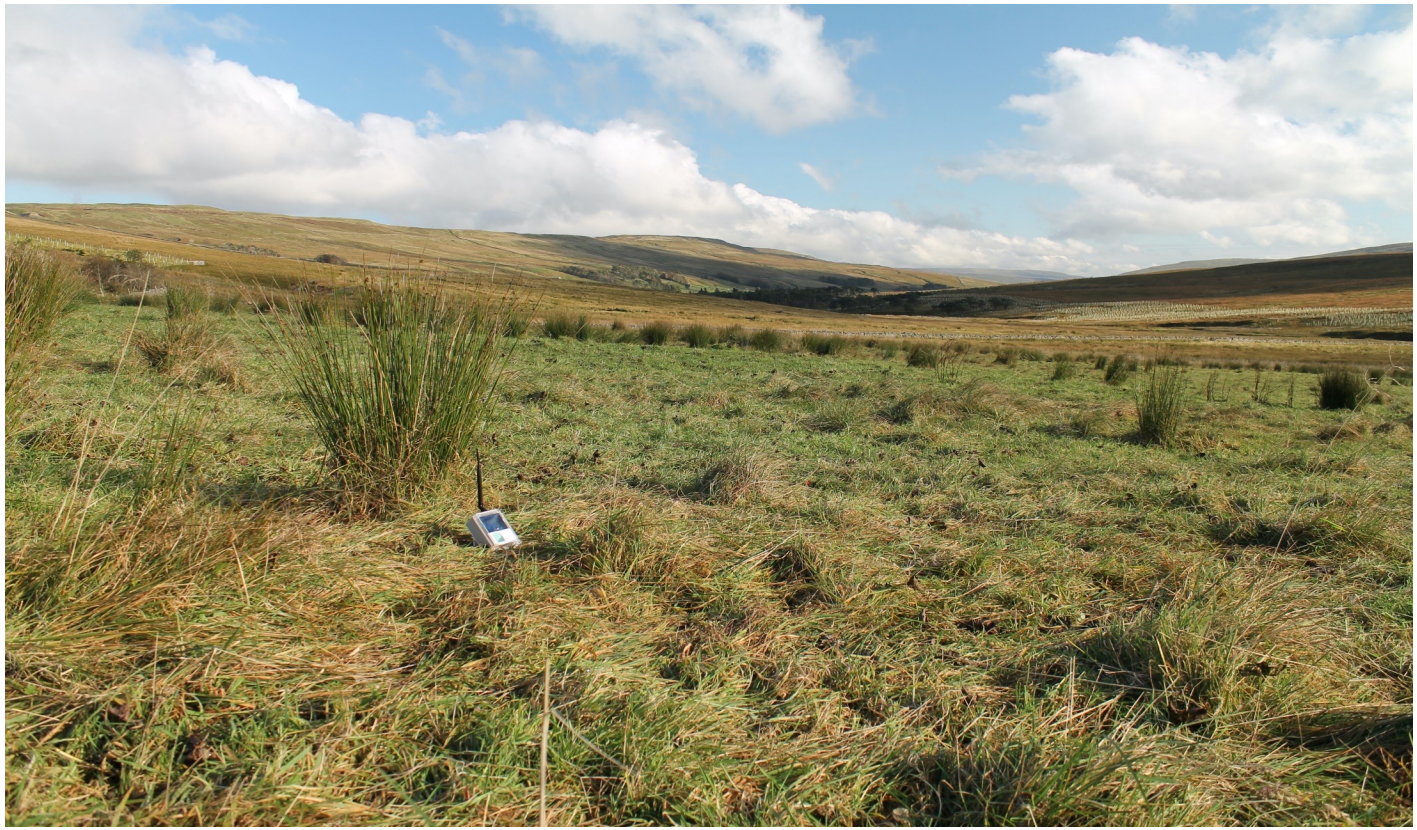
Dales Land Net™

Environmental Soil Monitoring



Our Markets:

- Flood Prediction & NFM
- Agriculture & Irrigation

Our Technology:

- Low-cost monitoring
- Remote IoT real-time data delivery

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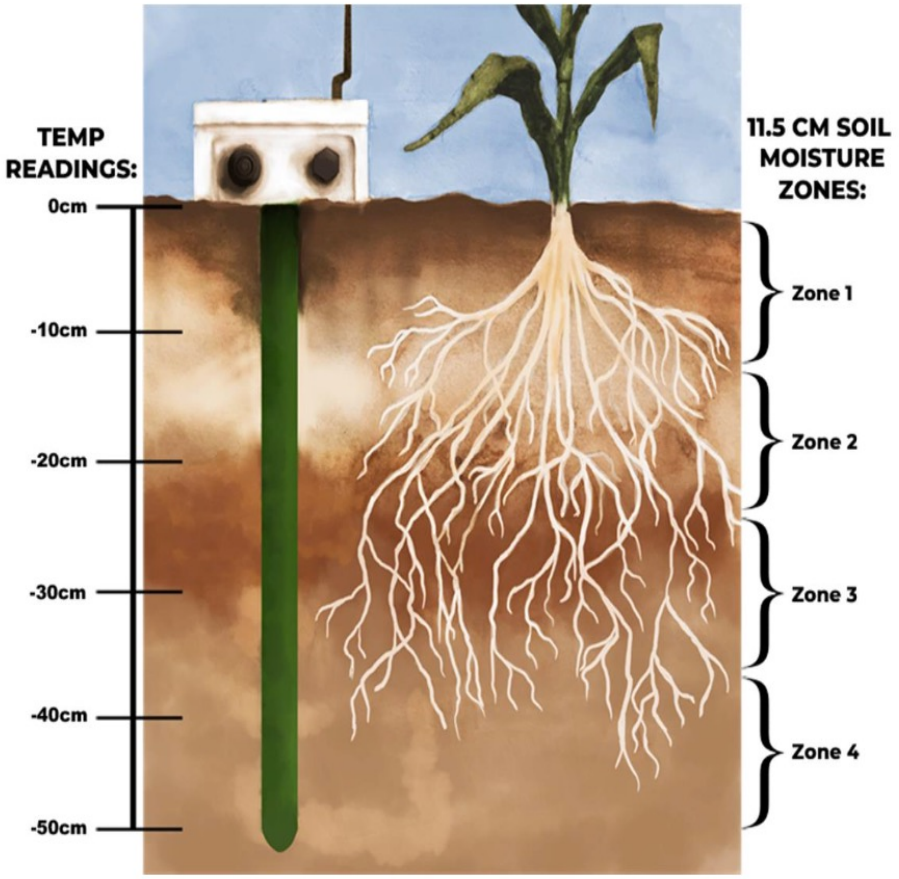
Started with Aire Valley Flooding in 2015

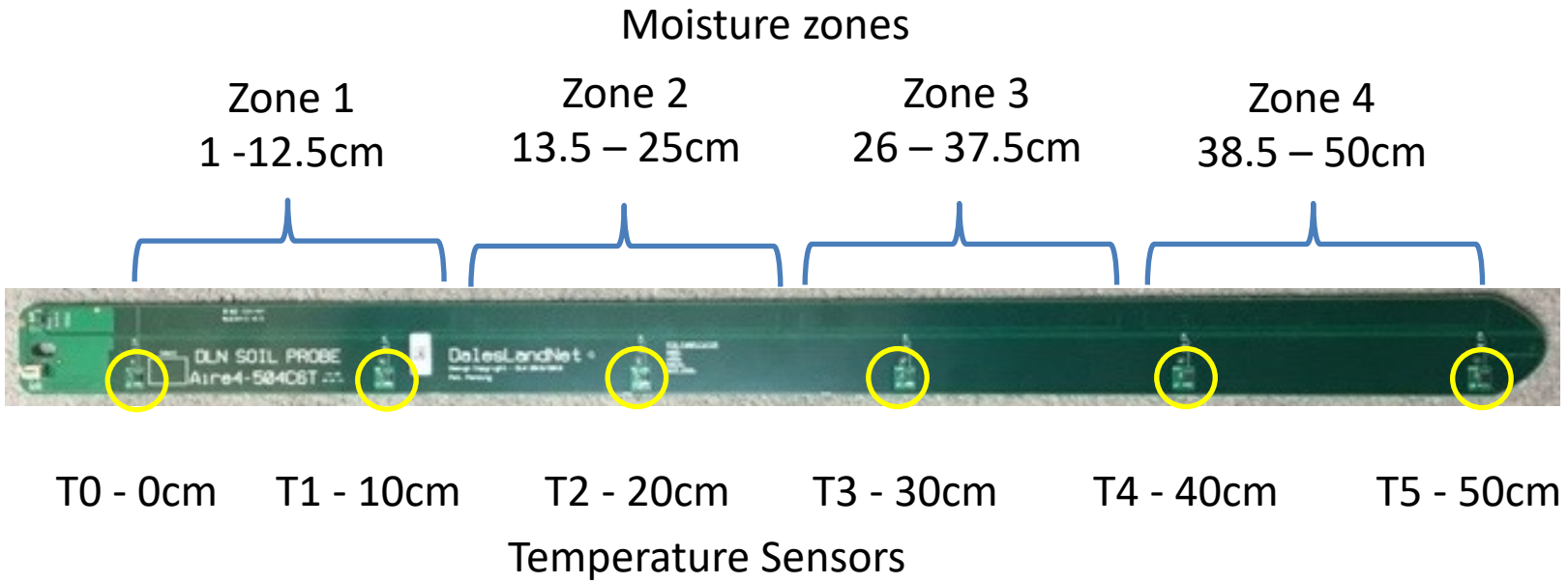
What matters is how wet the ground is

Low-Cost, Remote, Soil Moisture Sensors

DLN have developed a low-cost sensor that sends soil moisture and temperature, every 30 minutes, all year.



The Sensor Design

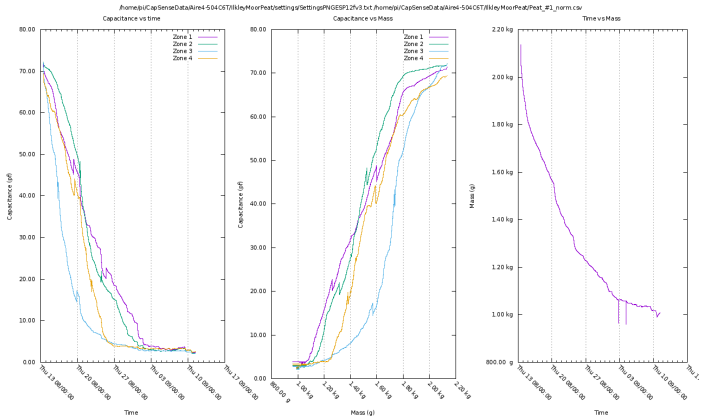


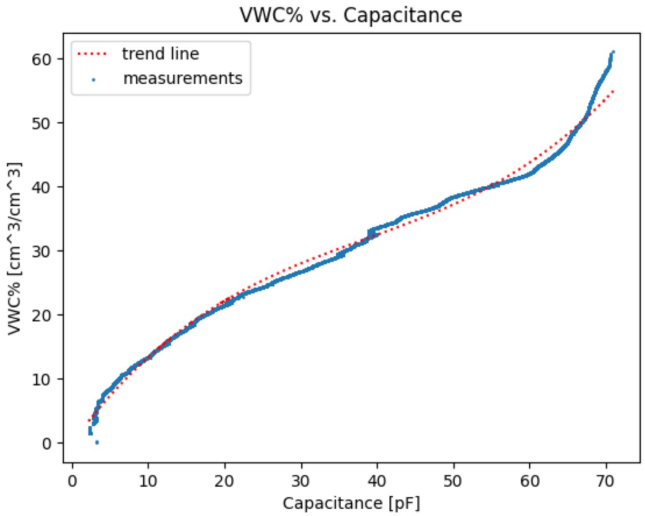
- Each moisture zone gives a single reading
- Highly linear response in each zone allowing use in moisture and liquid level measurement
- Only senses off the front face of the sensor
- Robust encapsulated design

Sensor Moisture Calibration

Gravimetric calibration used to covert raw data into %VWC for a soil type

- Volume of sample measured
- Sensor inserted
- Slowly brought to water saturation
- Suspended off a custom rig
- Mass and raw sensor data recorded
- Final dry mass recorded after oven drying.
- Data used to calculate a best fit line as a 3rd order polynomial
- Coefficients used by dashboard to display raw data as %VWC





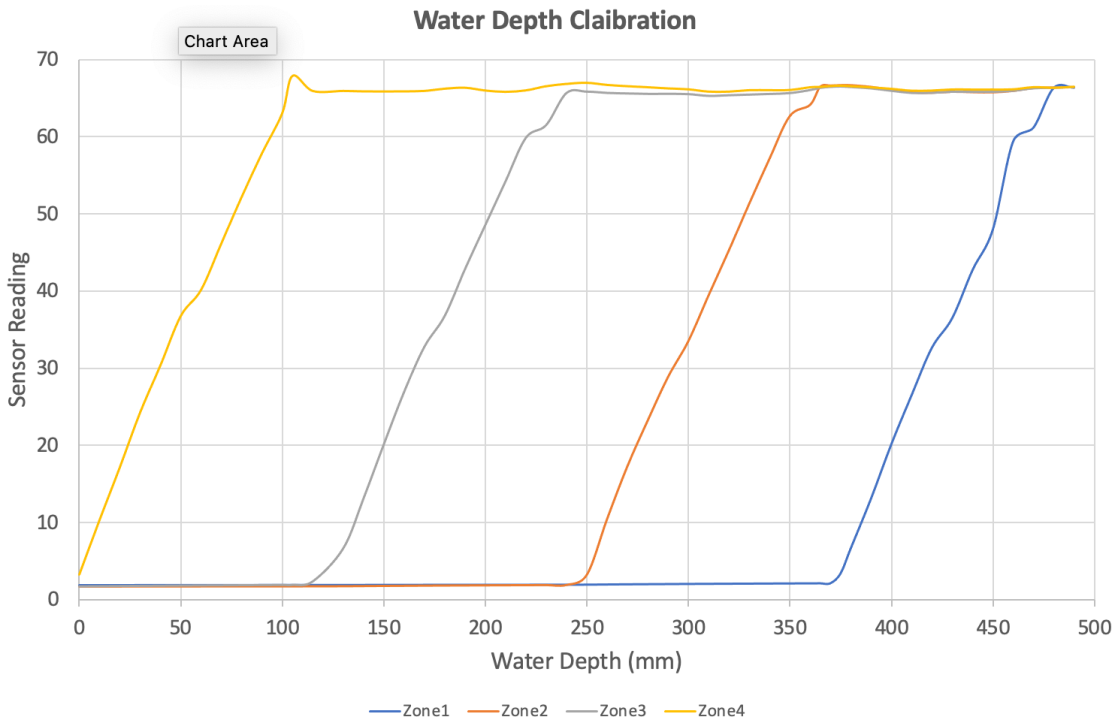
Example values calculated (Ilkley Moor Peat):

$$y = 1.61952 * x + -0.03083 * x^2 + 0.0002666535 * x^3 + -0.03234$$

Sensor Liquid Depth Calibration

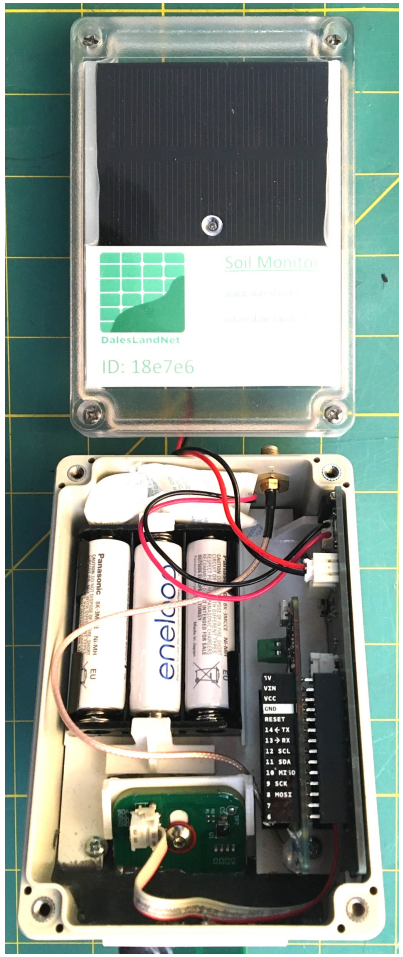
Water column immersion

- Sensor suspended in tube
- De-aired water added slowly
- Stopping to let level rest at 1cm depth points
- Sensor raw data recorded
- Used to generate best fit line
- Line slope used in dashboard to show liquid depth on sensor zone



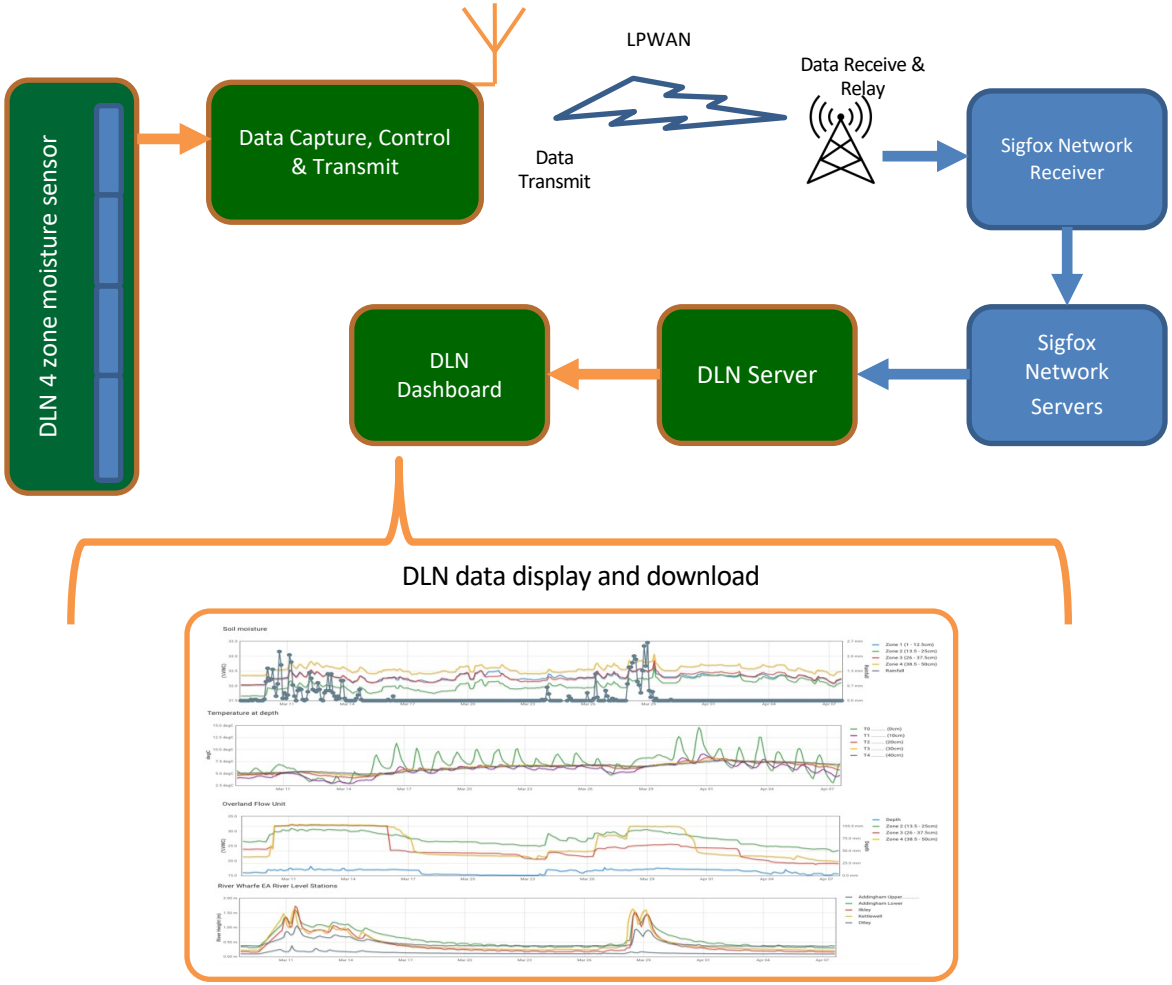
Data Capture

- Low cost, Low power controller
- Data read and send every 30min
- Sent over low power wide area network
- Sigfox or LoRaWAN networks for remote operation
- NiMH + Solar for continuous operation
- Battery level monitoring
- IP65 case and seals



Data Relay to the DLN Dashboard

Using Sigfox IoT 0G network to collect data from remote units



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The Integrated Customizable Dashboard

All the data in one place, downloadable in your browser

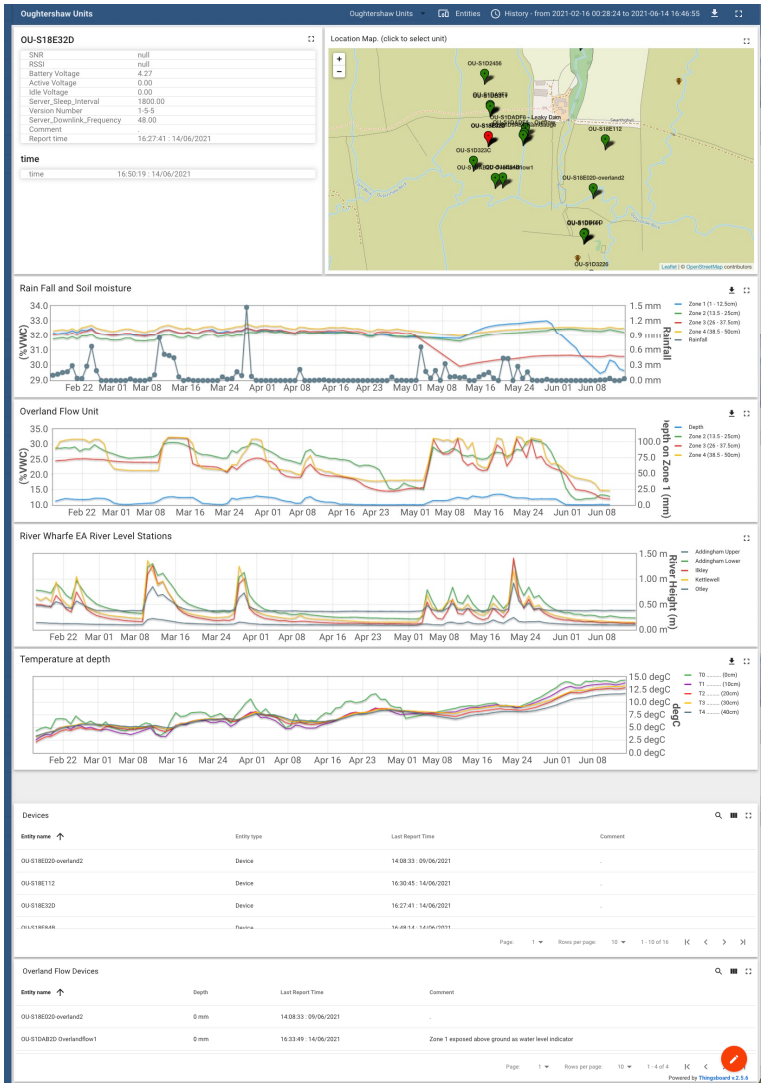
Unit Ident, signal strength and battery level and clickable location map

%VWC for selected moisture unit and overland flow units

Local EA river level stations

Temperature reading for selected unit

List of selectable moisture and overland flow units



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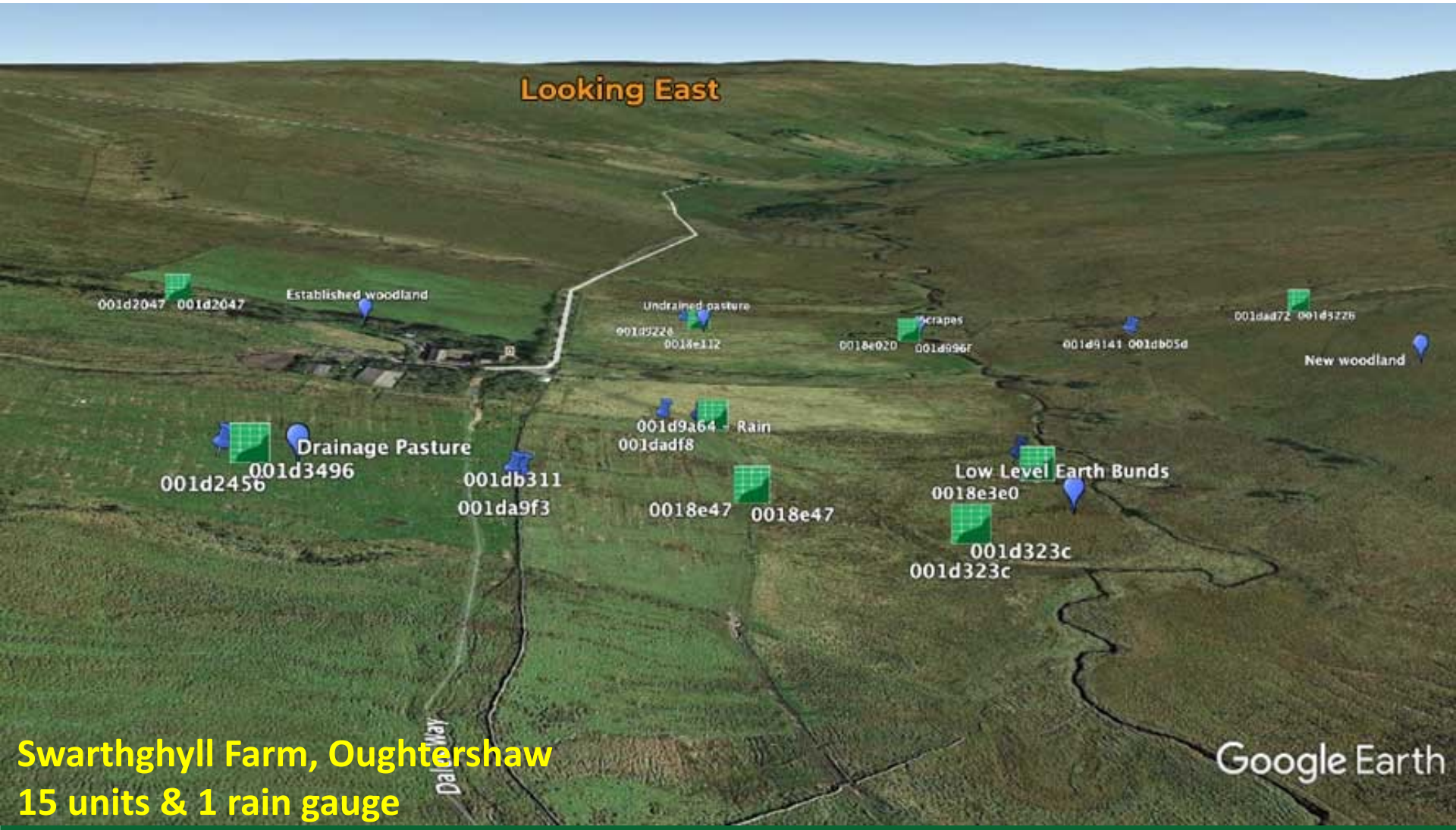
Monitoring a Wide Range of NFM Features

Bunding, Scrapes, Dams, Pipes, Overland flow

Real-time letting you know when a feature is activating



Swarthghyll Farm, Oughtershaw
15 units & 1 rain gauge

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Leaky Dams & Pipes

Overland Flow

- Zone 1 left exposed above ground
- Zones 2, 3, 4 under ground
- Using liquid depth calibration and soil moisture calibrations
- Gives an indication of how moist the ground is and when overland flow starts

Topping Over and Silt Build Up

- Zone 1 left exposed above ground
- Zones 2, 3, 4 under ground
- Sensors give a reading of build up silt on the front
- Sensors show when the max level on pond is reached

Rain Fall

- DLN Rain gauge
- Standard “tippy bucket” mechanism
- Can be supplied calibrated
- Data display on the same dashboard as soil moisture

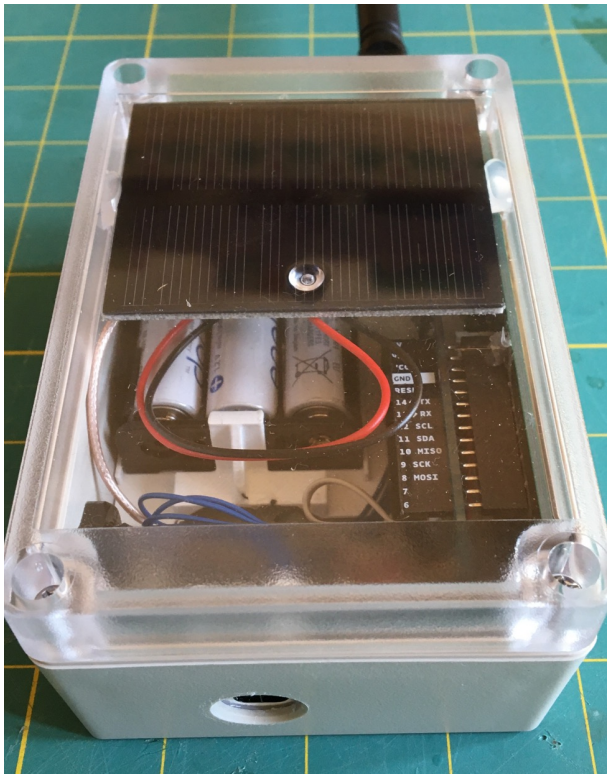
Next Gen and New Developments

3rd Generation Case

- Highly Robust
- Concealed antenna

Range/Level Measurement

- Infra Red or Ultrasound



4th Gen Planned Features

- Exploit low cost low power connectivity
- Accelerometer
- High accuracy GNSS/GPS positioning
- Connectivity Options
  - Remote satellite
- Soil Health
  - pH, NPK, CO2
- River flow rate

Dales Land Net™

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