Addressing the limitations of federated groundwater bore data

(another challenge for the 21st Century)

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eResearch challenges

- **Ubiquitous high-speed broadband** being rolled out.
- **The Petabyte Age**… >50% of the world’s data is being collected each year – how do we utilise it?.
- **Open data policies**… raw data is more accessible, but how to interpret it?.
- **Mobile technologies**… everyone is spatially enabled and spatially aware – we want to know about here and now.
- **3d visualisation technology** is more commonplace than ever before - television, cinema, printers…
The 21st Century Context

eResearch questions:

• How do we provide access to big and complex data in a way that people can use easily... but without biasing the data?

• How do we incorporate qualitative data with quantitative data into models to improve accuracy?

• How can we harness Citizen Science and use crowd-sourced data to improve our hydrogeologic science?

• Can we use digital technologies to ensure that we don’t keep repeating the same science?
A collaboration of 17 partner organisations

An interoperative spatial information portal that federates groundwater data from disparate sources.

Primarily for research and investigation.

Non-government portal (unique?).
The 2013 iAWARDS
Victoria Award Winner

Project benchmarking
Please take some time to complete the online benchmarking survey.
Mobile version

✓ Data on the nearest bores

✓ Sink a virtual borehole

✓ Interrogate the groundwater systems under foot
Bore data from four different databases + springs

Examples include elevations, waterlevels, heads, gradients, aquifer parameters, bore construction measurements, chemistry, isotopes, pumping data and extraction volumes.

Time-series monitoring data is particularly useful to understand the dynamic behaviour of groundwater systems.
Numeric surfaces (grids) generated from quantitative data

Predictions of aquifer top, bottom and thickness

e.g. surface elevation + basalt thickness
Bores link to original data source where possible.

Archival boring records are particularly important sources of information.
But what about the qualitative data?

Data often overlooked by scientists (hydrogeologists), but it can be critically important.

Examples include observations about landscape features, soil colours, vegetation types, seeps, springs, wetland ecosystems, and anecdotal information from long-term occupiers of the land.

Redoximorphic features in saprolite, Dundas Tableland, Vic
Access to rare spatial data (e.g. Ballarat Water Board maps from 1870)
Even ephemera can be valuable.
So what constitutes groundwater data?

- Geology
  - Lithology
  - Stratigraphy
  - Hydrostratigraphy
  - Aquifers
  - Aquifer parameters

- Flow systems
- Age (dating)

- Geomorphology
  - Terrain
  - Landscape

- Climate
  - Rainfall
  - Runoff
  - Infiltration
  - Recharge

- Environmental History
  - Land use
  - Soils
  - Salinity

- Discharge
  - Springs
  - GDEs
  - Baseflow
  - River flows
  - Lake levels

- Hydrobiology
  - Phreatophytes
  - Stygofauna
  - Microbiology

- Chemistry
- Contamination

- Geophysics

- Management
  - Beneficial uses
  - Licences

- Risk
3D visualisation of Victoria’s groundwater systems on demand uses pre-modelled surfaces...
Will modelling on-the-fly ever be possible?

Combining technologies with QUT – dynamic 3D visualisations in a browser
The 21\textsuperscript{st} Century Groundwater Research Challenge

How to take advantage of the 21\textsuperscript{st} Century New Digital Age

- Interoperability
- Big data
- Legacy data
- Crowdsourced data

To answer the frequently asked hydrogeological questions?
To dynamically generate conceptual and predictive models?
To make new discoveries and avoid Zombie Science?