QuaternaryInfo

Quaternary catchment dashboard – in-browser app • Hydrogeological Repository

What it does

QuaternaryInfo puts everything the national datasets hold for a quaternary catchment on one page. Pick catchments on a map or from a list and it charts **90 years of naturalised monthly flow and rainfall**, **50 years of daily climate**, the WR2012 hydrology and baseflow figures, all 43 GRAII groundwater parameters and the 2022 census population – for up to six catchments at once, so they can be compared rather than looked up one at a time.

The quaternary catchment is the smallest unit the national water resource studies report on. South Africa has 1 946 of them, and the numbers describing each are scattered across a spreadsheet study, an Access database, a shapefile and 1 946 daily text files. This app joins them on the catchment code and puts them behind one selection.

Where the data comes from

Four sources, joined on the quaternary catchment code. **WR2012** is the surface water study; **GRAII** is the groundwater assessment.

Source	Covers	Period	What it holds
WR2012 – surface water	1 946	1920–2009	Hydrology, baseflow and groundwater use, naturalised monthly flow and monthly rainfall – the datasets listed below.
GRAII – groundwater	1 945	–	43 parameters over five projects, each a national 1 km grid reduced to one value per catchment – listed below.
Hydroclimatic Data	1 946	1950–1999	Daily rainfall, temperature, soil water stores and deficits, runoff, humidity, radiation and reference evaporation – 35.5 million records.
Census	1 946	2022	Population within the catchment.

The map also carries the national river network – 10 178 reaches, classed perennial, non-perennial, dry or unclassified, and named where the source names them. It is drawn for context only; nothing in the app is derived from it.

WR2012 is the *Water Resources of South Africa 2012* study, at waterresourceswr2012.co.za. **GRAII** is the *Groundwater Resources Assessment Phase II*, at www.dws.gov.za/groundwater/GRAII.aspx. The app reports these datasets and does not modify or reinterpret them.

The WR2012 datasets

Dataset	Covers	Period	What it holds
Hydrology	1 946	–	Evaporation and rainfall zone, MAE, MAR, MAP, and recharge as a percentage of rainfall.
Baseflow	1 921	–	Pitman, Hughes and Schultz baseflow estimates, and groundwater use.
Naturalised flow	1 944	1920–2009	Monthly naturalised streamflow in million m^3, October to September.
Rainfall	470 zones	1920–2009	Monthly rainfall as a percentage of the zone's mean annual precipitation.

The GRAII datasets

GRAII ran as five projects. Each produced national 1 km grids, and the app carries every one of them: the value shown for a catchment is the mean of the grid cells inside it. The project reports supplied with the grids describe how each parameter was derived and are the definitive reference for all of them.

Project	Subject	Parameters carried
1	Groundwater quantification	Depth to and thickness of the weathered and fractured zones, storativity, transmissivity, groundwater level, and groundwater stored – in total, in the upper 5 m, and above the water-level limit (18 parameters).
2	Resource and exploitation potential	Drought index, exploitability and potability factors, and the six potential levels – AGRP, AGEP, PGEP, UGRP, UGEP and UPGEP – each for a normal and a drought year (16 parameters).
3	Recharge, and groundwater–surface water interaction	Mean annual recharge in mm/a and as a percentage of rainfall, recharge in a normal and a drought year, baseflow, and groundwater and rainfall chloride (7 parameters).
4	Groundwater level change	Change in groundwater level (1 parameter).
5	Groundwater use	Groundwater use (1 parameter).

The potential levels build on one another: AGRP is the Average Groundwater Resource Potential, AGEP the Average Groundwater Exploitation Potential, PGEP the Potable Groundwater Exploitation Potential, UGRP the Utilisable Groundwater Resource Potential, UGEP the Utilisable Groundwater Exploitation Potential, and UPGEP the Utilisable Potable Groundwater Exploitation Potential. Transmissivity is the one parameter that comes from the GRAII database rather than a grid – 1.46 million points on the same 1 km lattice, summarised the same way.

Volumes are per 1 km cell. Storage, the potential levels and groundwater use are quantities per grid cell, so a catchment total is the value shown multiplied by the cell count, which the app reports alongside them. This was checked rather than assumed: the storage grids sum to 234 km³ nationally, GRAII's published figure for South Africa's groundwater storage.

Two conversions the numbers depend on

The rainfall table is a percentage, not a depth. Each monthly value in the WR2012 rainfall file is that month's rainfall as a percentage of the rainfall zone's mean annual precipitation. The app converts it as **mm = percent ÷ 100 × MAP**, using the catchment's own MAP, which is why two catchments in the same rainfall zone share a seasonal pattern but differ in magnitude. Read straight out of the table the values are percentages and are not comparable with anything measured in millimetres.

Flow and rainfall run October to September. Both tables are indexed by hydrological year, so the year labelled 1920 covers October 1920 to September 1921. The daily climate record is calendar-based and is carried onto the same hydrological year here, so a runoff series and a rainfall series line up on one axis. Monthly averages are shown in that order too, October first.

What you get

Output	Detail
Map	All 1 946 catchments with labels, shaded by MAP, MAR, transmissivity or population, over the river network, on a street, aerial or hybrid base map. Perennial rivers are solid, the rest dashed. Click to select; Ctrl+click to add; click again to remove.
Attributes	Every single-value property of the selection – WR2012, all 43 GRAII parameters grouped by project, and the census – one column per catchment.
Time series	Any of sixteen quantities, annual or monthly, optionally as a cumulative departure from the mean.
Monthly averages	The long-term mean of each calendar month – the seasonal signature of the catchment.
Statistics	Mean, median, standard deviation, coefficient of variation, and the 10th to 90th percentiles of the annual series, with a box plot.
Exports	CSV of the attributes, flow, rainfall, monthly or daily climate, the chart on screen or the monthly averages; PNG of the map and of every chart; and a printable report.

How a run works

Step	What happens
1. Catchments	Select on the map or from the searchable list, up to six at a time.
2. Attributes	The WR2012 and GRAII properties, side by side.
3. Time series	Choose the quantity, the interval, and whether to plot the cumulative departure.
4. Monthly averages	The seasonal pattern, month by month.
5. Statistics	Summary statistics of the annual series, and their distribution.
6. Report	A standalone report of the selection, ready to print or save as PDF.
7. Export	CSV of any part of the selection.

Why this one is not entirely in your browser

The other apps in this collection download their dataset and compute everything on your machine. This one cannot: the database behind it is 2.2 GB, most of it the 35.5 million daily climate records. The catchment boundaries are downloaded once (0.7 MB) and the map, the charts and the statistics are all drawn in the browser, but the numbers for a selection are queried from the server as you select. Nothing about your selection is stored.

Reducing a grid to one number per catchment

Every GRAII parameter is national and gridded, so each has to be reduced to a single value for a catchment. That value is the **mean of the 1 km cells falling inside the catchment** – between about 55 and 20 000 of them, and the app reports the cell count so the basis is visible.

Four parameters are not averaged that way. Transmissivity, the two storativities and the two chlorides span orders of magnitude and are log-normally distributed – transmissivity's national arithmetic mean is 28.3 m²/d against a median of 19.7 – so those carry the **geometric mean**, which is the conventional representative value. The database records which statistic each parameter uses, and the app shows it when a row is hovered.

Limitations worth knowing

- These are modelled national datasets, not measurements at a point. Naturalised flow is what the catchment would have yielded without dams, abstraction or afforestation – it is not gauged flow and it is not what the river does today.
- The rainfall series is a zone average scaled to a catchment MAP, so every catchment in a rainfall zone has the same year-to-year pattern. The 470 zones cover 1 946 catchments.
- Every GRAII parameter is a regional interpolation averaged over the catchment. They are the right starting point for a regional assessment and the wrong basis for siting a borehole.
- The records do not overlap fully. Flow and rainfall run 1920–2009, the hydroclimatic record 1950–1999, and the census is a single 2022 snapshot, so a statistic from one is not a like-for-like comparison with another.
- A few catchments are reported jointly in WR2012 – B20A and B20B, for instance, share one set of figures – and a handful have no naturalised flow at all in the arid interior. The app shows what the source holds and leaves the gaps empty rather than filling them.
- Six catchments is the limit for one selection. More makes the charts unreadable before it makes them slow.
- The Map (OpenStreetMap) base map may be dropped from an exported PNG by the browser. Aerial and Hybrid export cleanly.

Checked against the sources. Every WR2012 value was compared cell by cell with the source workbook, the monthly climate summaries reproduce the daily record exactly (35 537 852 days, identical totals), and the mean annual flow of a catchment matches its published MAR. The rainfall percentage conversion was verified against MAP across all 470 zones and 90 years.

Credit

The data is the work of the WR2012 study team, of the Groundwater Resources Assessment Phase II, and of the compilers of the hydroclimatic record. This app presents their published datasets and claims no authorship of them.

Beta. QuaternaryInfo is published for evaluation and feedback. Check any figure you rely on against the original study before using it in an assessment.