

Federating hydrogeological data to visualise Victoria's groundwater



Peter Dahlhaus
Andrew MacLeod
Helen Thompson

Visualising Victoria's Groundwater project

Use high-speed broadband to:

- ✓ Distribute groundwater bore data
- ✓ Visualise groundwater data
- ✓ Model groundwater systems on-the-fly

A collaboration of 13 partner organisations



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Canada



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*An interoperative web-GIS
that federates groundwater
data from disparate sources
to assist water managers
make the correct choices for
the sustainable use of a
precious resource*

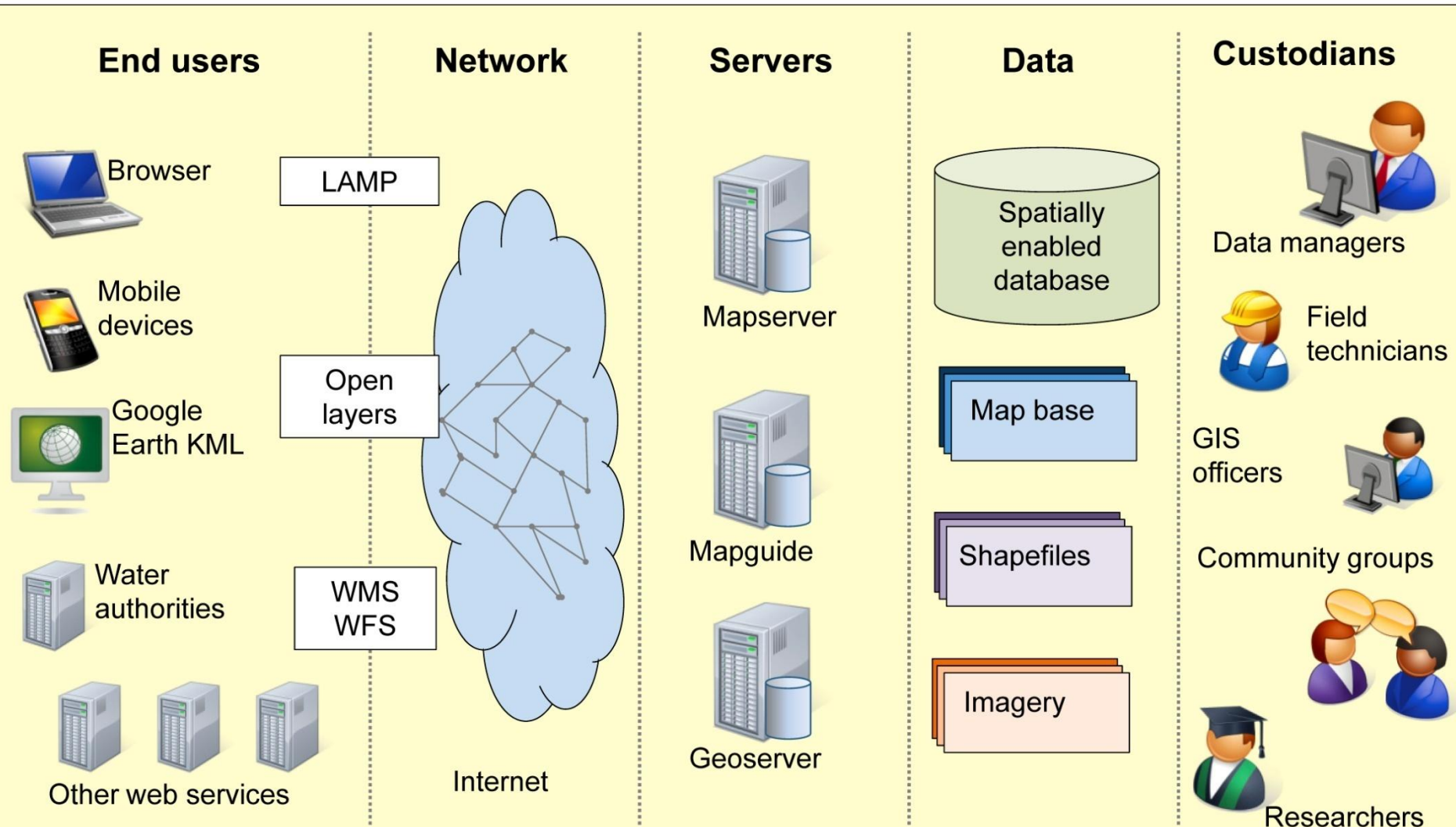
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Design Principles

- ✓ Data resides with the data managers
- ✓ Intuitive to use (e.g. Google Earth)
- ✓ Include vector & raster data
- ✓ Allow data downloads (subject to data manager's consent)
- ✓ Link spatial data to original documents and images
- ✓ Link spatial data to real time data (data loggers, webcams)
- ✓ Capable of generating models on the fly
- ✓ Allow users to add, edit or update data (subject to QA/QC)
- ✓ Spatial data and models should be credible to the user

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System architecture



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Interoperability is based on the Open Geospatial Consortium (OGC) standards for Geography Markup Language (GML), specifically **GroundwaterML**

http://ngwd-bdnes.cits.rncan.gc.ca/service/api_ngwds/en/gwml.html

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GroundWater Markup Language Specification v. 1.0

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Introduction


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This document is a detailed description of GroundWater Markup Language (GWML). GWML is a GML (Geography Markup Language) application to exchange groundwater related information. It is an extension of another GML application - GeoSciML - designed to exchange geoscience (essentially geology) information (Duffy and Sen 2005). Therefore, GWML also borrows from Observation and Measurements (O&M : OGC 07-022r1) and Sampling Features (OGC 07-002r3) specifications. A more detailed list of conformance is given below.



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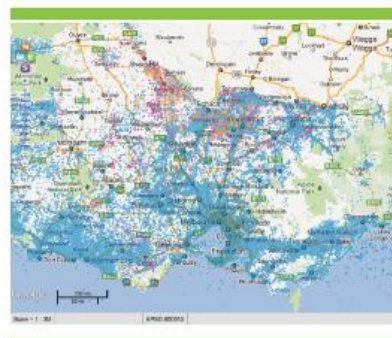
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"Adapting new technologies to sustainably manage a precious resource"

The VVG project will:

- Distribute groundwater bore data
- Visualise groundwater data
- Model groundwater systems on-the-fly
- Utilise high-speed broadband



Project benchmarking

Please take some time to complete our [online benchmarking survey](#)



Project funded by the State
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News

- * Potential collaboration with Queensland University of Technology (QUT)
- * VVG Website Launch
- * [More news >](#)

Project blog

Data quality issues

We have been receiving some feedback on the quality of some data layers (which is to be expected). Users are reminded that data cleaning is something that has been scheduled for the next 18 months ([a...Read here](#))



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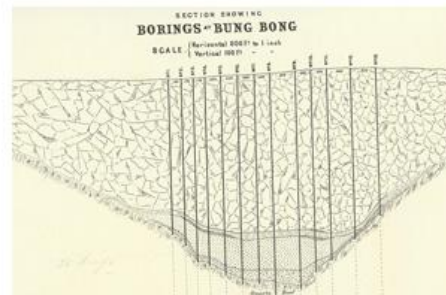
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History of groundwater bore data

Records of drilling by the Victorian Government date back to 1884, with the *Diamond Drills and Water Augers* reports. These were followed by the *Diamond Drills and Other Boring Machinery* reports, *Annual Reports of the Secretary for Mines*, *Annual Reports of the Secretary for Mines and Water*, *Special Reports - Records of Boring Operations*, *Summary of Annual Reports of the Geological Survey Branch and Records of Boring Operations*, *Records of Boring Operations*, *Annual Reports Including Gold and Mineral Statistics and Boring Records*, and the *Boring Records* which ceased after 1965.



Giant Drill working at Coalville



Section showing Borings at Bung Bong

Bore data from 1884 to present day

The first comprehensive groundwater bore database was assembled by the Geological Survey of Victoria (GSV) in the late 1960s, with the introduction of the *Groundwater Act 1969*. Up until the mid 1980s the bore locations were plotted on mapsheets and the individual bore records kept in hardcopy. From the mid 1980s onwards a digital database, compiled from the existing records of all Government bores and private bores, was progressively assembled on mainframe computers. From 1969, a permit to drill groundwater bores was required, and the information captured by the licensing process was added to the database. This included groundwater investigation or observation bores drilled by other government agencies such as the State Rivers and Water Supply Commission (SRWSC) and the Soil Conservation Authority (SCA) and subsequent equivalents, although these agencies also kept their own bore

Data quality issues

Posted on **July 27, 2012**

We have been receiving some feedback on the quality of some data layers (which is to be expected). Users are reminded that data cleaning is something that has been scheduled for the next 18 months (and beyond) and that the data currently shown in the map portal is simply that contained in the current databases.

We are currently exploring ways in which to best handle feedback on data quality as in most cases we do not control or manage the data. The data cleaning and enhancement that will occur over the next 6-18 will be filtered back through the relevant data custodians and hopefully included in the next iteration of their data bases.

To this end we will try to provide a regularly updated summary of the types of issues that users are identifying. We hope that by being as transparent as possible we will improve the quality of feedback and save the users from submitting feedback on issues which have already been flagged.

Posted in [Data quality and enhancement](#) | [Leave a reply](#)

VVG Portal – Map updates

Posted on **July 20, 2012**

We have been receiving some fantastic feedback from stakeholders following Wednesday's meeting and the release of the VVG website. We would like to thank everyone for their participation and contribution on the day. Please keep the feedback coming in.

A few small glitches that we discovered on the day have since been resolved.

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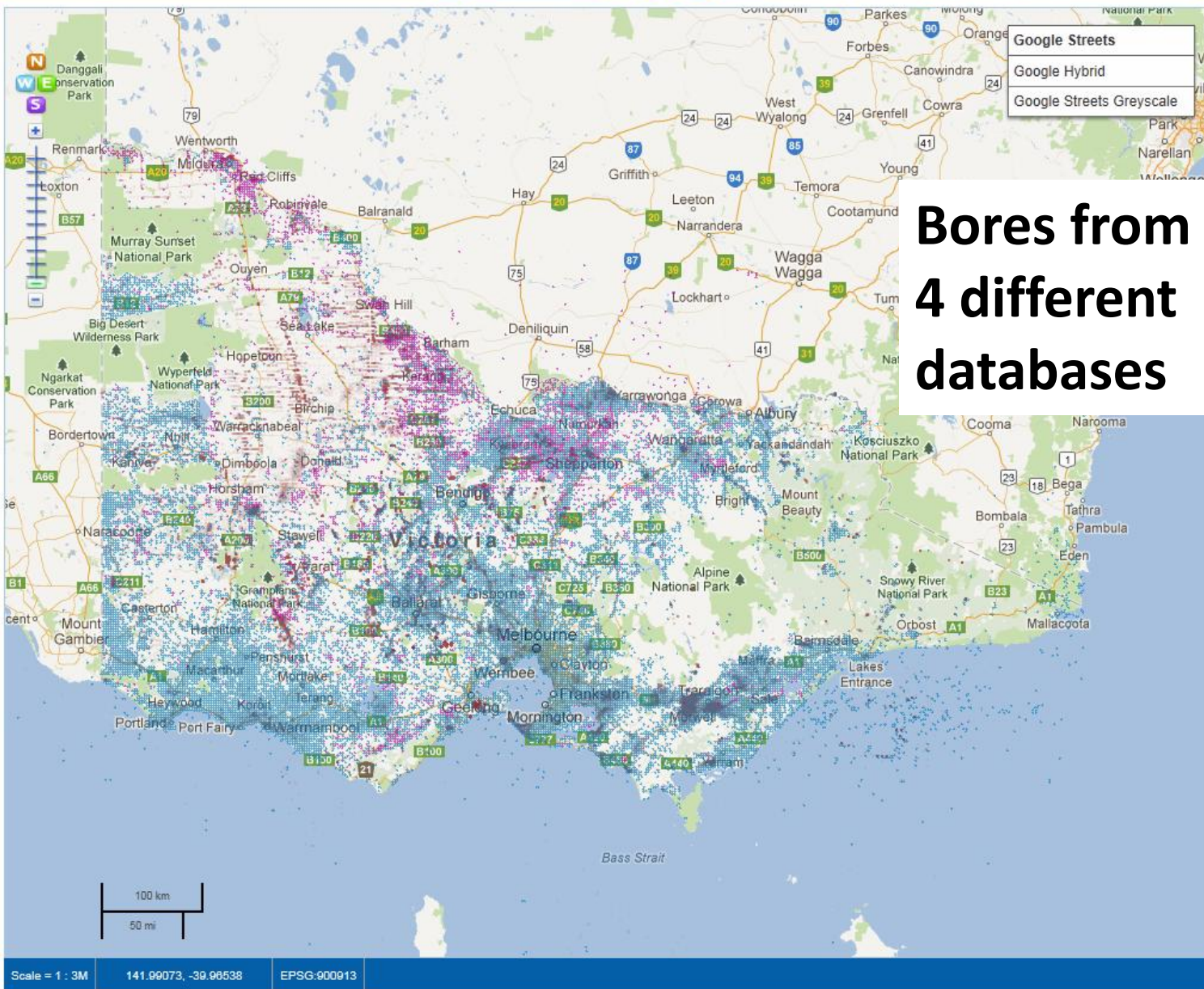
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Bores from 4 different databases

- Google Streets
- Google Hybrid
- Google Streets Greyscale

Layers

- ☐ Elevation of watertable (SRW)
- ☐ Depth to watertable (SRW)
- ☐ Groundwater salinity (SRW)
- ☐ Bore yield (SRW)
- ☐ Elevation of basalt aquifer (DSE)
- ☐ Thickness of basalt aquifer (DSE)
- ☐ Elevation of basement (DSE)
- ☐ Surface elevation (DSE)
- ☒ Bores - DPI GSV GEDIS (minerals)
- ☒ Bores - DSE GMS (groundwater)
- ☒ Bores - UBSpatial (groundwater)
- ☐ Bores - DPI FFSR Salinity
- ☐ Geology (DPI GSV) ⓘ

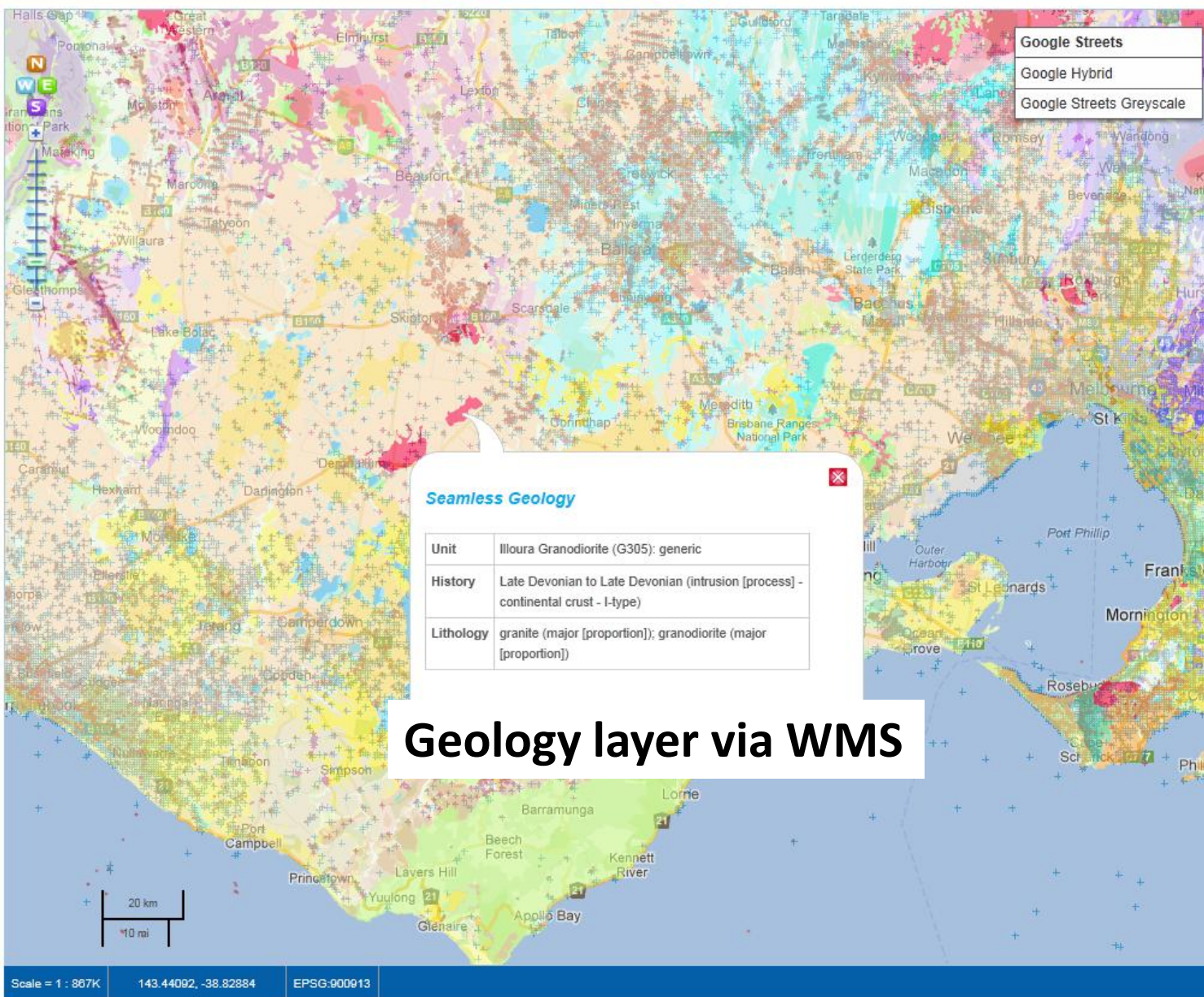
Query mode: Bores

Info Legend Search Tools

Hints & Information

A quick way to zoom in to a specific region is using a **zoom box**. You can create a zoom box by holding the **shift-key** and using your mouse to drag a rectangle over the map.

To perform a query, **single-click** anywhere on the map. By default this will return bores within a 500 metre radius. Use the **query mode** option above to switch between other groups of layers to query.



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Query mode: GSV Geology

[Info](#) [Legend](#) [Search](#) [Tools](#)

Geology Layer *Provided by Geoscience Victoria*

Click on a polygon to query the geology layer. Please Note: Other layers cannot be queried while the Geology layer is active.

Adjust Transparency



Adjust layer transparency

Predictions of aquifer top, bottom and thickness

| Layer | Value |
|--|-------------|
| Surface elevation | 157.14 mAHD |
| Upper Tertiary/Quaternary Basalt (101) thickness | 69.0 m |
| Upper Tertiary/Quaternary Basalt (101) top | 153.50 mAHD |

- Google Streets
- Google Hybrid
- Google Streets Greyscale

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Query mode: DSE statewide aquifers ▼

Info Legend Search Tools

Comment/Share

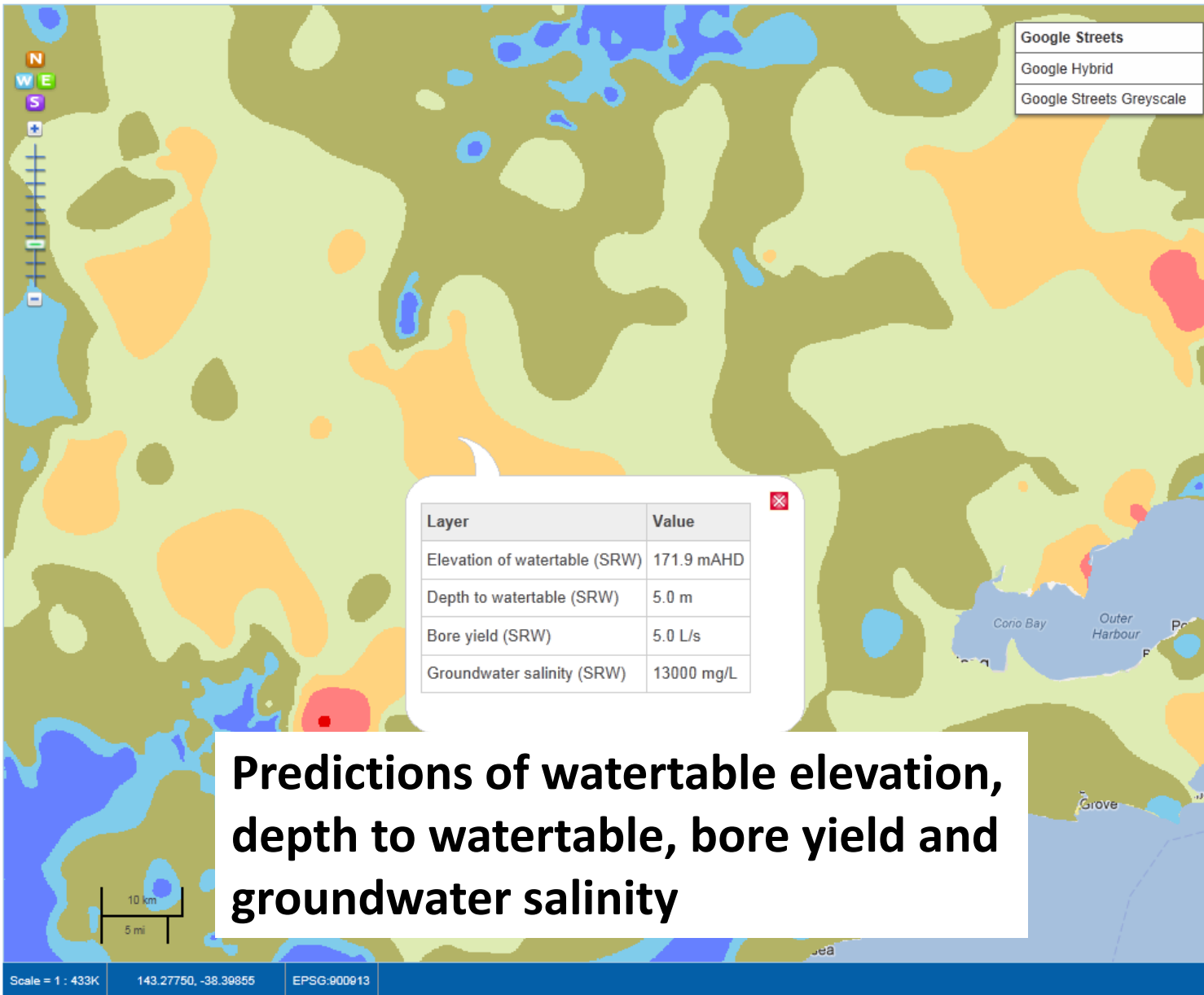
Export

Layer ordering

Drag layers to reorder

- Bores - DSE GMS (groundwater)
- Thickness of basalt aquifer (DSE)
- Surface elevation (DSE)

Layer reordering



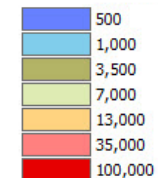
Layers

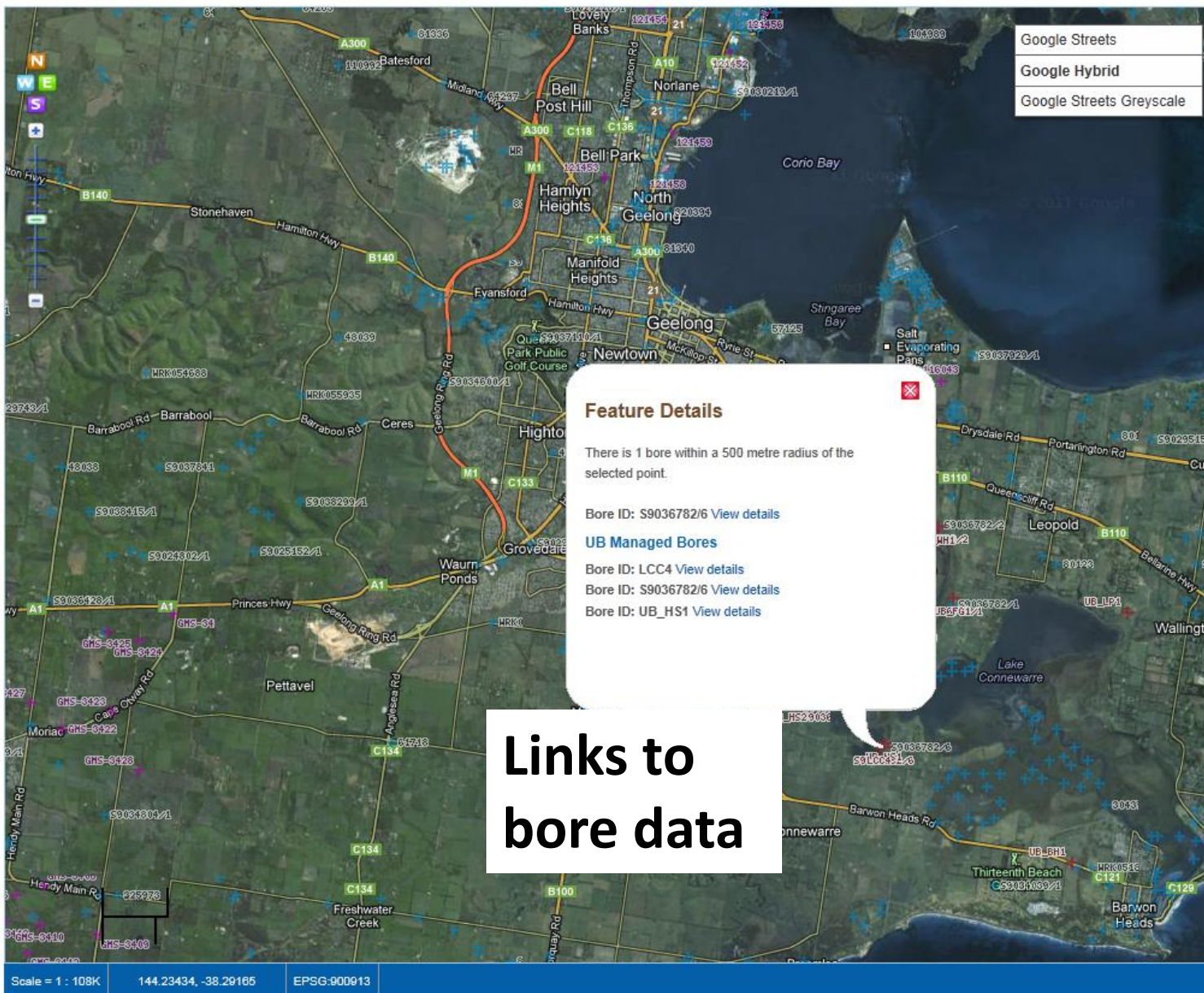
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Query mode: SRW Aquifers

Info Legend Search Tools

SRW Salinity mg/L





Layers

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- ☐ Geology (DPI GSV) ⓘ

Query mode: **Bores**

Info Legend Search Tools

GMS Bores

- + Unmonitored
- + Previously Monitored
- + Monitored
- + UB Bores



Groundwater Monitoring Database

Bore Details: LCC6

[Printable Version](#)

BORE DETAILS | **AQUIFER** | **MONITORING** | **CHEMISTRY** | **LITHOLOGY** | **STRATIGRAPHY**

| Bore ID | | LCC6 | | | |
|----------------------------|-----------------------------|-------------|---------------------------|-----------------|-----------------|
| Datum | Longitude | Latitude | MGA zone | Easting(m) | Northing(m) |
| GDA 1994 | 144.409315 | -38.213338 | 55 | 273187.0 | 5767341.0 |
| Surveyed Elevation (m AHD) | Digitised Elevation (m AHD) | | Location Accuracy | Total Depth | Completion date |
| 0.97 | | | +/- 0.02 | 8.40 | 2006-04-21 |
| Bore Authority | Bore type | Bore use 1 | Bore use 2 | Bore use 3 | |
| University of Ballarat | Groundwater | Observation | Groundwater Investigation | | |
| Monitoring status | Monitoring frequency | Parish | Old Bore ID | Local bore name | |
| Currently monitored | Quarterly | MOOLAP | | | |

Construction Details

| | |
|---------------------------|--------------------------------|
| Driller | South Western Drilling Pty Ltd |
| Drill rig | Geoprobe 6610DT |
| Drilling method | Direct push rig |
| Headworks height(m) | 1.62 |
| Casing/standpipe material | Galvanised steel pipe, locked |
| Collar material | Concrete |

| Casing type | Casing diameter | Casing From depth | Casing To depth |
|-------------|-----------------|-------------------|-----------------|
| PVC | 38.0 mm | | 1.20 m |
| PVC | 38.0 mm | | 1.20 m |

| Screen type | Screen diameter | Screen aperture | Screened from | Screened to | Screened in |
|-------------|-----------------|-----------------|---------------|-------------|---------------------------|
| Slotted PVC | 38 mm | | 1.20 m | 2.70 m | Silt, sand and shell beds |
| Slotted PVC | 38 mm | | 1.20 m | 2.70 m | Silt, sand and shell beds |

| Filter packed from | Filter packed to | Filter pack material |
|--------------------|------------------|----------------------|
| 1.18 m | 2.75 m | 16/30 sand |
| 1.18 m | 2.75 m | 16/30 sand |

Source: A.S. Miner Geotechnical 2006

Bore Attachments/Links



Bore location & construction

Aquifer parameters

Waterlevel monitoring

Groundwater chemistry

Bore lithology

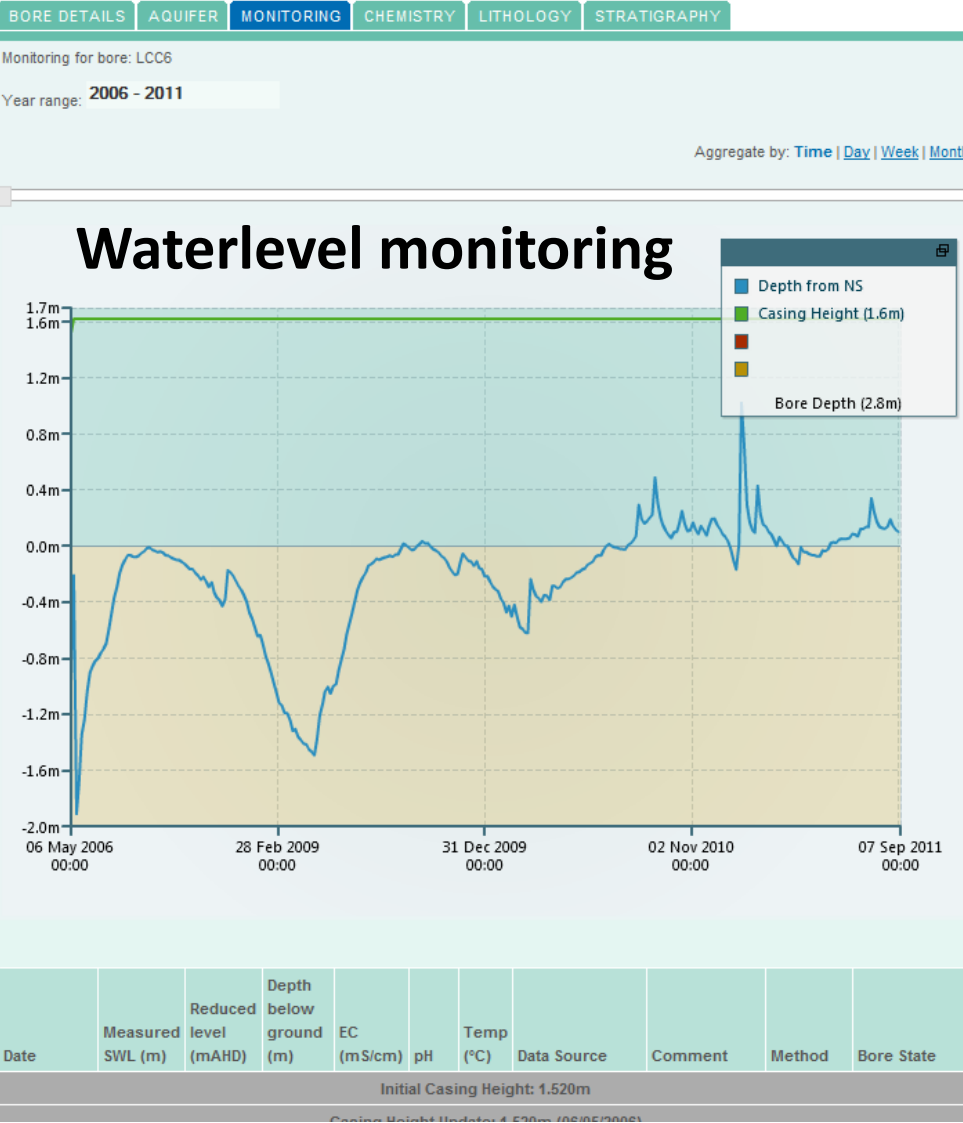
Stratigraphy

Links to:

- ✓ Photos
- ✓ Documents
- ✓ Maps & sections

Bore Details: LCC6

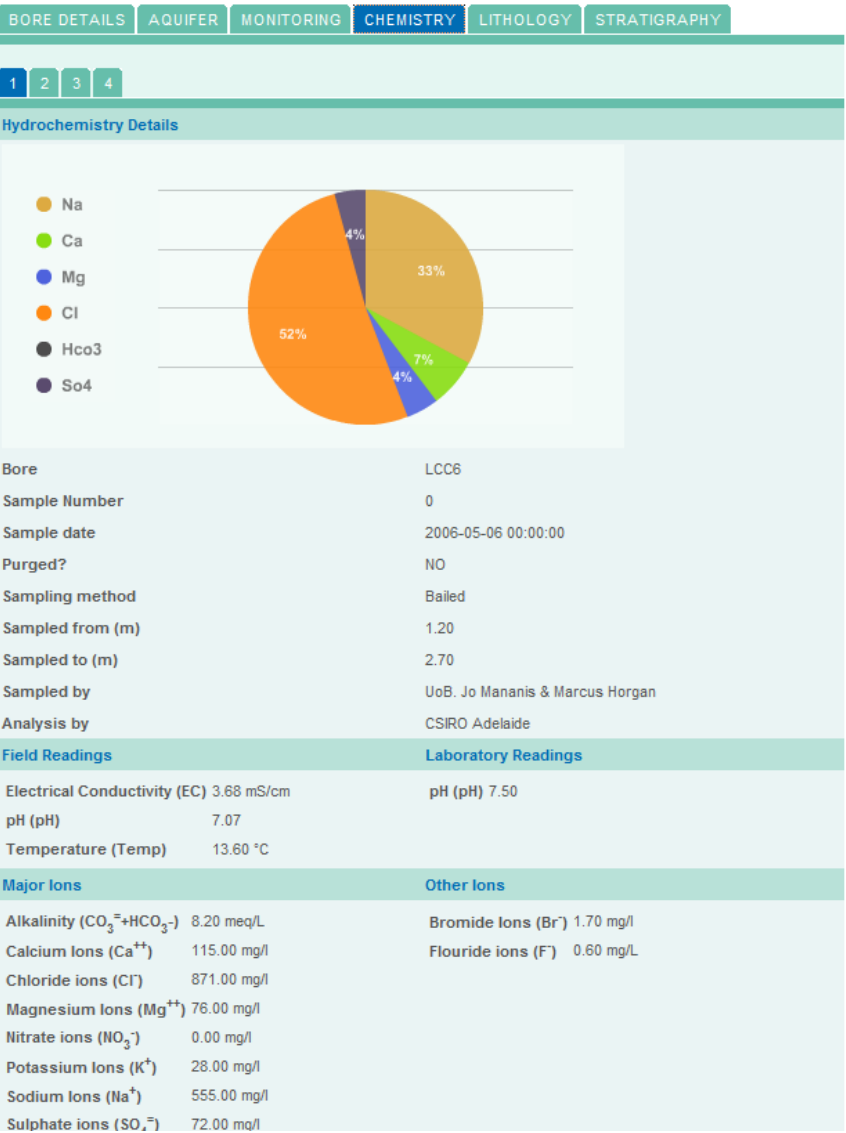
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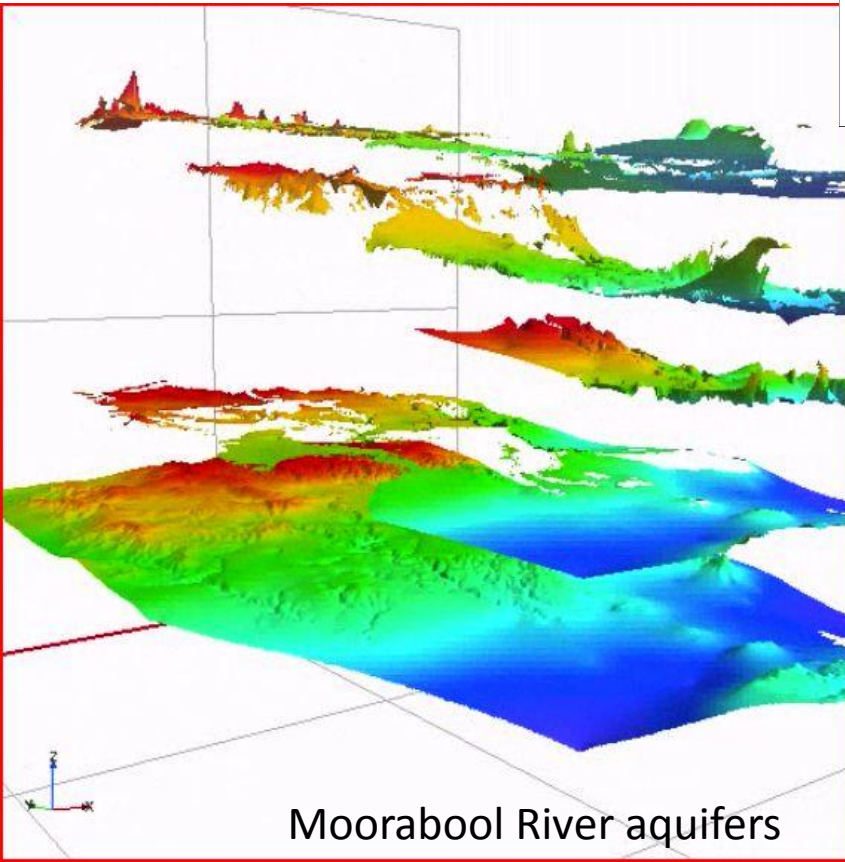
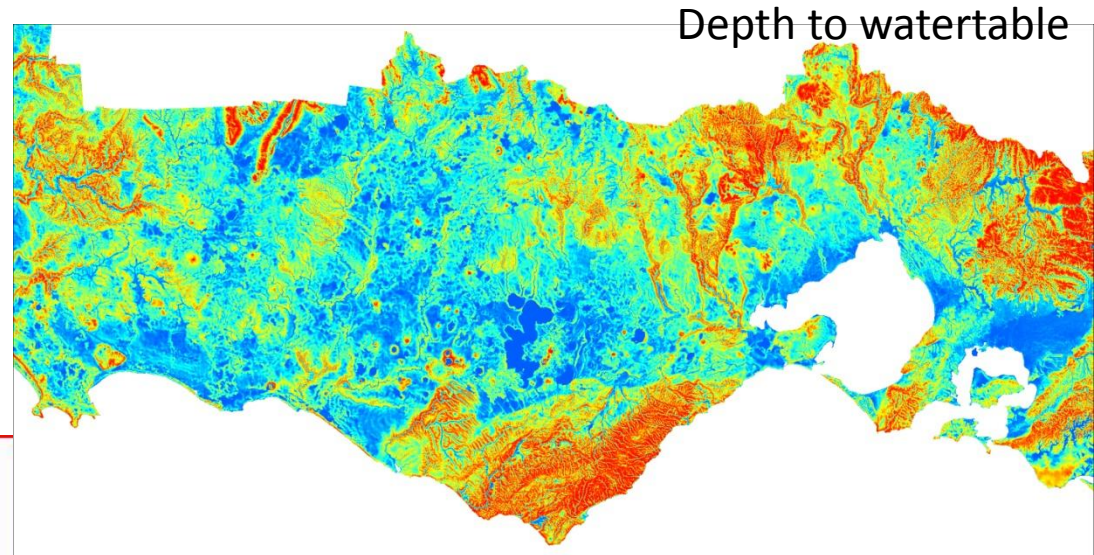
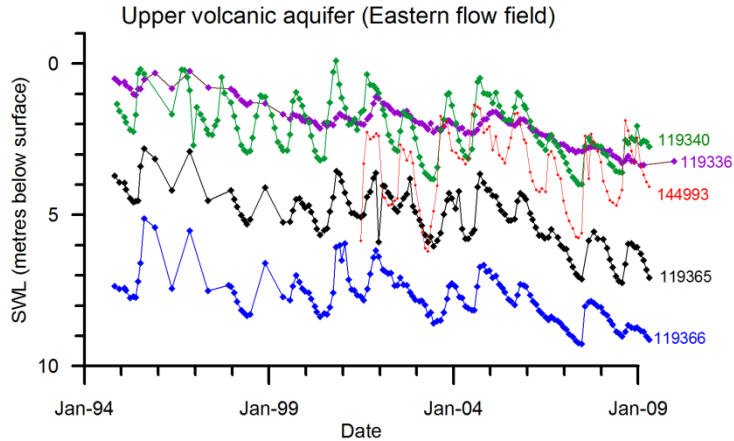
Groundwater chemistry

Bore Details: LCC6

[Print](#)



Visualising Victoria's Groundwater project



Future developments

Tools that provide (on-the-fly):

- ✓ Groundwater bore graphics
- ✓ Chemistry plots
- ✓ Watertable animations
- ✓ Cross sections of aquifers
- ✓ Three-dimensional models of groundwater systems

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