# Procurement Ledger: Vertical Field Anchor (VFA)

**Role:** Alpha Node (Ground Truth) | **Quantity:** 1,280 Units

The Vertical Field Anchor (VFA) serves as the primary "Truth" node within the FarmSense grid. Unlike the high-density LRZ scouts, the VFA is a high-fidelity instrument designed to provide the baseline calibration data for the entire field. This document details the granular costs associated with the procurement and physical deployment of these nodes within the San Luis Valley (SLV) Subdistrict 1.

## 1. Granular Hardware & Component Costs

| Category | Component Description | Supplier | Part # / Type | Cost (Unit) |
|---|---|---|---|---|
| Housing | 2" SCH 40 UV-HDPE (7ft) | Ferguson | UV-White HDPE | $18.50 |
| Housing | Custom ABS Tapered Driving Tip | Proprietary | Mold-V4 | $4.25 |
| Housing | Carbon Fiber Mast (1.25" x 4') | Rock West | Uni-Directional | $32.00 |
| Fasteners | 316-SS Pin-and-Weld Set (x4) | McMaster | 92383A540 | $1.15 |
| Seals | Viton (FKM) 2" O-Rings (x2) | McMaster | 9464K114 | $6.50 |
| Seals | Marine-Grade Gap Filling Cement | West Marine | Loctite 404 | $0.85 |
| Computing | NXP i.MX RT1060 Alpha-Sled | Digi-Key | MIMXRT1061 | $112.00 |
| Sensing | TDR Probe Array (Gold-Plated) | JLCPCB | ENIG-Finish | $88.00 |
| Sensing | BME280 Atmospheric Suite | Mouser | 380-BME280 | $45.00 |
| Sensing | AS7262 Visible/IR Sensor | Mouser | 984-AS7262 | $28.00 |
| Radio | LTU Lite 5GHz PtMP Client | Ubiquiti | LTU-Lite | $44.00 |
| Power | 20Ah LiFePO4 Cells (Dual) | Bioenno | BLF-1220A | $62.00 |
| Thermal | 5W Kapton Heater + Mylar | Mouser | KH-Series | $9.75 |

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|---|---|---|---|---|
| Thermal | 8mm PE Closed-Cell Insulation | FoamOrder | R-1.4 | $3.00 |
| TOTAL | Per Unit Hardware Cost | | | $455.00 |

### 2. Technical & Material Justification

- **Structural Materials:** The housing utilizes UV-stabilized HDPE from Ferguson to prevent "chalking" and structural embrittlement under the intense high-altitude UV radiation of the SLV. The addition of a 4ft Carbon Fiber mast from Rock West ensures that the 5GHz radio maintains a stable line-of-sight to the District Hub, even during high-wind events where PVC or aluminum would suffer from signal-degrading sway.
- **The TDR Advantage:** We utilize custom ENIG-finished TDR (Time Domain Reflectometry) probes. Unlike cheaper capacitive sensors, TDR probes are immune to the high soil salinity and variable mineralogy of the Valley floor, providing the "legal-grade" moisture data required for Water Court verification.
- **Winterization Suite:** To survive the "Polar Vortex" events common in Colorado, the VFA is equipped with a dual-stage thermal defense. 8mm PE insulation creates a thermal buffer, while 5W Kapton heaters ensure the LiFePO4 batteries remain above 32°F for safe charging cycles, drawing from the 40Ah (combined) capacity.
- **Environmental Sealing:** The use of Viton (FKM) O-rings is a critical "molecular audit" inclusion. Standard Nitrile (Buna-N) seals become brittle at -10°F; Viton maintains a hermetic seal down to -40°F, preventing internal condensation that would otherwise short-circuit the $112 NXP processing sled.

### 3. Deployment Totals (Subdistrict 1)

The deployment of 1,280 units across Subdistrict 1 is executed via a "Blitz" methodology, utilizing a 2-person UTV crew equipped with a specialized 1" hydraulic flighted auger.

- **Hardware Subtotal:** $582,400
  - *Includes all internal electronics, sensors, and structural components listed in Section 1.*
- **Install Kit (Consumables):** $12,800
  - *Covers specialized items like Loctite 404, 316-Stainless hardware, cable ties, and dielectric grease for external radio connectors.*
- **Logistics & Labor:** $76,800
  - **Labor:** Calculated at $45/hr for a 2-person crew, averaging 1 hour per VFA for site selection, augering, physical installation, and RF-handshake verification.

- **Logistics:** Includes fuel, UTV maintenance, and the amortization of the hydraulic auger rig during the 60-day blitz window.

**VFA TOTAL PROJECT COST: $672,000**

*Note: All pricing is based on bulk-buy procurement for 1,000+ units. Lead times for the NXP*