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Defensible by Design

Technology Overview

Managed geodetic-grade GNSS

Continuous subsidence monitoring for a defensible annual record

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Evolution Overview

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Kurloo Technology
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Australia

- Registered Surveyor
- (QLD, NT)
- QUT B. Applied science survey (1996)
- 30 years consulting, GNSS, Aerial survey, Precise Monitoring
- Australia, NZ, UK
- Respected Innovation and research partner

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- GNSS Commercial Operator since 202
- 60 commercial customers AUD/ NZ
- Export partners in NZ. Chile and Singapore
- 14 mth operation in Colorado (Landslips and Nevada (Mining)

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LONE STAR Groundwater Conservation District

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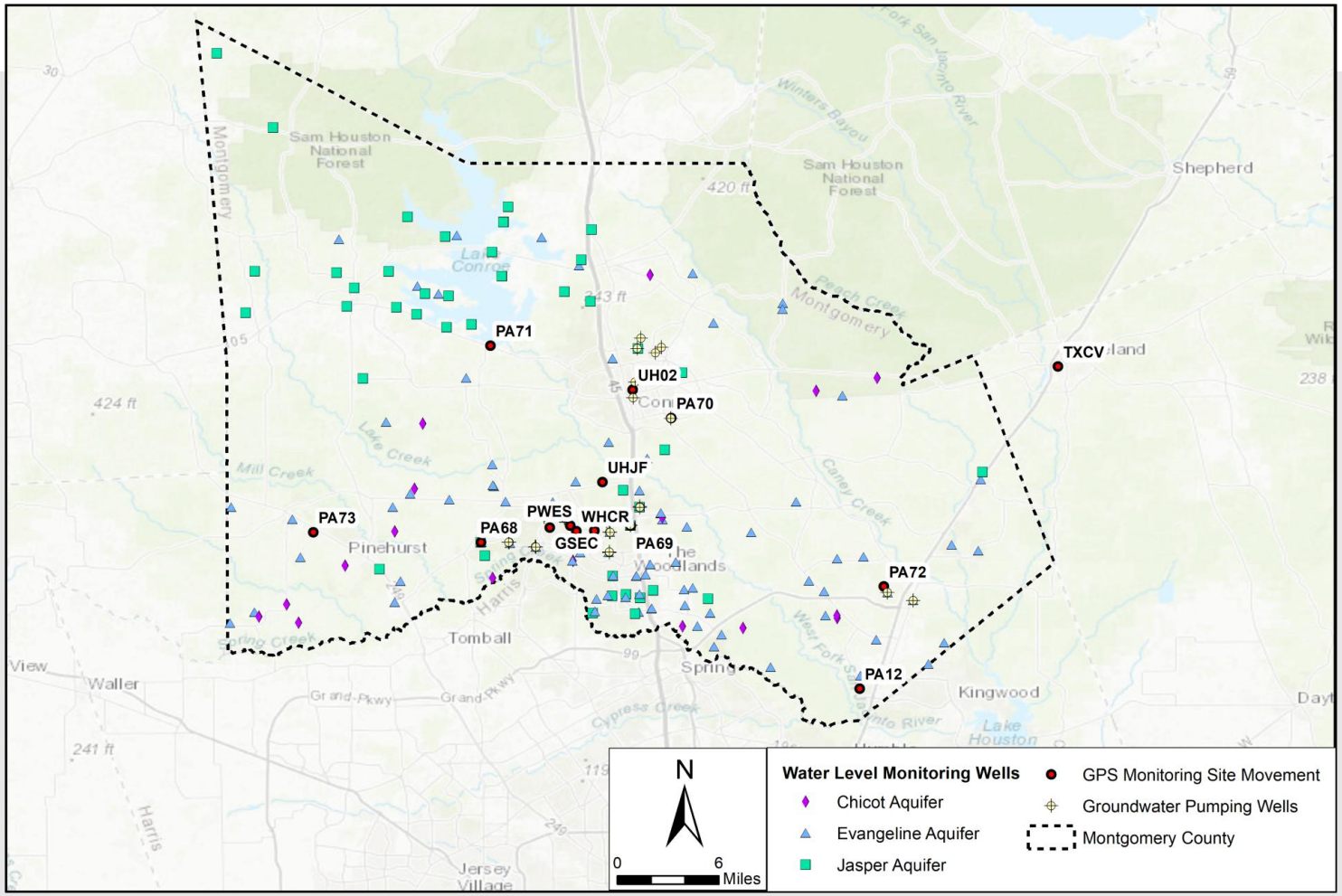
Current State - LSGCD



Where does the time go?

The first is physics. The other two are decisions.

1

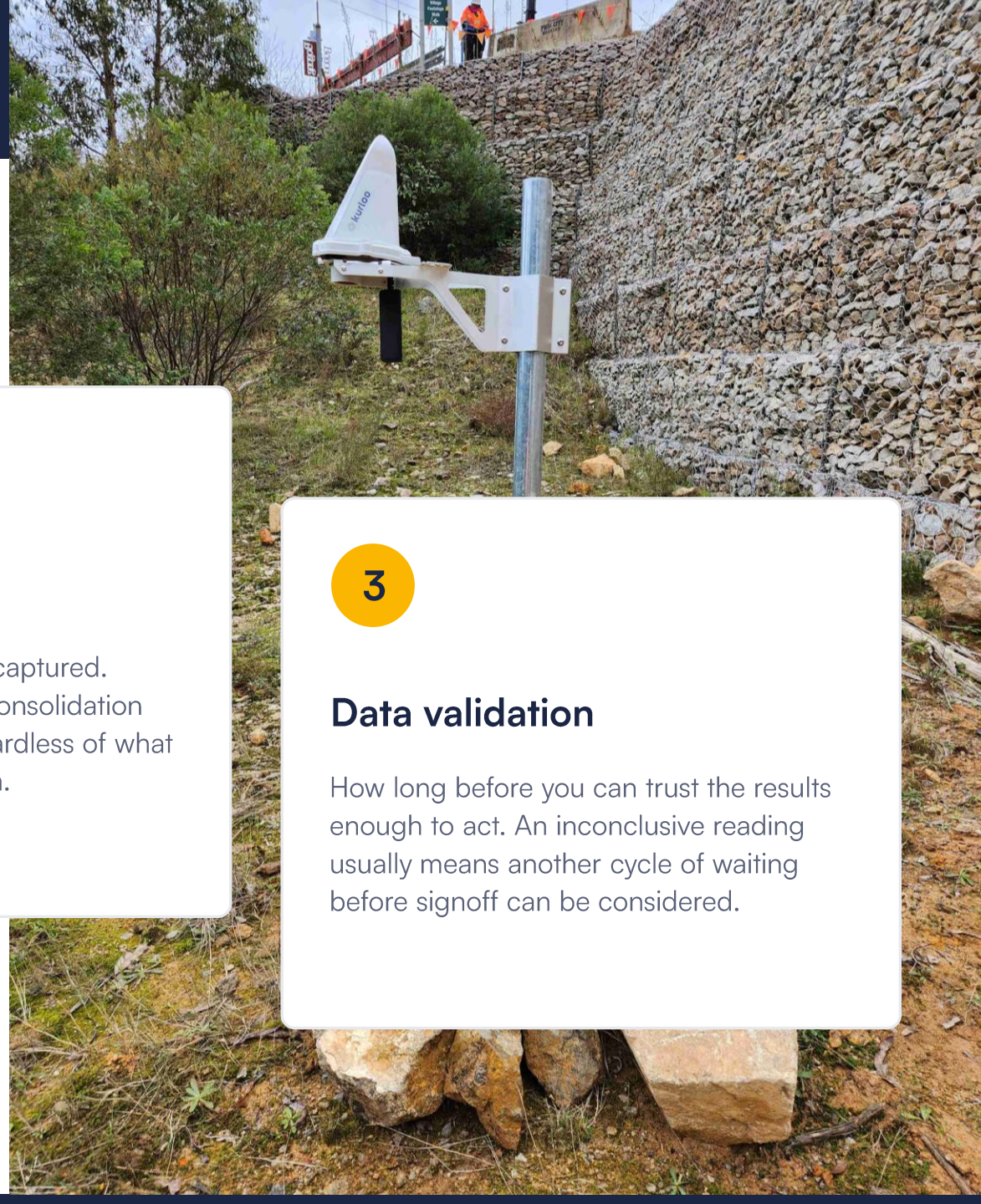
The soil consolidating

Governed by drainage paths, surcharge height and soil properties. Only ground improvement can accelerate it.

2

Data availability

How often displacement is captured. Monthly survey resolves a consolidation curve in monthly steps, regardless of what the ground does in between.



3

Data validation

How long before you can trust the results enough to act. An inconclusive reading usually means another cycle of waiting before signoff can be considered.

GNSS readings with no data gaps

The annual subsidence rate is calculated from the readings taken. Those missed can't be added later.

1

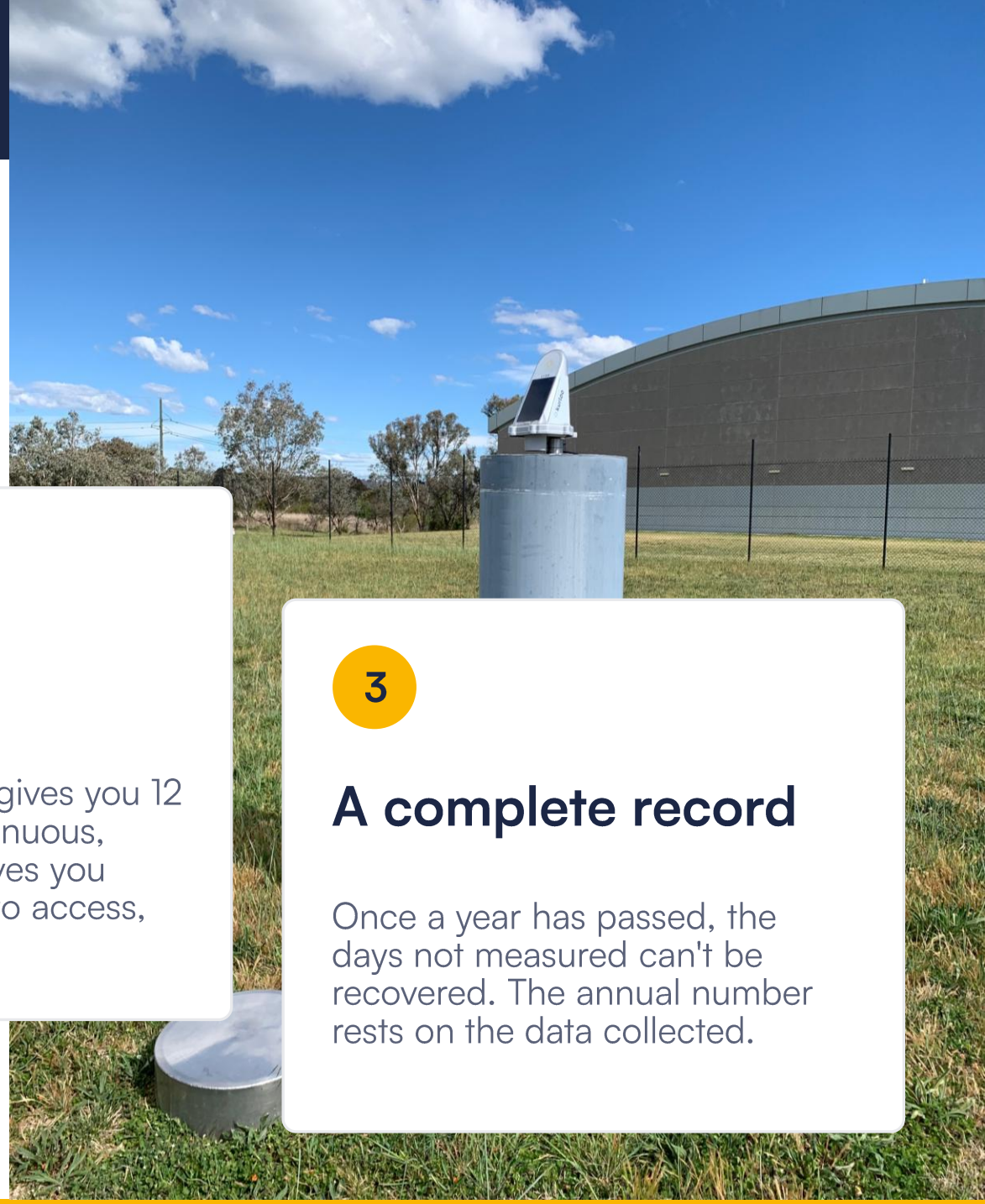
A Reliable Trend

Subsidence is slow. Resolving change in the signal needs confidence in the long-term trend, not just in a single reading.

2

No gaps

A monthly campaign gives you 12 readings a year. Continuous, remote monitoring gives you >100, with none lost to access, weather or workload.



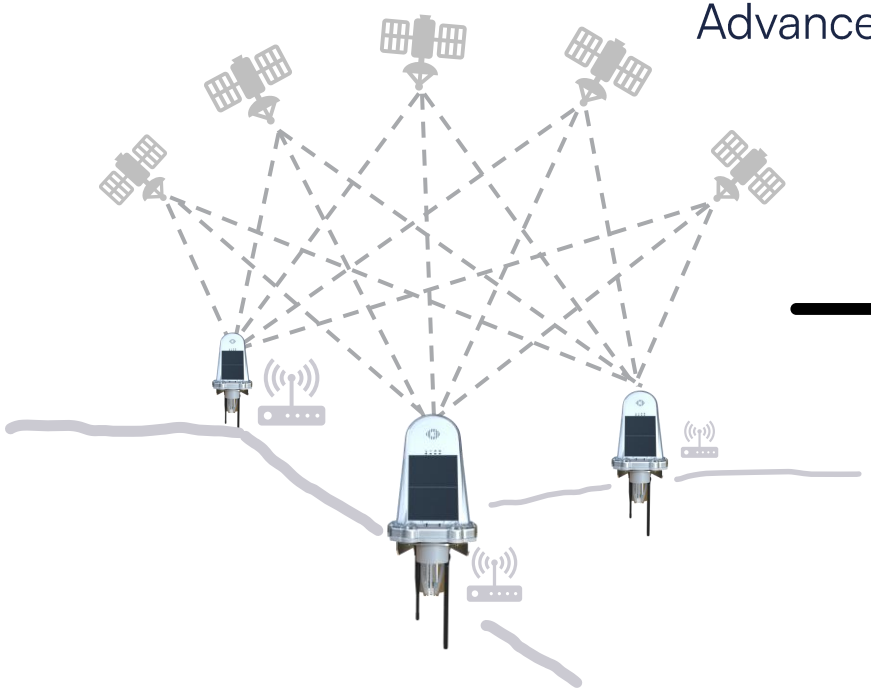
3

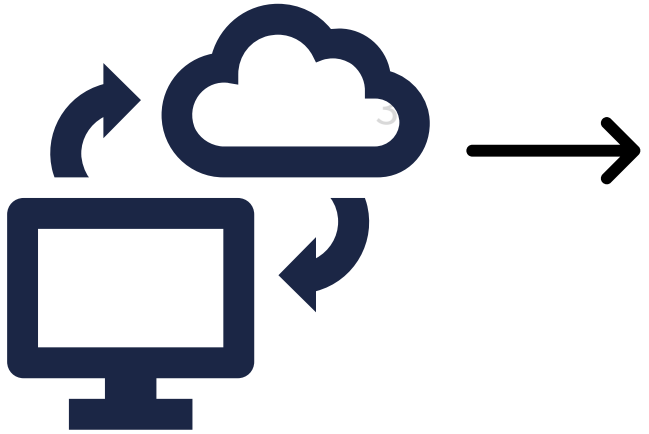
A complete record

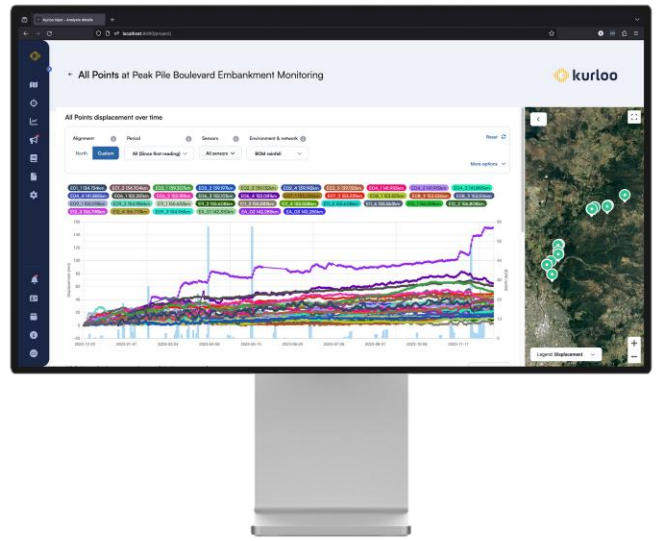
Once a year has passed, the days not measured can't be recovered. The annual number rests on the data collected.

Kurloo is a professionally managed GNSS service

Advanced IoT plug and play hardware + Professionally managed care and support







1. Purpose built field Kurloo Devices

- The patented Kurloo device is remotely configured to collect thousands of GNSS satellite frequency signals along with sensor readings and device heath and status data.
- Harnessing its onboard solar power system and communications system, the device sends the onboard data via 4G LTE-M or Wi-Fi to the purpose-built Kurloo processing cloud.
- The Kurloo solar battery will last up to 28 days without charge.

2. Secure Cloud Storage & Data Processing

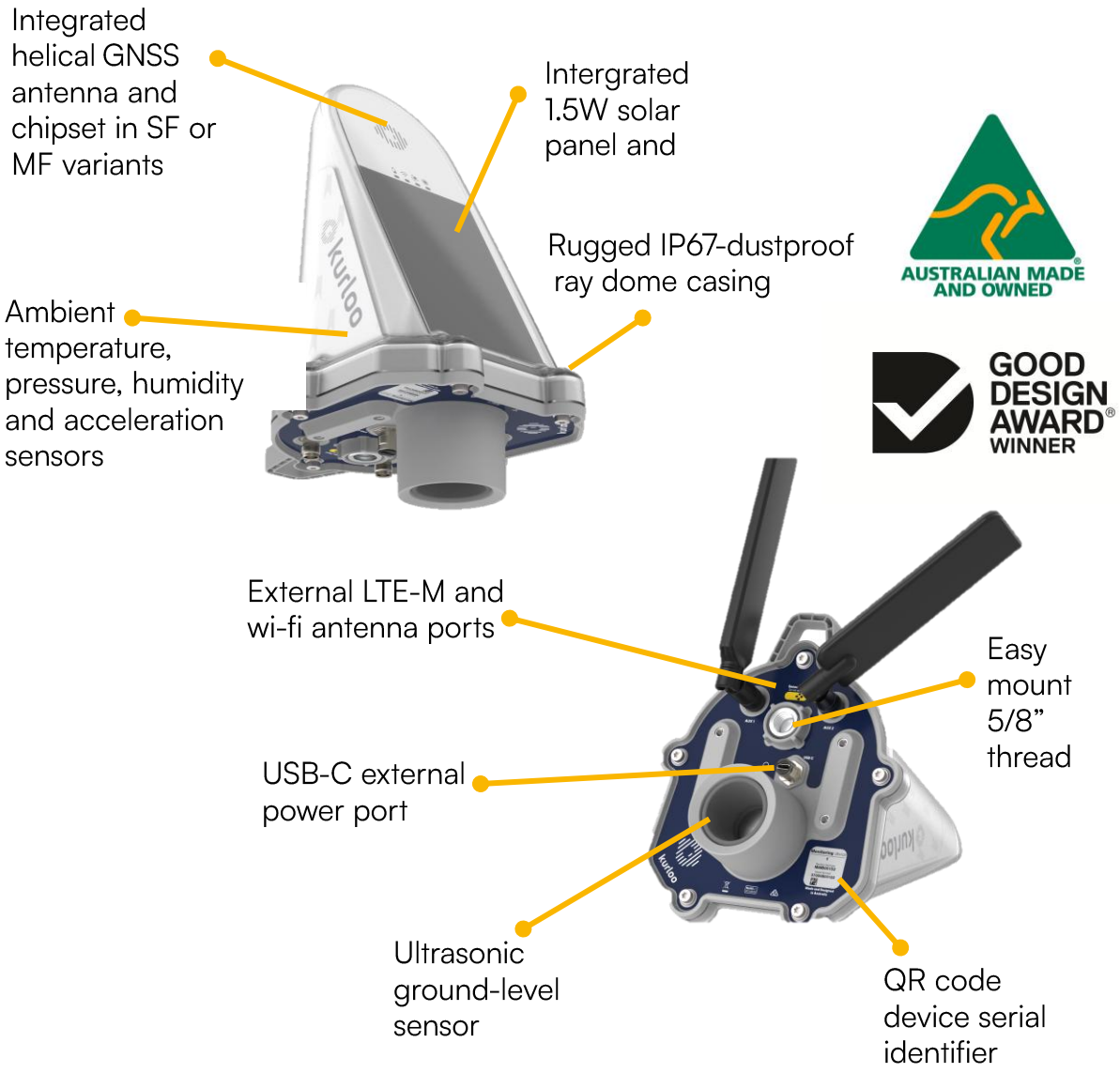
- All data is transferred via LTE-M Modem or Wi-Fi access point to the cloud, where it is automatically securely stored in the cloud for post processing.
- Custom designed GNSS post processing algorithms hosted in the Amazon Web Service (AWS) autonomously resolve signals into mm positioning of the device on site.
- Kurloo processing procedures takes just a few minutes to store and report results to the Kurloo Nest.

3. Web-based reporting via the ‘Kurloo Nest’

- The precise location of each Kurloo is then autonomously compared to the previous location reading to derive a highly accurate relative spatial displacement for every device location.
- Results are then simply displayed in the Kurloo 'Nest' where you can examine all historical data, set alerts and perform analysis. Users can tailor their own result at any time.
- Simple and easily integrate data and share results with users of any level.

Kurloo Device Features.

Kurloo's patented device is compact and packed with intelligent sensors that autonomously collects data from the field.



- Australian made IP67 ruggedised integrated compact design (169mm x 207mm x 272 mm and weighing just 1325g.)
- Integrated 1.5W solar panel with rechargeable 46Ah lithium iron battery (up to 21 days without charge)
- Ideally suited to open environments with a clear sky view.
- LTE-M or wi-fi* communications (*additional gateway required for wi-fi).
- Multiple integrated sensors that quickly alert to any device or environmental changes.

What a managed GNSS service gives the LSGCD

1	**Continuous capture**	Autonomous, solar powered devices measuring every day. Each logs on board and backfills when communications return, so an outage never becomes a gap.
2	**Validated daily**	Results reviewed by geodetic specialists and delivered within minutes of capture, with alerts if movement departs from trend.
3	**District-owned**	The data record belongs to the District. Every raw observation is preserved and exportable, compatible with public records obligations.
4	**Frame and epoch**	Positions referenced to the national reference frame through CORS, with the frame and epoch stated on every result.
5	**No site visits**	After installation, nobody needs to return to the stations. No access arrangements, scheduling, or crews travelling between sites.

GOOD DESIGN AWARD® WINNER

AUSTRALIAN MADE AND OWNED

Small-form geodetic-grade GNSS receiver

Not all GNSS monitoring is equal

Every GNSS device reports a position to three decimal places.
The Kurloo System design determines whether that position is true, or just precise.

Calibrated GNSS antenna

Antenna calibrated to the international IGS ANTEX standard. An uncalibrated antenna carries phase centre error that concentrates in the vertical component, which for subsidence is the entire measurement.

Referenced outside the site

Positions are referenced to the national reference frame through continuously operating reference stations (CORS), external to the site, rather than to a benchmark that may itself be subsiding.

Raw observations retained

Every observation is retained in RINEX format. Any reading can be reprocessed and independently verified, years afterwards.

A managed service, for greater reliability and consistency

Processing is configured to pre-existing site conditions: reference stations, elevation masks, session length and multipath error handling. Results are validated by geodetic experts before they are released.

Kurloo is committed to working with the District

1	**Data Ownership**	The District owns its data record, both raw and processed, with the right to release it.
2	**Data security**	Kurloo can host the District's data in the United States, with continuity of service included the contract.
3	**Data Access**	We'll collaborate with allied agencies in your district to preserve and enhance current workflows.
4	**Comparable numbers**	Results stated against the same reference network the regional record uses, so they can be compared directly

Proposed next steps

1. Internal discussion and approval for a commercial trial of 6 sites
2. Integration with existing systems
3. Look for staged capital investment over the next 2-3 years to move to GNSS autonomous monitoring .

Questions welcome.

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