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Water Monitoring by the CSG Industry in South East Queensland

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Water Planning and Resources
Santos GLNG

Importance of water monitoring

PAST CONDITION

*Monitoring **establishes a baseline** on what is normally happening in existing groundwater and surface water systems*

CURRENT CONDITION

*Monitoring **provides objective evidence** of changes over time and in different locations*

FUTURE CONDITION

*Monitoring data **improves the accuracy of our predictions** so we can narrow the range of likely outcomes when we determine potential impacts*

"Modelling makes predictions of <u>potential</u> impacts, but appropriate management and response is only achieved by monitoring"

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Types of Water Monitoring

1. **Baseline assessment -** landholder bores
2. **Dedicated groundwater monitoring wells –** ongoing monitoring program
3. **Remote monitoring (telemetry)** – landholder bores
4. **Specific activities** – eg. soil monitoring, water infrastructure monitoring

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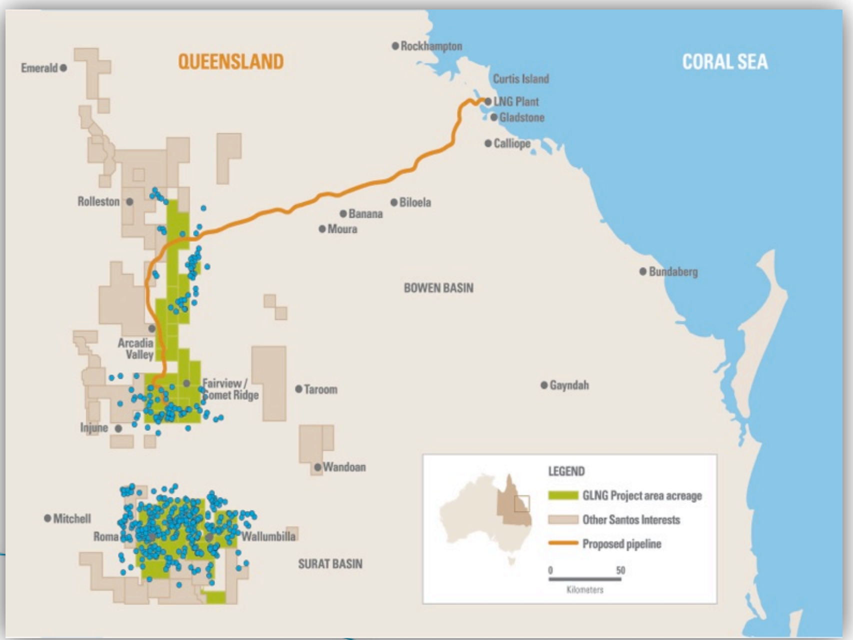
Baseline Assessment

Landholder Bores

- Follow guidelines and requirements of the Water Act (2000)
- Surveys and locates all existing on-tenement bores and wells
- Records basic well construction and infrastructure
- Take water quality results, and assessment of instant yield and flow rate where possible
- Industry has visited and surveyed up to ~3000 landholder bores so far



Santos **Bore Assessment Results**

Bore ID	8227	Owner's Name	[redacted]
Gov. Registration #	123131	Latitude (WGS84)	-26.4975
Cadastral	177/WAL33463	Longitude (WGS84)	148.9331
Date of Visit	28/09/2012	Position From	GPS
Purpose of Bore	Domestic Supply	Operational	Yes
Bore Name	-	Assessors	RG/AT/KM

Field Measurements			
Water Sample Collected	Yes		
Standing Water Level (While Pumping) (m)	-	Comments	-
Water Level Method			
Reason Water Level Not Taken	Unable to obtain water level due to insufficient room in the bore cap to fit dipper probe through.		
Reference Point	-	Reference Point Height (m)	-
Gas Meter	-		
Comments	-		

Bore Construction Details			
Bore Diameter (mm)	135	Casing Stick-Up (mm)	240
Casing Material	Steel Casing (unspecified)	Bore Depth (m)	-
Comments	-		

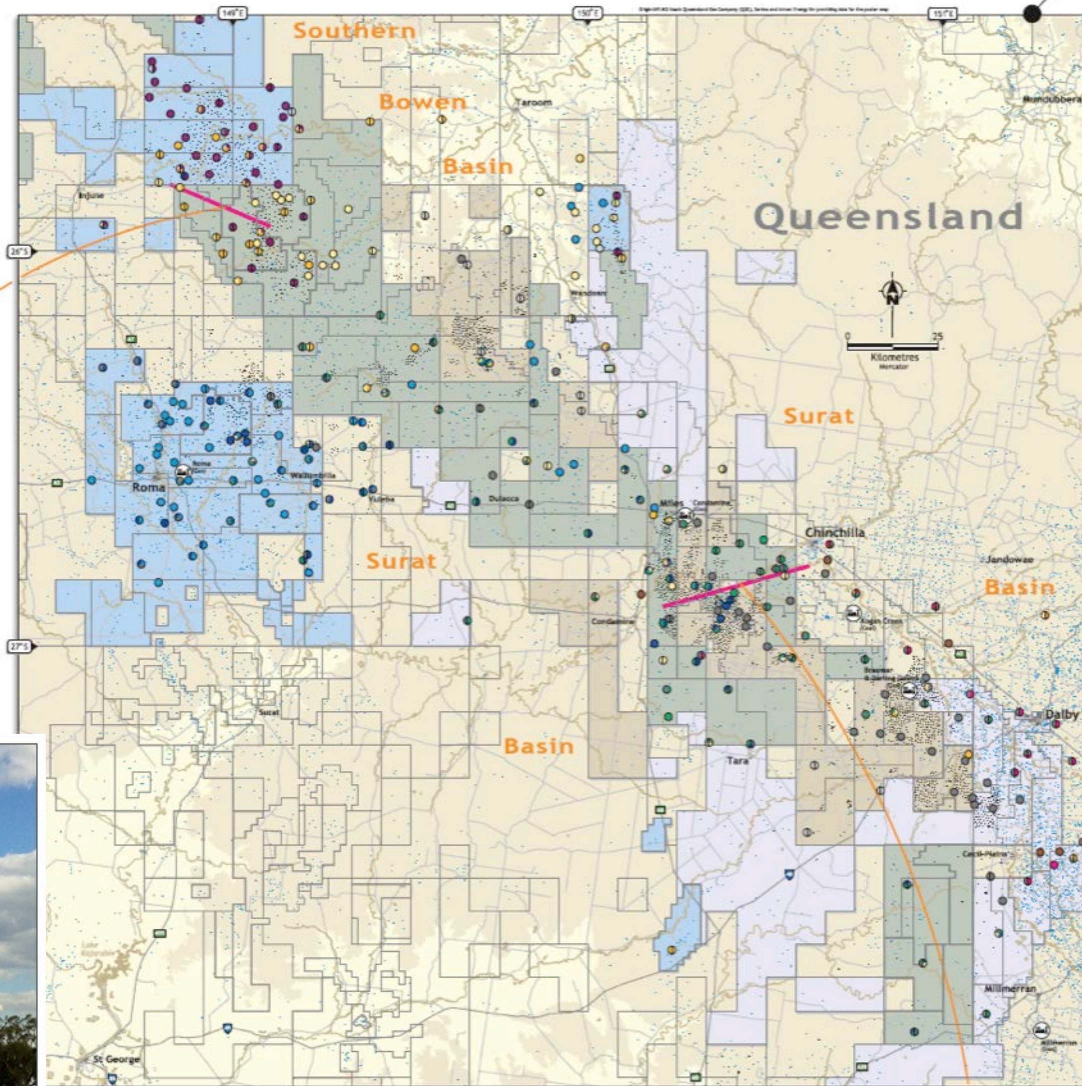
Pumping Data			
Type of Pump	Submersible	Flow Rate (L/second)	1.73
Pump Power Source	Mains Supply	Comments	Esky and stopwatch method.
Pump Depth (m)	-	Maximum Flow (L/second)	-
Details of Recent Pumping	-	Flow Totaliser	-
Bore Use Period	Year Round	Comments	-
Pump Model	-	Access To Well	No
Comments			

Laboratory Analysis			
Sample Date	28/09/2012	Laboratory	ALS Group
Sample From	Well Head		

Santos Bore Assessment - Bore 8227, 28/09/2012 Page 1 of 7

Dedicated groundwater monitoring wells

- Monitor what is happening in important aquifers – particularly those used by landholders
- One single unified network across entire CSG industry
- Spacing appropriate to scale of predicted impact and location of potentially affected landholders
- More than 500 monitoring points planned (nested and multi-zone)



Map Source: origin

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Remote monitoring (telemetry)

Landholder water bores

- Very unobtrusive set up (see image below)
- Bores are ‘telemetered’:
  - Automated data collection
  - Data can be viewed ‘live’ online
- Patterns and trends can be viewed daily, weekly, monthly etc.
- Equipment is solar powered, with minimal maintenance required (i.e. annual)
- Santos provides landholders with an individual login to view their bore level data

Specific activities

Monitoring related to specific activities

e.g:

- Soil monitoring of irrigation fields
- Water storage ponds
- Water re-injection schemes

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Use of monitoring data

- ALL data is submitted to **Queensland Government (Office of Groundwater Impact Assessment)**:
  - OGIA use the data to improve model predictive certainty
  - CSG enforcement unit have access to the data when requested by landholders to investigate possibly impacted bores
- **Industry** use the data to:
  - Screen against predicted impacts to assess implementation of management activities
  - Implement appropriate make good measures
  - Update and improve in-house predictive models
  - Update water monitoring publications and data viewing platforms (e.g. Santos 'Water Portal' and Envault tools)

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Santos Water Portal

For water monitoring data from the Santos GLNG project, visit:

www.santoswaterportal.com.au

http://www.santoswaterportal.com.au/

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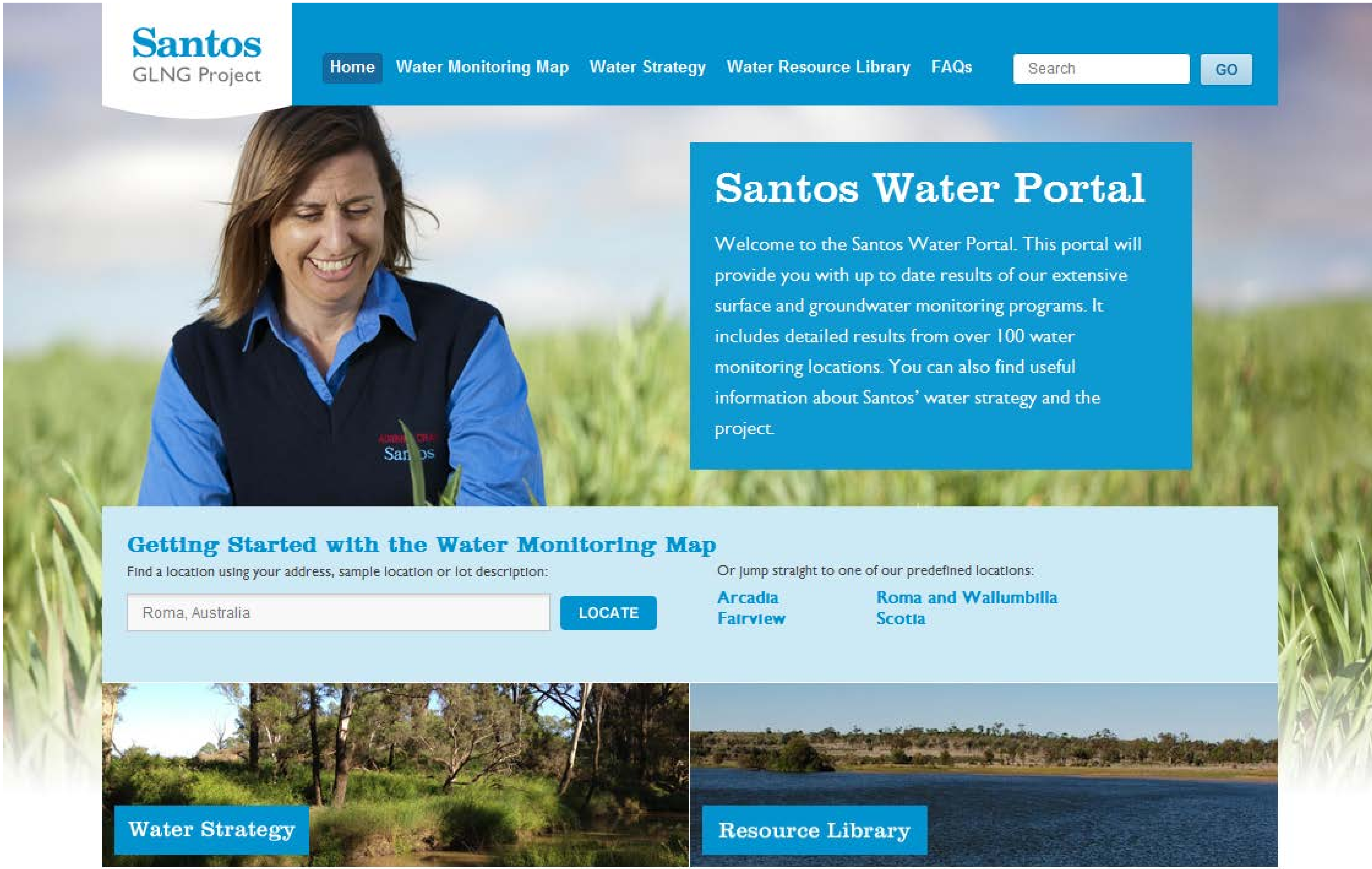
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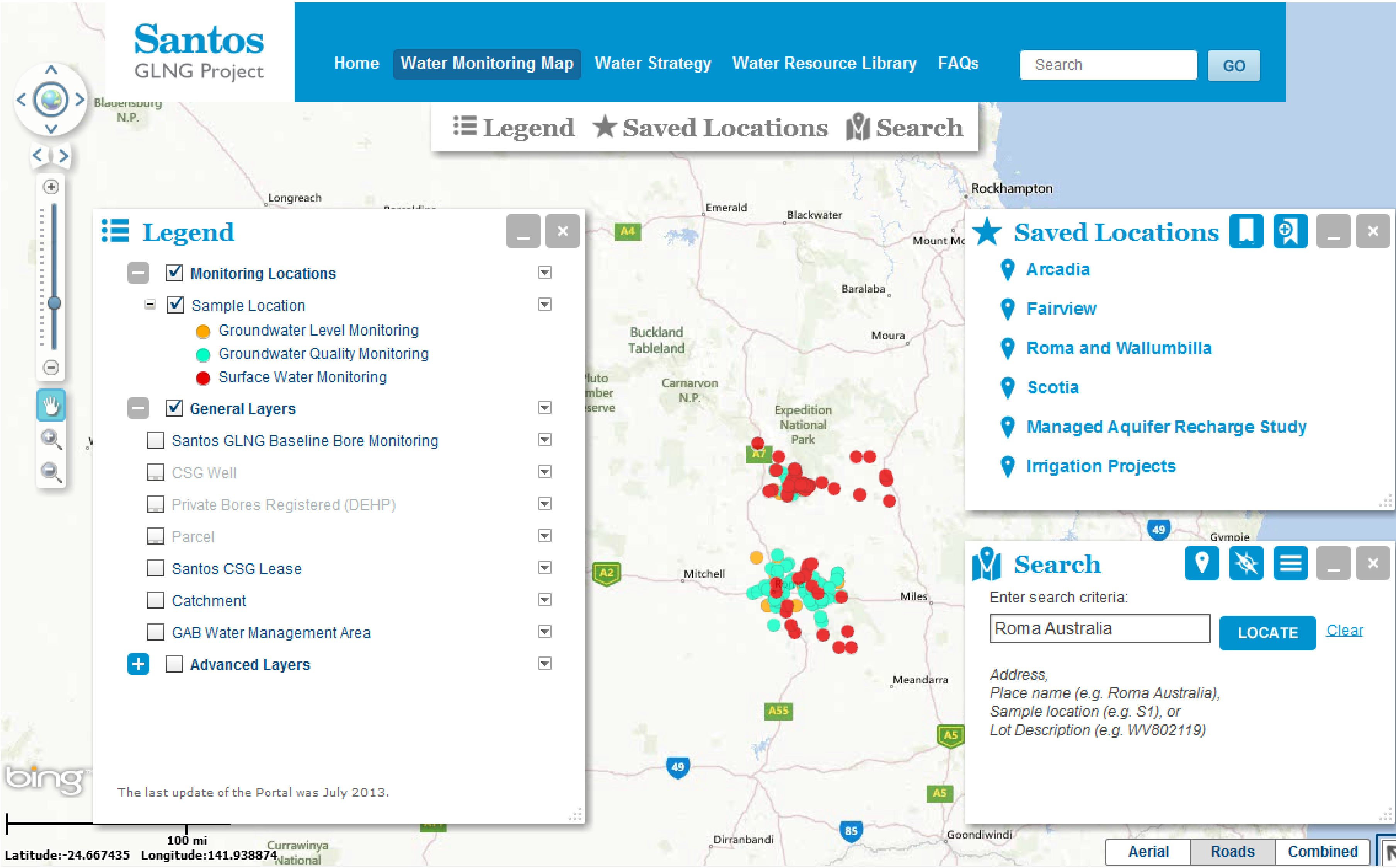
Santos Water Portal
Welcome to the Santos Water Portal. This portal will provide you with up to date results of our extensive surface and groundwater monitoring programs. It includes detailed results from over 100 water monitoring locations. You can also find useful information about Santos' water strategy and the project.
Getting Started with the Water Monitoring Map
Find a location using your address, sample location or lot description:
Roma, Australia
LOCATE
Or jump straight to one of our predefined locations:
Arcadia
Fairview
Roma and Wallumbilla
Scotia
Water Strategy
Resource Library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Monitoring Locations
Sample Location
Groundwater Level Monitoring
Groundwater Quality Monitoring
Surface Water Monitoring
General Layers
Santos GLNG Baseline Bore Monitoring
CSG Well
Private Bores Registered (DEHP)
Parcel
Santos CSG Lease
Catchment
GAB Water Management Area
Advanced Layers
The last update of the Portal was July 2013.
Saved Locations
Arcadia
Fairview
Roma and Wallumbilla
Scotia
Managed Aquifer Recharge Study
Irrigation Projects
Search
Enter search criteria:
Roma Australia
LOCATE
Clear
Address,
Place name (e.g. Roma Australia),
Sample location (e.g. S1), or
Lot Description (e.g. WV802119)
Longreach
Emerald
Blackwater
Rockhampton
Baralaba
Moura
Buckland Tableland
Carnarvon N.P.
Expedition National Park
Mitchell
Miles
Meandarra
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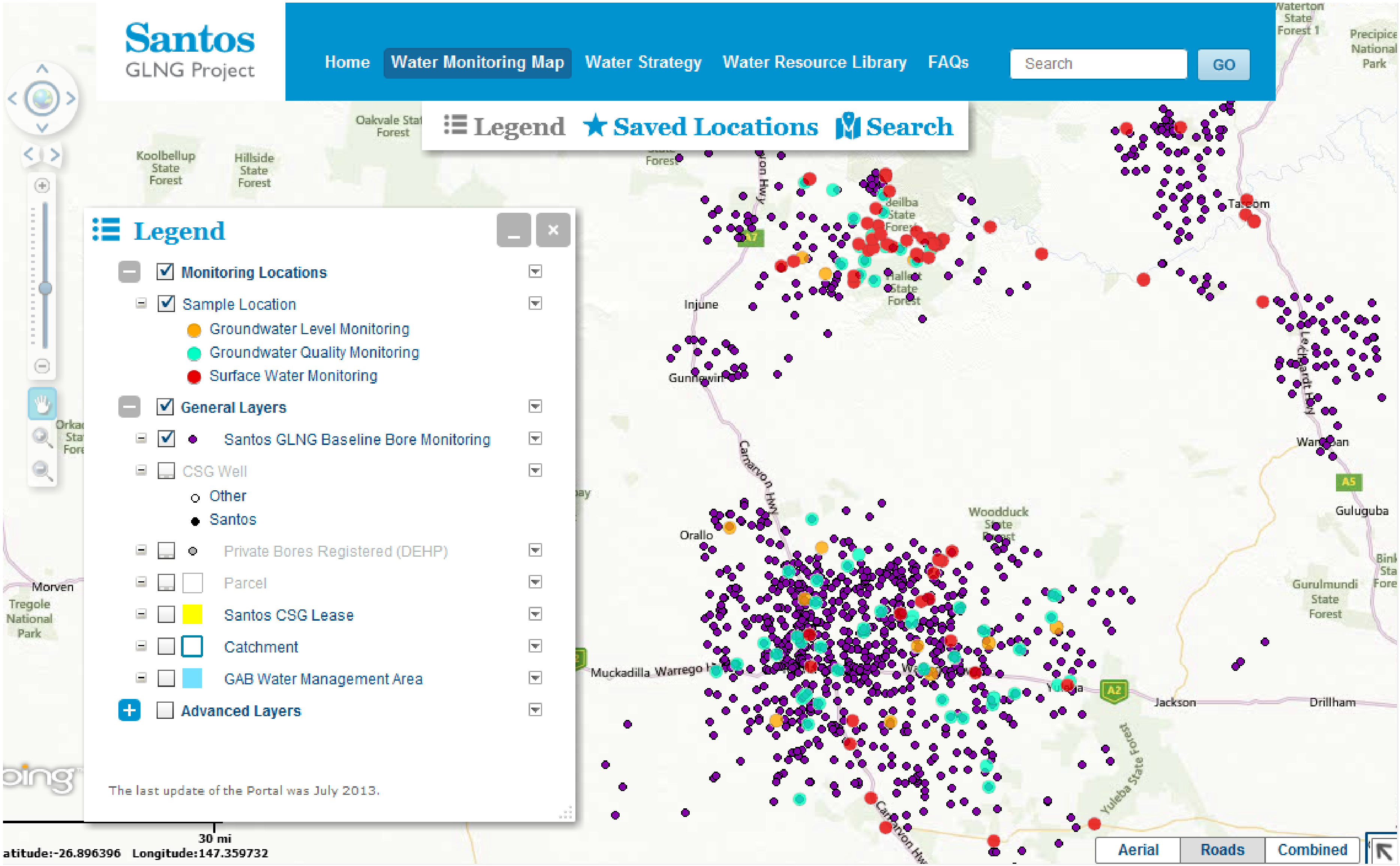
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CSG Well
Other
Santos
Private Bores Registered (DEHP)
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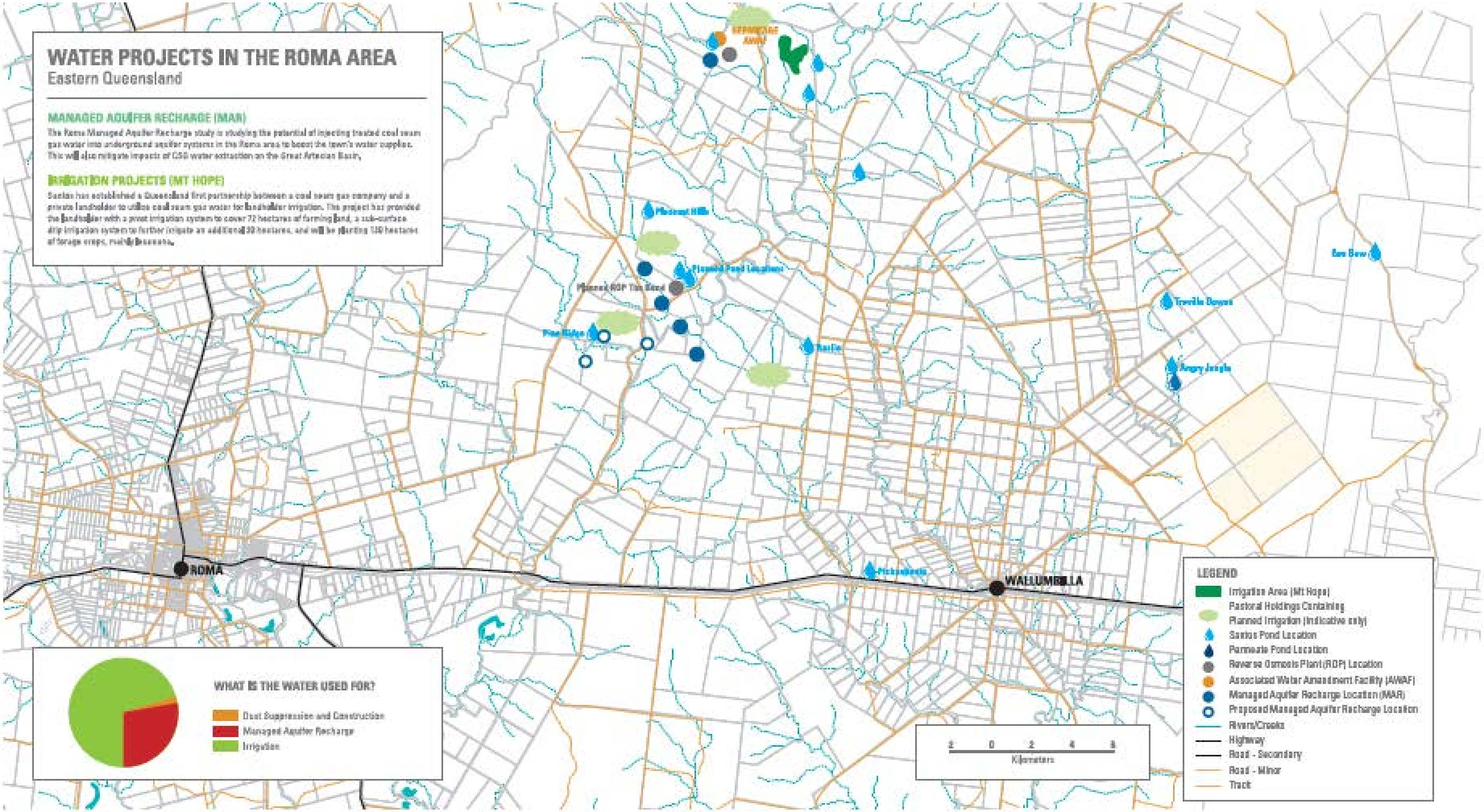
Injune
Taroom
Wandoan
Guluguba
Orallo
Jackson
Drillham
Yuleba
Muckadilla
Morven
Tregole National Park
Koolbellup State Forest
Hillside State Forest
Oakvale State Forest
Precipice National Park
Woodduck State Forest
Gurulmundi State Forest
Carnarvon Hwy
Leichhardt Hwy
Yuleba State Forest
Warrego
30 mi
atitude:-26.896396 Longitude:147.359732
Aerial
Roads
Combined

Water Projects in the Roma region

Water Utilisation Projects - Roma



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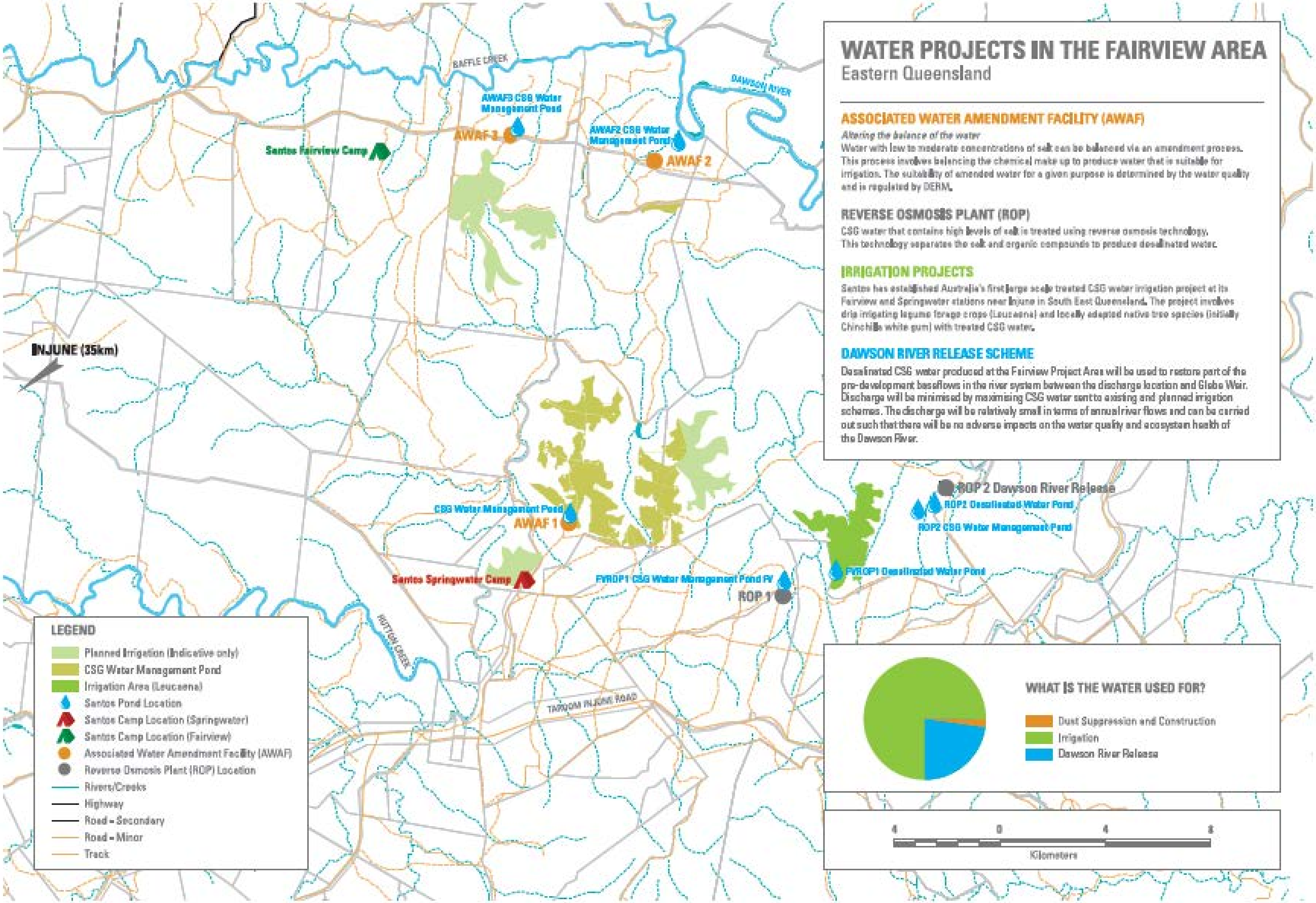
Water Utilisation Projects - Fairview



Irrigation

Fairview

- 1500 Ha of trees under drip irrigation
- 234 Ha of leucaena (forage), under pivot irrigation
- New areas are being brought on line over the next 2 years, however, for reasons of operational simplicity and cost savings, Santos is moving towards new irrigation areas being forage crops

Irrigation

Roma

- There is currently 100 Ha under irrigation at the Mt Hope Pilot irrigation area
- A further 500 Ha will be brought under irrigation over the next two years (to the end of 2014)

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Managed Aquifer Recharge

- **Objective:** Inject treated water into a shallow sandstone aquifer that has been depressurised by town water supply
- **Scheme Description:**
  - Initially 4 injection bores injecting up to 9 ML/d
  - Expanding to nominally 10 injection wells with potential to expand to 14 injection wells
  - Ultimately, Santos is likely to reach up to 15 ML/d injection rate

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