GROUNDWATER SA
WATER SOLUTIONS FOR A SUSTAINABLE TOMORROW

CLIENT GUIDE / PQWT-S500

A clearer basis for borehole siting

Multi-point grid surveys and intersecting geological profiles

Groundwater SA uses surface geophysical measurements to investigate changes below ground and identify locations that merit further investigation for borehole drilling. This guide explains a proposed PQWT-S500 grid-survey workflow and how the evidence is interpreted.

Instead of relying on a single reading, the survey collects a sequence of measurements along several planned lines. Additional lines cross the initial profiles, allowing an anomaly to be checked from another direction and compared with the surrounding ground.

MEASURE / COMPARE / INTERPRET

1. Measure electrical responses at mapped surface stations.
2. Compare repeat readings, neighbouring lines and crossing lines.
3. Interpret the patterns alongside geology and nearby borehole evidence.
4. Rank potential drilling targets and explain remaining uncertainty.

What the survey is intended to achieve

A defensible recommendation for a possible drilling position, supported by a survey layout, electrical-response profiles and a geological explanation. Where justified, an indicative target-depth interval can be discussed, with the assumptions and uncertainty clearly stated.

What confirms a usable groundwater supply

Drilling establishes the actual formations and water strikes. Pumping and recovery tests assess borehole performance; laboratory testing assesses water quality. A surface survey alone cannot certify water availability, litres per hour, sustainable yield or potability.

About this guide: All diagrams are conceptual teaching illustrations. No measurements from your property are presented, and no site-specific drilling recommendation is implied.

The science behind the measurement

Electrical contrasts provide clues about subsurface conditions

What the PQWT-S500 records [1, 2]

The manufacturer describes a passive, frequency-selective natural electric-field method. Two ground-contact electrodes, M and N, sense a potential difference at selected frequencies. The recorded response is expressed in millivolts (mV); the instrument produces curves and processed profile displays.

These readings are not a direct measurement of water volume, flow rate or rock type. A voltage in mV must not be relabelled as formation resistivity in ohm-metres without a justified measurement and modelling procedure.

The basic measurement relationship

Approximate electric field along the dipole: E = voltage difference / L

L is the distance between the electrodes. The measurement samples an electrical response influenced by a volume of ground, rather than a narrow vertical column.

Why geology and groundwater affect electrical response [3, 4]

Dissolved ions allow groundwater to conduct electricity. Rock porosity, water saturation, fracture connectivity, clay and conductive minerals all influence the bulk electrical behaviour. Water-filled fractures or weathered zones may therefore contrast with surrounding competent rock.

However, clay-rich ground, saline water or mineralisation can also create conductive contrasts. A conductive feature may contain little extractable fresh water. Electrical conductivity and hydraulic productivity are different properties.

Frequency and depth: a cautious interpretation [5]

In electromagnetic methods, lower frequencies generally have broader and deeper sensitivity, but the relationship also depends on ground conductivity and structure. Each frequency responds to a range of depths; it does not sample one exact layer.

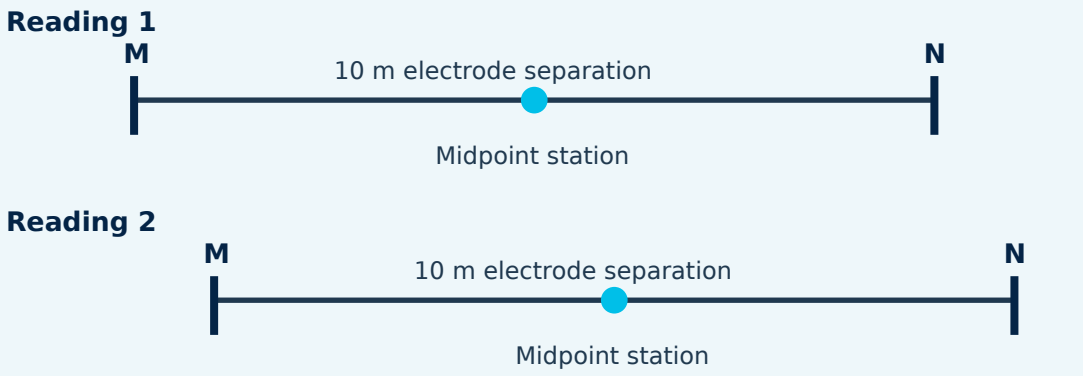
The S500 designation and its nominal 500 m range are manufacturer specifications, not proof of useful investigation depth at every site. A depth scale on an automatic profile is an interpretation aid. It is not an independently verified water-strike depth.

This electric-field-only survey should not be presented as a full magnetotelluric resistivity inversion or conventional injected-current electrical resistivity tomography (ERT).

How a measurement point is collected

The electrode separation and the station interval are different distances

The PQWT manual gives an example with 10 m electrode separation and 1 m station advance, with each reading assigned to the midpoint. Both electrodes move together, maintaining their separation. The spacing and relevant settings remain consistent within a line. Confirm the procedure against the supplied instrument version. [1]



Illustrative positions: M 0 / N 10 / midpoint 5 m Next: M 1 / N 11 / midpoint 6 m

Field procedure for each line

1. Set out: Record a line ID, direction, endpoints and station chainages. Use tape measurements for relative positioning and record GPS coordinates and their accuracy.

2. Prepare: Inspect leads and electrodes, perform the appropriate equipment checks, and establish consistent ground contact. Note dry ground, wet patches and any contact treatment.

3. Acquire: Collect the selected frequency sequence at each station. Keep the electrode orientation, separation and acquisition settings consistent and record any unavoidable changes.

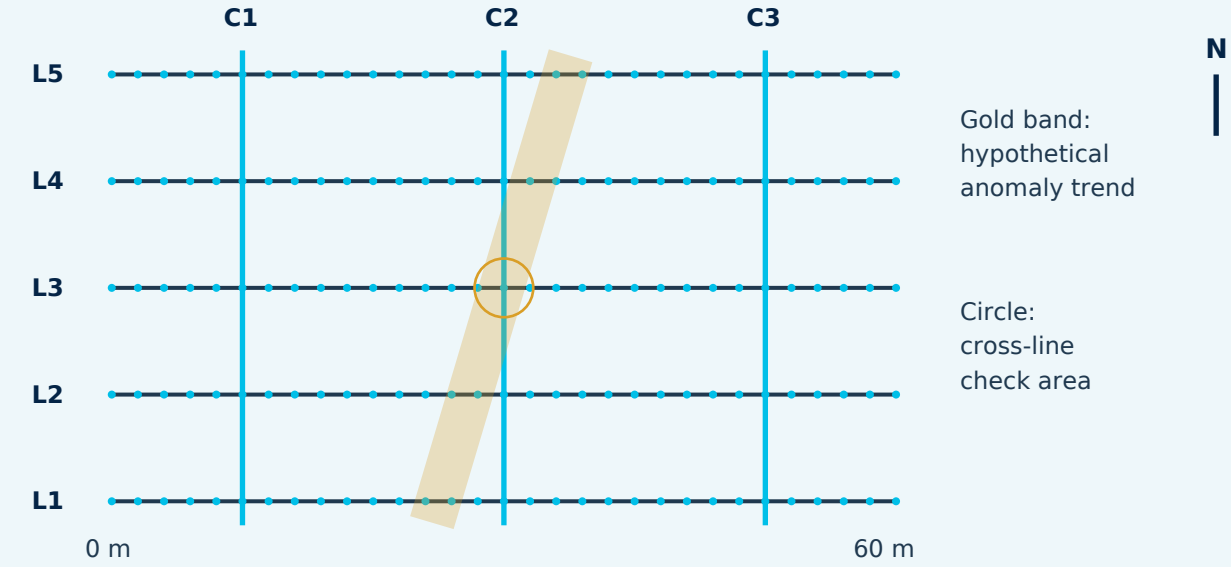
4. Verify: Reoccupy representative background stations and suspected anomalies. Preserve original and repeat readings; investigate unstable results before interpretation.

Resolution note: A 1 m station interval does not mean 1 m subsurface resolution. Adjacent readings overlap in their ground sensitivity. The midpoint is a mapping convention, not the centre of a precisely isolated underground sample.

A grid checks the ground in two directions

Example layout only - actual coverage is designed for the property

Parallel primary lines establish whether an anomaly continues across the site. Cross-lines test its position and extent from a different direction. Lines should cross the expected geological trend where practical; closer infill lines investigate shortlisted areas.



Dots show selected stations only; full example uses 1 m spacing.

Illustrative coverage and measurement count

For a 60 m x 40 m station grid: five 60 m primary lines at 10 m line spacing and three 40 m cross-lines at x = 10, 30 and 50 m. With 1 m station intervals and both endpoints included, this gives 5 x 61 + 3 x 41 = **428 station readings**, before repeats or infill.

A crossing station is measured again with the dipole turned along the cross-line. Its response can differ with orientation, so identical mV values are not required. The interpreter checks spatial agreement, repeatability and geological plausibility.

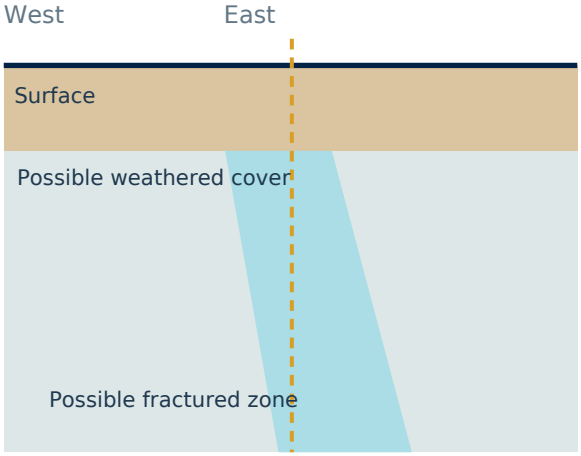
Access allowance: A centred 10 m dipole needs 5 m beyond each end of a station line. The plan must allow this space or shorten the usable station range. These dimensions are an example, not a fixed service package or universal survey specification.

How crossing profiles are interpreted

Two views of the same candidate zone - not a photograph of an aquifer

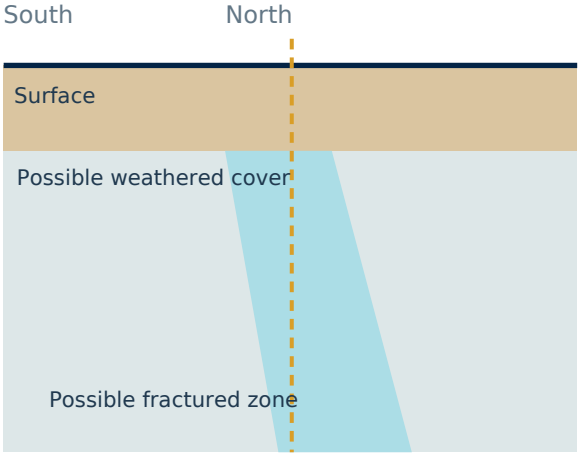
Each survey line produces a profile showing response variation along that line. The interpreter examines the original curves and processed display together, then compares the position of features at line intersections. The illustrations below show only a conceptual geological hypothesis.

Primary line L3



Conceptual depth - not to scale

Cross-line C2



Conceptual depth - not to scale

Dashed gold lines identify the same plan location at the L3/C2 intersection. Blue shading represents a hypothesis to test; it is not measured water or a calibrated PQWT colour legend.

What supports a stronger target?

A repeatable feature that extends across neighbouring lines, has a compatible position on a cross-line and fits a plausible geological structure deserves more attention than a single isolated low reading. Check for an alternative explanation such as a buried service, clay band or electrical noise.

What the colour display means

Read the units, legend and processing settings. Colours show electrical response, not litres of water. Automatic rescaling can change appearances between lines; use comparable scales only where acquisition and processing permit.

Interpretation limit: Several 2D profiles provide spatial checks, but do not automatically form a validated 3D aquifer model. Apparent feature widths, boundaries and depth intervals remain uncertain. No universal rule says that blue, a low value or an intersecting anomaly proves groundwater.

From field evidence to a drilling decision

Quality control and a transparent recommendation

Before and during the survey

Review available geology, terrain, drainage, nearby borehole records and the client's water requirement. Map buildings, fences, power lines, buried services and possible contamination sources. Agree access and line coverage before measurements begin.

Record timestamps, station positions, instrument settings, weather, soil contact conditions and disturbances. Assess interference from pumps, electrical infrastructure and metalwork; avoid affected ground where possible. Suspend work during lightning and follow equipment safety instructions.

Include repeat background and target measurements, and repeat or offset suspect lines. Review raw data before accepting a profile. If poor repeatability or interference persists, qualify or reject the affected interpretation rather than forcing a drilling target.

Suggested target-ranking framework

Higher relative confidence

Repeatable, supported on adjacent and crossing lines, and consistent with site geology.

Moderate relative confidence

A plausible repeatable anomaly, but limited coverage or unresolved geological alternatives.

Low confidence / defer

Isolated, inconsistent or interference-prone response; additional investigation required.

These categories compare evidence within a survey. They are not numerical probabilities of drilling success and do not guarantee a productive borehole.

When additional investigation is appropriate

If the site is electrically noisy, geologically complex or the cost of a failed borehole is high, consider independent hydrogeological review and complementary methods such as properly designed ERT or other suitable geophysics. The choice depends on the geological question, access and expected target depth.

What the client should receive

A documented target recommendation and the next verification steps

Recommended survey report contents

Site and coverage: Location, survey date, objectives, line/station map, coordinates, coordinate reference system, positioning accuracy and any unsurveyed areas.
Method and quality: Instrument model, acquisition mode, electrode and station spacing, line spacing, settings, repeat checks, noise sources and exclusions.
Evidence and interpretation: Labelled curves and profiles with units, scales and orientation; anomaly locations; geological alternatives; and confidence reasoning.
Recommendation: Ranked target coordinates, access constraints and, only where supported, an indicative depth interval with its basis and uncertainty. State explicitly if no defensible target was identified.

After the target is selected

Confirm drilling access and service clearance, then record drilled formations, water strikes and borehole construction. Use pumping and recovery testing to assess performance and inform abstraction planning. Obtain water-quality analysis before selecting treatment or declaring suitability for a particular use.

Discuss your property with Groundwater SA

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Technical references and scope

[1] PQWT, Operation Manual for PQWT-S150/S300/S500, pp. 4-6 and 17-19. Measurement principle, wiring and cross/grid layouts.

[2] PQWT, S150/300/500 product description. Manufacturer description of natural-field frequency-selective measurement.

[3] US EPA, Electrical Methods. Electrical properties and the effects of saturation, composition and salinity.

[4] US EPA, Electrical Conductivity and Resistivity. Groundwater ions, clay and bulk electrical response.

[5] Geoscience Australia, Magnetotellurics. General frequency/depth principles; not validation of PQWT depth accuracy.

Sources accessed 30 October 2026. This educational methodology is not a completed site investigation. The example grid, quality checks and ranking framework are proposed survey-design guidance; no independent S500 success-rate or depth-accuracy validation is claimed.