15. Continuously remove drill cuttings using water flushing or air flushing during drilling operations.
16. Monitor drilling progress and maintain records of depth, diameter, and encountered strata.
17. Stop drilling upon reaching the specified depth or when the required drainage condition is achieved.
18. Flush the completed hole thoroughly to remove all drilling debris and slurry.
19. Measure and record the final depth, diameter, and discharge condition of the drainage hole.
20. Inspect the hole for free flow and verify that no blockage remains.

21. Collect and dispose of drilling waste, sludge, and debris in accordance with site procedures.
22. Document the cleaning and drilling details, including location, date, depth achieved, discharge observations, equipment used, and photographs.

Submit the completion report and update maintenance records for future reference.

Measurement & Payment

Measurement shall be made on a per Meter of Completed Boring

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 14: Supplying, installing, testing, and commissioning of a **Wireless Data Logger (Gateway)**, integrated for real time monitoring and live data acquisition from all **Vibrating Wire sensors, Tilt Meters, Water Level and Flow Sensors, Weather Station, and RS485 (Modbus) Digital Nodes**, with onboard edge recording for 15 days, internal battery backup, **LTE cellular radio** with internal **SIM slot**, data transfer to **Web DAS** via wireless gateway powered by **AC/DC**, **IP67** rated enclosure, operating **-20°C to +60°C**, integrated solar charging circuit with **AC/DC** charging, complete in all respects as directed by the Engineer-in-Charge.

Technical Specification Wireless Data logger (Gateway)

Sr. No.	Parameter	Technical Specification
1	Instrument Type	Wireless Data Logger (Gateway) for real-time monitoring and data acquisition
2	Application	Collection, storage, transmission, and management of data from dam instrumentation and environmental monitoring systems
3	Sensor Compatibility	Compatible with Vibrating Wire Sensors, Piezometers, Uplift Pressure Cells, Settlement Systems, Tilt Meters, Water Level Sensors, Flow Sensors, Weather Stations, and RS485 (Modbus) Digital Nodes
4	Data Acquisition	Real-time data acquisition and transmission from all connected sensors
5	Edge Data Storage	Onboard memory capable of storing minimum 15 days of recorded data during communication outages
6	Communication Interface	Wireless gateway communication with remote monitoring server/Web DAS
7	Cellular Connectivity	Integrated LTE/4G cellular modem/radio
8	SIM Facility	Internal SIM card slot for cellular network connectivity
9	Data Transmission	Automatic transmission of sensor data to centralized Web-Based Data Acquisition System (Web DAS)
10	Communication Protocols	Support for Modbus RTU/RS485 and other standard industrial communication protocols
11	RS485 Interface	Integrated RS485 communication ports for Modbus-compatible digital instruments
12	Data Logging Capacity	Configurable logging intervals with non-volatile memory for secure data retention
13	Power Supply	Operable on AC and DC power sources
14	Battery Backup	Integrated rechargeable battery backup for uninterrupted operation during power failures

15	Solar Charging Support	Built-in solar charging controller/circuit compatible with solar panel charging
16	AC/DC Charging	Automatic charging through AC/DC power source and solar input
17	Enclosure Rating	IP67 weatherproof and dustproof enclosure suitable for outdoor installations
18	Enclosure Material	Industrial-grade corrosion-resistant enclosure suitable for dam environments
19	Operating Temperature	-20°C to +60°C or better
20	Data Security	Secure data storage and transmission with automatic recovery after communication interruptions
21	Network Management	Remote configuration, diagnostics, and health monitoring capability
22	Integration Capability	Fully compatible with project SCADA, Web DAS, cloud platform, and monitoring software
23	Surge Protection	Integrated surge and lightning protection for communication and power interfaces
24	Mounting Arrangement	Suitable mounting hardware/brackets for field installation
25	Accessories	Complete with antenna, power supply units, connectors, mounting accessories, communication cables, and all necessary hardware
26	Documentation	Manufacturer's technical datasheets, calibration records, installation manuals, operation & maintenance manuals in English
27	Testing & Commissioning	Complete installation, configuration, testing, commissioning, integration with all sensors, and demonstration of system performance
28	Scope of Supply	Supply, installation, testing, commissioning, integration, and making operational in all respects as directed by the Engineer-in-Charge

Wireless Data logger (Gateway)

1. Verify that the wireless data logger (gateway) specifications are compatible with the installed dam instrumentation sensors and communication network.
2. Select a secure location in the dam gallery or control room or monitoring station with adequate signal coverage and environmental protection.
3. Ensure the mounting surface is stable, dry, and accessible for operation and maintenance.
4. Securely mount the gateway using the manufacturer's recommended brackets or hardware.
5. Connect the gateway to the designated power supply and verify the required voltage is available.

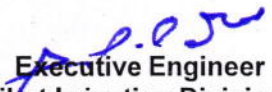
6. Install and position the communication antenna as recommended to achieve reliable wireless connectivity.
7. Connect sensor interfaces, communication cables, or network connections according to the wiring diagram.
8. Configure the gateway settings, including device ID, communication protocol, network parameters, and data transmission intervals.
9. Pair and establish communication between the gateway and field instrumentation devices.
10. Verify signal strength and communication quality for all connected sensors.
11. Perform a functional test to confirm that sensor data is being received, stored, and transmitted correctly.
12. Synchronize the gateway time settings with the monitoring system or server.
13. Check all electrical and communication connections for proper operation and security.
14. Record installation details, configuration settings, and commissioning results in the instrumentation logbook.

Monitor the gateway performance for an initial observation period and rectify any communication or power issues if detected.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 15: Supplying, installing, testing, and commissioning of Vibrating Wire Wireless Nodes, integrated for real-time monitoring and live data transmission to DAS via mesh network gateway, supporting 1 Vibrating Wire channel + 1 Thermistor channel (x 4) or (x 5), Flat Mesh v3 networking protocol, IEEE 802.15.4 standard, 2400–2485 MHz ISM band, 6.5 dBm maximum transmit power, 200–6000 Hz frequency range with 0.001 Hz resolution and ± 0.02 Hz repeatability, thermistor measurement $\pm 0.1^\circ\text{C}$ accuracy, -40°C to $+85^\circ\text{C}$ range, powered by 3.6 V lithium thionyl chloride battery (19,000 mAh) with 10–15 years life, IP68 protection, complete in all respects as directed by the Engineer-in-Charge.

Vibrating Wire Wireless Nodes for Vibrating Wire Sensors

Sr. No.	Parameter	Technical Specification
1	Instrument Type	Vibrating Wire Wireless Node for real-time monitoring and wireless data transmission
2	Application	Data acquisition and transmission from Vibrating Wire instruments to Wireless Gateway/DAS
3	Sensor Compatibility	Vibrating Wire Piezometers, Uplift Pressure Cells, Load Cells, Strain Gauges, Crack Meters, Settlement Systems, and other Vibrating Wire Sensors
4	Channel Configuration	4 or 5 Vibrating Wire Channels with corresponding Thermistor Channels
5	Vibrating Wire Inputs	1 Vibrating Wire Channel + 1 Thermistor Channel per measurement channel
6	Data Transmission	Real-time wireless data transmission to Gateway/DAS
7	Network Architecture	Self-healing Mesh Network
8	Networking Protocol	Flat Mesh v3 Networking Protocol or equivalent
9	Wireless Standard	IEEE 802.15.4
10	Radio Frequency Band	2400–2485 MHz ISM Band
11	Maximum Transmit Power	6.5 dBm or better
12	Communication Range	Suitable for dam instrumentation mesh network deployment with automatic routing capability
13	Frequency Measurement Range	200 Hz to 6000 Hz

14	Frequency Resolution	0.001 Hz
15	Frequency Repeatability	± 0.02 Hz or better
16	Sensor Reading Accuracy	As per manufacturer's calibration and instrument specifications
17	Thermistor Input	Integrated thermistor measurement for temperature compensation
18	Temperature Measurement Accuracy	$\pm 0.1^{\circ}\text{C}$
19	Temperature Measurement Range	-40°C to $+85^{\circ}\text{C}$
20	Power Supply	Internal high-capacity battery powered
21	Battery Type	3.6 V Lithium Thionyl Chloride Battery
22	Battery Capacity	19,000 mAh
23	Battery Life	Minimum 10–15 years under normal monitoring intervals
24	Data Storage	Internal memory for temporary storage during communication interruptions
25	Enclosure Protection	IP68 rated waterproof and dustproof enclosure
26	Enclosure Material	Rugged industrial-grade corrosion-resistant enclosure suitable for dam environments
27	Surge Protection	Integrated surge and lightning protection for sensor inputs and communication circuits
28	Mounting Arrangement	Suitable mounting brackets, clamps, and hardware for permanent installation
29	Configuration	Remote configuration and diagnostics through wireless gateway
30	Compatibility	Fully compatible with Wireless Data Logger (Gateway), Web DAS, and SCADA systems

31	Environmental Suitability	Suitable for continuous outdoor operation in dam and hydrological monitoring applications
32	Accessories	Complete with antenna, battery pack, mounting accessories, connectors, weatherproof cable glands, and all necessary hardware
33	Documentation	Manufacturer's datasheets, calibration certificates, installation manuals, operation & maintenance manuals in English
34	Testing & Commissioning	Complete installation, configuration, testing, commissioning, network integration, and operational demonstration
35	Scope of Supply	Supply, installation, testing, commissioning, integration with wireless monitoring network, and making operational in all respects as directed by the Engineer-in-Charge

Vibrating Wire Wireless Nodes for Vibrating Wire Sensors

1. Verify that the vibrating wire wireless node is compatible with the installed vibrating wire sensor and project specifications.
2. Inspect the wireless node, cables, connectors, and battery for any physical damage before installation.
3. Select a suitable installation location near the sensor with adequate wireless signal coverage and protection from water ingress and mechanical damage.
4. Securely mount the wireless node on the designated bracket, wall, or support structure within the dam gallery or monitoring area.
5. Connect the vibrating wire sensor leads to the corresponding terminals of the wireless node as per the manufacturer's wiring diagram.
6. Connect the thermistor wires, if provided, to enable temperature measurement and compensation.
7. Ensure all cable glands, connectors, and enclosure covers are properly tightened to maintain environmental protection.
8. Install or connect the battery/power source and verify that the node powers up correctly.
9. Configure the wireless node settings, including node ID, sensor type, measurement interval, and communication parameters.
10. Pair the wireless node with the gateway and confirm successful network registration.
11. Verify wireless signal strength and communication stability between the node and gateway.
12. Perform a test reading and confirm that sensor frequency, temperature, and engineering-unit values are being transmitted correctly.
13. Compare the received data with baseline or reference readings to verify proper operation.
14. Secure and label all cables, nodes, and associated equipment for identification and maintenance purposes.
15. Record installation details, node configuration, sensor identification, and commissioning test results in the dam instrumentation logbook.
- 16.

Monitor the system after commissioning to ensure continuous and reliable data transmission.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


**Executive Engineer
Rajkot Irrigation Division
Rajkot**

ITEM NO. 16: Supplying, installing, testing, and commissioning of Wireless Mesh Repeater Node for extension of communication range in Vibrating Wire Wireless Monitoring System, enabling reliable multi-hop data transmission between field nodes and Data Acquisition System (DAS) through mesh gateway, complete with all accessories, configuration, and commissioning, as per specifications and as directed by the Engineer-in-Charge.

Vibrating Wire Wireless Repeater Node

Sr. No.	Parameter	Technical Specification
1	Instrument Type	Wireless Mesh Repeater Node
2	Application	Extension of wireless communication range in Vibrating Wire Wireless Monitoring System
3	Function	Receives, regenerates, and retransmits data packets between field sensor nodes and Gateway/DAS
4	Network Architecture	Self-healing Multi-hop Mesh Network
5	Communication Protocol	Flat Mesh Networking Protocol or equivalent
6	Wireless Standard	IEEE 802.15.4 or equivalent
7	Operating Frequency Band	2400–2485 MHz ISM Band
8	Data Transmission	Bi-directional wireless communication with automatic routing and relay functionality
9	Communication Range	Suitable for long-range field deployment with mesh network extension capability
10	Network Reliability	Automatic route discovery and alternate path selection in case of communication failure
11	Compatibility	Fully compatible with Vibrating Wire Wireless Nodes, Gateway, Data Logger, and Web DAS
12	Data Integrity	Error detection and retransmission capability to ensure reliable data delivery
13	Network Capacity	Capable of supporting multiple wireless sensor nodes within the monitoring network
14	Power Supply	Internal battery and/or external DC power supply as specified
15	Battery Type	High-capacity Lithium battery suitable for long-term unattended operation
16	Battery Life	Minimum 5–10 years under normal operating conditions or as per manufacturer's specifications
17	Enclosure Protection	IP68 rated weatherproof and dustproof enclosure

18	Enclosure Material	Rugged UV-resistant and corrosion-resistant industrial-grade enclosure
19	Operating Temperature	-40°C to +85°C or better
20	Surge Protection	Integrated surge and lightning protection for communication and power circuits
21	Antenna	Integrated or external high-gain antenna suitable for mesh communication
22	Mounting Arrangement	Suitable mounting brackets, clamps, poles, or wall mounting hardware
23	Configuration	Remote configuration and diagnostics through mesh gateway
24	Status Indication	LED indicators or equivalent for power, communication, and network status
25	Environmental Suitability	Suitable for continuous outdoor operation in dam, hydrological, and geotechnical monitoring environments
26	Accessories	Complete with antenna, battery, mounting hardware, connectors, weatherproof cable glands, and all necessary accessories
27	Documentation	Manufacturer's datasheets, installation manuals, operation & maintenance manuals, and configuration guides in English
28	Testing & Commissioning	Complete installation, network configuration, testing, commissioning, and demonstration of communication performance
29	Scope of Supply	Supply, installation, testing, commissioning, integration into wireless monitoring network, and making operational in all respects as directed by the Engineer-in-Charge

Vibrating Wire Wireless Repeater Node

1. Verify the repeater node model, power requirements, and compatibility with the DAM communication network before installation.
2. Inspect the installation location and ensure it provides adequate signal coverage between network devices.
3. Mount the repeater node securely on the designated DIN rail, panel, or enclosure.
4. Connect the power supply to the repeater node as per the approved wiring diagram.
5. Connect the incoming communication cable from the DAM network to the repeater node input terminals.
6. Connect the outgoing communication cable from the repeater node output terminals to the next network segment.
7. Ensure correct communication wiring polarity and cable shielding throughout the network.
8. Install termination resistors and grounding connections as required by the communication protocol.
9. Configure the repeater node settings, including communication parameters, according to project requirements.

10. Energize the repeater node and verify power and communication status indications.
11. Check network communication across all connected segments to confirm proper signal regeneration.

Perform functional and communication tests and record commissioning results before placing the system into service.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 17: Supplying, installing, testing, and commissioning of Server-Based and Cloud-Integrated Software for Data Logger, integrated for real-time monitoring, capable of acquiring, processing, filtering, storing, visualizing, and alarming geotechnical (Vibrating Wire and ModBUS), and hydro-meteorological sensor data, with SQL/Azure database storage, secure web interface with user/group access control, geo-referenced map and image visualization, customizable dashboards, interactive charts, complete in all respects as directed by the Engineer-in-Charge.

Details Module Based Software for Geodetic, Hydromet and Geotechnical as below

The software solution shall be capable of acquiring data from:

1. Dedicated Server based software for geodetic sensors data acquisition.
2. Cloud Based Geotechnical Sensors (Vibrating Wire and ModBUS).

The cloud solution shall be capable of controlling and monitoring. The Geodetic module shall be capable of processing the geodetic data for base line data capture, adjustments and Cloud view module for Geodetic Deformation.

Geodetic Web module and geotechnical Web module shall be of five year subscription.

Real time monitoring software (for wireless sensor)

The supplied software system must satisfy the following requirements:

S/N	Technical Specification
1.	The software system that is to be supplied must satisfy the following minimum requirements: A server-based and a cloud-based software solution shall be provided.
2.	<p>The software solution shall be capable of acquiring data from:</p> <ol style="list-style-type: none"> 1. Dedicated Server based software for geodetic sensors data acquisition. 2. Cloud Based Geotechnical Sensors (Vibrating Wire and ModBUS). 3. Dedicated Server Based seismic sensors (Part of this Bid), <p>Screening and filtering the data for data inconsistencies and outliers, processing that data and storing the data in an SQL/Azure database. The solution shall be capable of controlling and managing the data acquisition schedules.</p> <p>The Geodetic module shall be capable of processing the geodetic data for base line data capture, adjustments and Cloud view.</p>

S/N	Technical Specification
3.	The software should be capable of collecting, analysing, presenting in suitable formats (as indicated by Engineer-in-charge) and interpreting all seismic, geodetic, geotechnical and Hydro-meteorological data from various sensors.
4.	Data shall be stored in an SQL/Azure database, in a structured manner, and facility to export to 3 rd party software.
5.	The data acquired by the monitoring solution shall be accessed, visualized, analysed, alarmed and reported via a secure web interface. Access to the internet interface shall be strictly controlled by customizable levels of access for users and groups of users of the system, with the system administrator having control and management of this access facility.
6.	Data visualization shall be displayed on a geo-referenced map background and capable of being displayed on a user-supplied image, with the alarm status of each sensor being clearly represented by the colour of the sensor icon. The status of each sensor shall be updated in rapid near real time.
7.	Displacements must be capable of being displayed in an upstream/downstream reference frame relative to the dam wall.
8.	The solution shall include interactive charts and analysis capabilities to allow advanced users the ability to analyse and compare data from different sensors and sources. The solution shall compute and alarm on data changes over time, velocity. The system shall include a composite display of user definable panels of information, to allow the user to create a customized data display.
9.	The system shall include comprehensive alarming capabilities capable of triggering SMS, email and batch file alerts. There shall be 6 levels of alarm with alarm for exceeding threshold limits and rate of change. The system shall track alarm responses and shall be capable of automatically and manually logging all issues related to alarms. It should be possible to create user groups and individuals to assign specific alarms.
10.	The system shall be fully scalable, allowing for sensors to be added or removed, users to be added or removed, and additional dams to be added or removed. Where the system is used for many dams, there shall be a centralized control facility providing an overview of all the dam installations in the group.

S/N	Technical Specification
11.	There is a requirement for DAS software package for Geodetic and Seismic to be installed by the Bidder at center of excellence along with import API and ftp for other Geotechnical and ModBUS Sensors.
12.	DAS software will come free of annual licensing charges, such that it can run indefinitely without incurring further expense. No cost for software upgrades through the Warranty and Maintenance period.
13.	Ability to set alarm thresholds and issue SMS text. There must also be an ability to send an email to any number of stakeholders, based on either a single condition of multiple conditions.
14.	Ability to export the data in .xlsx or .xls format as well as in text format. The text format shall be in conformance with manufacturer's standards. The export facility must be one that can be run automatically to feed another system (hot drive). Colour map display of installations and alarm related data that is automatically updated as data are received. Colours of installation data on the map will be user programmable based on the requirements of the user. A simple interface to program the display must be available.
15.	Ability to move data from the central location center of excellence computer server to the cloud server.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 18: Supply of portable readout unit for vibrating wire and analogue/digital geotechnical instruments, complete with Bluetooth Low Energy (BLE) communication, mobile application compatibility, rechargeable battery, carrying bag, and all necessary accessories for field monitoring applications.

The readout unit shall be compact, rugged, and suitable for outdoor use with minimum IP65 protection rating. The system shall support wireless communication with Android and iOS devices through a dedicated mobile application for sensor configuration, data acquisition, visualization, storage, and sharing.

The unit shall be capable of reading vibrating wire instruments and displaying electrical as well as engineering values simultaneously with high accuracy and resolution. It shall also provide real-time graphical display and spectrum analysis of vibrating wire signals including peak value indication.

Portable Read out Unit for vibrating wire sensor

Sr. No.	Particular	Technical Specification
1	Item Description	Supply of portable readout unit for vibrating wire and analogue/digital geotechnical instruments for field monitoring applications.
2	Application	Suitable for monitoring geotechnical and dam instrumentation such as piezometers, strain gauges, load cells, settlement systems, crack meters, pressure cells, extensometers, and similar instruments.
3	Communication System	Integrated Bluetooth Low Energy (BLE) communication for wireless connectivity with smart devices.
4	Mobile Compatibility	Compatible with Android and iOS mobile devices through dedicated mobile application.
5	Mobile Application Features	Sensor configuration, data acquisition, real-time monitoring, graphical visualization, data storage, export, sharing, and report generation capability.
6	Readout Capability	Capable of reading vibrating wire sensors and analogue/digital geotechnical instruments.
7	Display Parameters	Simultaneous display of electrical values (frequency, period, resistance, voltage, etc.) and engineering values (pressure, strain, displacement, temperature, etc.).
8	Accuracy	High accuracy readout with minimum resolution suitable for precision geotechnical monitoring applications.
9	Signal Processing	Real-time signal processing with graphical waveform display and spectrum analysis facility.
10	Spectrum Analysis	Capability to display vibrating wire spectrum with peak value identification for proper sensor response verification.
11	Display Type	High-contrast LCD/LED/TFT digital display suitable for daylight outdoor visibility.
12	Data Storage	Internal memory for storing readings with date and time stamping.

13	Data Transfer	Wireless transfer to mobile devices and export facility in standard formats such as CSV/PDF/Excel.
14	Power Supply	Rechargeable internal battery with battery charger/adaptor.
15	Battery Backup	Minimum 8–10 hours continuous field operation or as per manufacturer standard.
16	Protection Rating	Minimum IP65 protection against dust and water ingress.
17	Construction	Compact, lightweight, rugged, and suitable for harsh outdoor/site conditions.
18	Operating Temperature	Suitable for operation under field environmental conditions typically ranging from 0°C to 50°C or better.
19	Accessories	Complete with connecting cables, probes, charging accessories, carrying case/bag, software, manuals, and necessary accessories.
20	Calibration	Factory calibrated with calibration certificate traceable to national/international standards.
21	Compliance Standards	Suitable for geotechnical instrumentation applications and compliant with relevant IS/IEC/international standards.
22	Warranty	Minimum 12 months warranty against manufacturing defects or as specified in tender conditions.
23	Measurement Unit	Per Number (Each).
24	Acceptance Criteria	Equipment shall be supplied complete in all respects, fully functional, tested, and approved by Engineer-in-Charge.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 19: Providing, supplying, installing, and commissioning Desktop PC / Workstation for dam data acquisition with minimum 27" display (Full HD/4K), high-performance processor equivalent to Intel Core i9 14th Generation or higher, 16 GB DDR5 RAM (expandable to 64 GB), 1 TB NVMe SSD storage or higher, integrated/dedicated graphics, preloaded licensed OS Microsoft Windows Professional (latest version), and licensed Microsoft Office (latest version), complete with required ports (USB 3.0+, HDMI/VGA, LAN, audio, USB-C), connectivity (Ethernet, Wi-Fi, Bluetooth), accessories (keyboard, mouse, cables, power adapter), and integration of required data acquisition software, including installation, configuration, testing, and commissioning at site, with minimum 5-year comprehensive on-site warranty, complete as per specifications and direction of Engineer-in-Charge.

Feature / Parameter	Specification / Requirement
Item Name	Desktop PC / work station for Dam Data Acquisition
Display Size	27 inch or higher
Display Resolution	Ultra HD/ 4k display/Full HD (1920 × 1080)
Processor	Intel Core i9, 14th Generation or higher
Storage	1 TB NVMe or higher
RAM	16 GB DDR5 or higher (expandable up to 64 GB)
Graphics	Integrated / dedicated graphics
Operating System	Microsoft Windows Professional (latest available version)
Office Software	Microsoft Office (latest licensed version)
Ports & Interfaces	Ports: USB 3.0 or higher, HDMI / VGA, Ethernet (LAN), Audio ports, C-type port and other required standard ports
Connectivity	Ethernet LAN, Wi-Fi, Bluetooth
Accessories	Keyboard, mouse, power adapter, cables
Warranty	Minimum 5 (Five) years comprehensive on-site warranty
Installation	Supply, installation and configuration at site complete in all respects

Additional terms	The agency should integrate the softwares' required for the data acquisition.
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Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 20: Supply and Installation of Multi-Function Laser Printer with Wired and Wireless Connectivity, LaserJet Online UPS (5KVA) for data Retrieval and Processing system with a backup 24 hours for full load. Compatible Operating System Windows 11, Windows 10, Android, iOS, macOS 12 Monterey, macOS 13 Ventura, MacOS v14 Sonoma & Linux.

Supply and Installation of Multi-Function Laser Printer with Wired and Wireless Connectivity, LaserJet Online UPS (5KVA) for data Retrieval and Processing system with a backup 24 hours for full load. Compatible Operating System Windows 11, Windows 10, Android, iOS, macOS 12 Monterey, macOS 13 Ventura, MacOS v14 Sonoma & Linux.

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 21: Providing, Supplying, Laying, Fixing, Testing and Commissioning of 4-Core Cable from Dam Instrument to Junction Box, including cable routing, protective conduits/trays wherever required, termination, ferruling, gland fixing, insulation, identification tags, clamps, connection accessories, and all allied materials, complete in all respects as per technical specifications and direction of Engineer-in-Charge.

Providing, laying, installation, testing and commissioning of 4 Core electrical cable of required size and rating, conforming to relevant IS standards, complete in all respects as per site requirement and as directed by the Engineer-in-Charge.

The work shall include:

- Supply of approved quality 4 core copper/aluminium conductor cable, PVC/XLPE insulated and PVC sheathed, suitable for underground/overhead application as applicable

The complete work shall be carried out as per:

- IS: 1554 / IS: 7098 (as applicable)
- Relevant IE Rules, safety norms and good engineering practices

The item shall be considered complete after successful testing, commissioning and approval by the Engineer-in-Charge.

Measurement & Payment

Measurement shall be made on a per Running Meter basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 22: Providing, Supplying, Laying, Fixing, Testing and Commissioning of 40-Core Cable from Dam Instrument to Junction Box, including cable routing, protective conduits/trays wherever required, termination, ferruling, gland fixing, insulation, identification tags, clamps, connection accessories, and all allied materials, complete in all respects as per technical specifications and direction of Engineer-in-Charge.

Providing, laying, installation, testing and commissioning of 40 core control/instrumentation cable of required conductor size, suitable for signal, control and data transmission applications, complete in all respects as per site requirements and as directed by the Engineer-in-Charge.

- The scope of work shall include:
- Supply of approved quality 40 core copper conductor cable, PVC/XLPE insulated, PVC sheathed, armored/unarmored as specified

The complete work shall be executed in accordance with relevant IS standards, manufacturer's recommendations, safety regulations and good engineering practices, and shall be deemed complete after successful testing, commissioning and approval of the Engineer-in-Charge.

Measurement & Payment

Measurement shall be made on a per Running Meter basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 23: Operation and Maintenance (O&M) of installed instruments, including repair, servicing, and to ensure continuous operation and accurate data output, for a period of 5 (five) years from the date of installation, including comprehensive piece-to-piece replacement of all defective components with all costs towards materials, spares, consumables, tools, tackles, labor, and transportation included, and also including training and capacity building of client personnel, submission of periodic analysis reports, and deployment of required manpower for the entire 5-year O&M period, complete in all respects.

Operation and Maintenance (O&M) of all the item included in the contract.

Documentation and Submittals

The Bidder shall submit complete documentation in English for all equipment and software components supplied, including user manuals and operation & manual.

In addition, the Bidder shall prepare and submit a project-specific System Operation Manual covering the following:

- Detailed equipment layout
- Procedural handbook
- System block diagrams (logical connections)
- Wiring diagrams
- Interface specifications, including communication protocols and configuration modes
- Software licenses
- Calibration and testing certificates
- Instrument operation manuals
- Maintenance schedules and guidelines

The documents will also be transformed in to web-based helpline. The manual shall be provided both as hardcopy and pen drive (20 copies).

Instrumentation Analysis report

The Bidder shall submit an instrumentation analysis report on a quarterly basis throughout the Operation and Maintenance (O&M) period. In addition, an annual instrumentation analysis report shall also be submitted during the O&M period.

The Dam Instrumentation Analysis Report should include the following:

5. Detailed description of all instrumentation

- Summary of all instrumentation
- A plan view drawing of the dam should be developed with the name and location of all instrumentation.

6. Compilation and presentation of available and new instrumentation data (Historical data shall be provided by the Dam owners for this analysis)

- Uplift Pressure Variation Hydrograph
- Piezometric hydrographs
- Flow measurement hydrographs and
- reservoir level correlation plots
- Dam Movement Monitoring Hydrograph

7. Data analyses

- In conjunction with developing instrumentation data plots, the bidder should analyse the data to evaluate the dam's performance, identify any concerning trends or data points, and assess whether any data gaps exist that warrant the installation of additional instrumentation.

8. Summary of findings and recommendations

- A summary section should clearly itemize conclusions and recommendations.

The details included in the Instrumentation Analysis Report are not limited to those mentioned above. The same shall be reviewed, verified, corrected, or supplemented by the Dam Owner in accordance with site requirements, and the necessary actions arising therefrom shall be carried out by the Bidder.

Operation and Maintenance Support

The Bidder shall provide comprehensive operation & maintenance services for a period of 60 months (5 years) after final acceptance of equipment.

Application of data collection software, and all other software packages that are procured by specialized personnel to be provided by Bidder. The personnel will have a firm grip of the software and be capable of training the Dam owner's officials as requested by the Dam owner. The personnel will assure that the data transmitted to the Center of excellence is being properly stored on base installation software.

The personnel will serve in providing assistance in maintaining the computer server and all software packages and all other activities.

All the activities must be carefully coordinated with the Dam owner. Regular dialogue is required between the Bidder and Dam owner.

The Maintenance services will include the following activities:

Maintenance of observation network including:

- Preventative Maintenance (PM) of observation network to occur every 3 months or sooner whereby each installation will be visited at that interval or sooner.

- Emergency Maintenance (EM) of observation network as required (installations down or delivering questionable data).
- Document maintenance visit, whether PM, using software specified and to be acquired by the Bidder.
- Provide monthly maintenance reports accounting for all field visits performed, nature of visits, action taken.
- The bidder shall make arrangements to ship the required equipment for maintenance. He shall receive those and maintain the same. He is also responsible for maintaining document equipment inventory.

Maintenance Reports

There is a requirement for the Bidder to provide monthly operation & maintenance reports during the warranty period. The reports shall be submitted on the 7th day of every month documenting the previous month's activity. The reports must include an accounting of all installation, or visits, actions taken.

Hand Holding Support Services

For Hand holding support in managing the operation of system: minimum one additional system engineer shall visit the site for two days in each quarter for five (5) years to facilitate data gathering and analysis from the instruments installed and resolve difficulties encountered / provide solutions resolve required to keep system operational. It shall not be paid separately.

Backup of Data

The monthly backup of data is to be provided by the Bidder before 5th day of next month with external hard disk/stick or any suitable digital backup system

Warranty

The warranty period shall begin immediately after all instruments have been commissioned and final acceptance accorded. The warranty and Comprehensive operation & maintenance period will last for five (5) years', during which time the Bidder will be responsible for the comprehensive operation and maintenance of the entire network. The Bidder will be responsible to replace faulty or damaged equipment.

The Bidder shall electronically record all maintenance activities using the software specified elsewhere in this document. Monthly maintenance reports shall be submitted to the Engineer-in-Charge, summarizing the number of visits conducted, sites attended, and the purpose of each visit. The Bidder may also be required to perform ad hoc queries or analyses as requested by the Dam Owner/Employer.

The Bidder shall deploy and utilize adequate staff as required for the proper execution of the works. The Dam Owner shall provide office space for instrument technicians; however, all costs related to transportation, ancillary equipment, tools, and consumables shall be borne by the Bidder.

The instrument technicians shall restore any installation or sensor outages within 48 hours of occurrence. For this purpose, technicians shall be stationed at the Field Control Room or State Control Room, as directed by the Engineer-in-Charge.

An Information Technology Specialist shall also be provided to maintain the newly procured and commissioned Field Control Room servers. The Dam Owner shall provide office space for the IT Specialist. The IT Specialist shall be responsible for overseeing data collection, and managing system hardware and software.

Additional Conditions during Warranty & AMC period:

In case of theft or damage to the telemetry system due to vandalism, the Contractor shall be responsible for repairing or reinstalling the affected components in accordance with the conditions of the contract. The payment for such repair or replacement work shall be made by the Engineer-in-Charge based on the approved item rates specified in the tender during the Operation and Maintenance (O&M) period. This replacement shall be in addition to the damage caused by the river waters during monsoon/non-monsoon period.

The bidder shall have an operational branch office in the State of Gujarat. In case the bidder does not have an existing branch office in Gujarat at the time of bidding, the bidder shall establish the same before commencement of the contract.

The Contractor shall make suitable arrangement to ensure that it's representative mandatorily visit each telemetry station once in a month and submit a certified report of matching telemetry data with the manual data.

Operational Engineer

During the stretch of each monsoon period, the bidder shall be deploying a qualified and experienced technical staff having sound knowledge for maintaining "Data Collection Centre" and other equipment/sensor/IT/ITES/ICT and devices as residential resource engineer at dam site for Throughout contract period.

The remuneration of deploying the residential technical staff shall be bear by the bidder including the salary, Insurance, staying, flooding, lodging & boarding etc.

The detail updated resume of two shorted candidates having experience to manage the dam site as resource engineer, bidder shall send all details of them for the screening and getting administrative approval from Project Engineer In charge before the final for nomination of candidates. The bidder shall be deploying one of the nominated technical staff either/or among two screened resumes as resource engineer. The shuffling resource engineers may be carried by bidder as per requirement and event of needs.

Project Engineer

The instrumentation & Monitoring activities under this O & M contract shall be carried under the supervision of qualified and experienced geotechnical engineer shorted by bidder after getting approval from project Engineer-In Charge. The bidder shall submit detailed resumes for screening of candidate having minimum 5 years of domain experience with project management skill for handing similar prototype of techno management works.

The geotechnical engineer shall have the understanding of dam safety monitoring principal, construction behaviors, instrumentation, hybrid communication network, deliverables to dam authority, necessities and priorities to be recognized. The engineer shall to install, maintain, and read the instruments

recognized. The engineer shall to install, maintain, and read the instruments properly and shall instruct field engineer remotely to look for the way engineering changes in the data and troubleshooting in system required with diagnostics. The engineer shall be capable of understating for any significant changes by reading the data and can rapidly brought to the attention of the engineer in charge/project authority.

The bidders shall ensure that the technical operator/filed staff assigned the responsibility to handle the O & M works, thereby creating a sense of involvement and motivation and permitting the engineer to concentrate on interpretation of the data. The assigned staff shall be capable of collecting, reducing and evaluating data taken through potable reader and taken manually from gauges.

The Bidder shall also ensure that the deployed technical staff having sound knowledge of dam safety, common causes of dam failures and incidents, identification of signs of potential distress any event recorded, observed and collected visually. Deployed engineer also shall be capable for understating any abnormal unusual conditions, signs of potential distress, or emergency conditions occur shall be taken on defined tabulated format.

The geotechnical engineer and Technician/operator's updated Resume, degree and experience certificate shall be submitted by Bidder during bidding with the tender document as mandatory required technical documents.

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Sr. No.	D & R-Role-Duties & Responsibilities	Qualification & Experience (Minimum)
01	Operational Engineer	ITI in Electronics/Electrical/Instrumentation; 3 years of experience in O&M for Dam Instrumentation and Monitoring (IT, ITES. ICT, Geodetic, Hydro meteorological, Geotechnical sensors, DAS, Data logger and components of Electrical System, Panel) etc. Experienced in execution of preventive and non-maintenance and troubleshooting
02	Project Engineer	B.Tech/ BE/ Electronics/Electrical/ Instrumentation/ Computers; 5 years of experience in O&M of Dam Instrumentation and Monitoring (IT, ITES. ICT, Geodetic, Hydro meteorological, Geotechnical sensors, DAS, Data logger, Calibration, Collection, Processing, Reduction and Evaluation and components of Electrical System, Electrical Distribution, Electrical Panel with Data Analysis and Plotting Etc. Experienced in execution of preventive maintenance schedules and troubleshooting of UPS, DG Sets & Transformers

The project requires the Bidder to provide one technician having graduate degree is required experience of handling this equipment for O &M, positions to fill the tasks of hydrometeorology, geodetic, geotechnical, seismic and computer systems & software support. The personnel will be required to be dedicated to the project as scheduled below, and will remain onsite for the period of the schedule.

Engineer-in-Charge will provide office space and furnishing (desk, chair, cabinets) for the Bidder provided staff at Dam sites. The staff will have their own arrangements for reliable transportation which will also be supplied by the Bidder. It is required that the vehicle being used shall be capable of holding and securing all of the equipment used for field measurements.

A list of mandatory & recommended high-usage spare parts and consumables for a period of five (5) years of operation must be submitted by the Bidder and include the cost of these spare parts & consumables in Comprehensive Operation & Maintenance price schedule. High- value spare parts, such as entire components, shall be included in this list. The Bidder shall indicate a number of spare installations to be supplied which are not intended for immediate installation. These spare installations will be available for short-term replacement of damaged or malfunctioning installations, while arrangements are made for repair, warranty or replenishment of spare parts.

The Bidder shall ensure that Instrument installed under the Dam instrument bid must have spare parts support from Original Equipment Manufacturer not less than 05 Years from the Date of installation. Even after, obsolete of Instrument from the market, Spare parts required during maintenance must be provided by OEM through Bidder.

In addition, the Bidder must submit a complete listing of spare parts for each equipment component (data loggers, power supply, etc.) and consumables valid for Five (5) years from the date of Final Acceptance. Cost of these spares and consumables shall be included in contract price.

Measurement & Payment

Measurement shall be made on each year of satisfactory completion of O&M after completion of installation.

Signature of Contractor

P. P. 15
Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 24: LED Screen 55"

- Resolution: 4K Ultra HD (3840 x 2160) | Refresh Rate: 50 Hertz
- Connectivity: Integration with 3 HDMI Ports for connecting your Set-Top Box/DTH, Soundbar, Home Theater, Gaming Console, and more. Plus, stay flexible with 1 USB-A Port for easy access to Hard Drives and other USB-compatible devices. Stay connected with Wi-Fi 5, Bluetooth 5.2, and HDMI eARC, along with an Ethernet LAN Port for stable wired internet. Additional features include Anynet+ (HDMI-CEC) for unified control and RF In for Terrestrial/Cable input.
- Sound Features: Powerful 20 W Sound Output | Object Tracking Sound | Q-Symphony | Bluetooth Audio | Adaptive Sound
- Smart TV Features: Works with Alexa/Google Assistant | Endless Content with Samsung TV Plus (Access 100+ free TV Channels) | Web Browser | SmartThings Hub | Matter Hub | IoT Sensor Support | Mobile-to-TV Mirroring | Sound Mirroring | Wireless TV On | Connect Apple Devices with AirPlay | Universal Guide | Workspace for Remote Access | Buds Auto Switch | Workout Tracker | Daily+ | Multi Control | Storage Sharing | Energy Rating: 4 Star | Annual Energy Consumption: 144.54 kWh | Additional features: Slim-look Design | 3 Bezel-less | TV Key | ConnectShare | Embedded POP | EPG | IP Control | MBR Support | Dongle Support | SlimFit Cam Compatible | S-Share
- Display Features: Crystal Processor 4K | HDR10+ Support | Pur Color | 4K Upscaling | Color Booster | Mega Contrast | Contrast Enhancer | HLG (Hybrid Log Gamma) | UHD Dimming | Motion Xcelerator | HDMI Black Level | Film Mode | Filmmaker Mode
- Warranty Information: 1-year manufacturer warranty and 1 year additional on Panel from date of purchase on the television set and 12-month warranty on the remote control. Warranty claims can be processed using the Amazon e-invoice

Measurement & Payment

Measurement shall be made on a per number (each) basis

Signature of Contractor


Executive Engineer
Rajkot Irrigation Division
Rajkot

ITEM NO. 25: civil or other work for above all item.

The Bidder shall provide the detailed instructions and standard design drawings like footprints of the equipment required for installation. All civil works are included in Bidder's responsibility during installation & during Comprehensive O & M period.

The civil and other works related to installation of equipment are responsibility of the Bidder.

Measurement & Payment

Measurement shall be made after completion of all the necessary civil work required to the installation of all the Instruments.

Signature of Contractor


**Executive Engineer
Rajkot Irrigation Division
Rajkot**