

MEETING MINUTES

14 May, 2014

Minutes: Santos Community Committee - Narrabri Shire
Wednesday, 14 May 2014
Narrabri Golf Club, Narrabri

Attendance: David Ross (Chair), Tahnee Laycock (Secretary), Annie Moody (Santos), Glenn Toogood (Santos), Tony Pickard, Victoria Hamilton, John Tough, Terry Hynch, Ian Duffy, Ken Flower, Tanya McShane (DRE), Andrew Ellis (DRE).

Apologies: Jon Maree Baker, Ron Campey, Brendan Warnock, Michael Guest, Vesna Rendulic (Santos).

	Discussion	Action/By Whom
1. Welcome, apologies and introductions	The chair opened the meeting at 5:36pm. Chair welcomed committee. Introduced Santos Representative: Glenn Toogood. Introduced Division of Resources and Energy (DRE) representatives: Tanya McShane and Andrew Ellis who wanted to briefly introduce themselves to the Committee.	
2. Short brief from DRE	Tanya introduced Andrew and herself and explained that the DRE are responsible for handing out exploration licenses. Tanya has 11 years working with stakeholders to engage in the process. Going back 18 months – two years ago, the department wanted to have greater presence in communities so they employed technical safety and environmental staff who went around and did presentations to councils who wanted it. There weren't enough presentations being done so the department in the last 6 weeks have advertised for another 4 community liaison officers to work in the areas that are having greater issues. Tanya stated that she is not an advocate for the industry, that it's about providing neutral information and getting a pulse for what's happening by being around the communities where there is resource development	

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	Discussion	Action/By Whom
	<p>and stakeholders that need to be engaged in the process.</p> <p>Q. Chairman: What's your role over the next year or two going to be with respect to Santos, Narrabri CCC and Narrabri Shire Council (NSC)?</p> <p>A. DRE: Once we have people on the ground it can be a little more proactive. We will be getting in touch with people that least want this getting off the ground and some of the other members that aren't as interested. It's an evolving process so it's very hard to state right now what the role will be. We are here to be somebody to talk to about the handing out of exploration licenses.</p> <p>Q. Committee member: Do you intend to get out and talk to anybody else other than the NSC?</p> <p>A. DRE: Absolutely. That is the whole point of my division of the DRE. It has a greater focus on public presence. It's about hearing from everybody that could be impacted.</p> <p>Q. Committee member: Where are you based so people can get in contact with you?</p> <p>A. DRE: We are still recruiting but at the moment Andrew will be here in Narrabri 3 days a week.</p> <p>Q. Chairman: Could the committee expect that if they were to invite DRE back to our meetings that would be okay?</p> <p>A. DRE: Absolutely. We need the opportunity to sit at the table and really flesh out the issues.</p> <p>Committee agreed that Tanya and Andrew could stay and listen to Santos's produced water management plan presentation.</p>	

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	Discussion	Action/By Whom
3. Produced Water Management Plan (PWMP)	<p>Presented by Santos's Glenn Toogood. This plan is for today and not for production.</p> <p><u>Ensuring management processes for produced water are in place</u></p> <p>PWMP requirement under condition 14 of PEL238</p> <ol style="list-style-type: none"> 1. Expected sources and estimated quantities of produced water 2. Proposed containment measures 3. Proposed treatment measures 4. Proposed beneficial reuse 5. Controls to be implemented to prevent and/or minimise pollution 6. Record keeping for the quality, quantity, transport and disposal of produced water <p>Appraisal water infrastructure</p> <ul style="list-style-type: none"> - This PWMP applies to the management of water produced during the exploration and appraisal activities ie the plan is for today and not for production - Santos will complete an evaluation of treatment and management options for produced water associated with the Narrabri Gas Project during EIS. - PWMP will constantly evolve as new appraisal information and options review develops. <p>Stages of produced water and coal seam gas production</p> <p>See Appendix 3. The time lines indicated are approximates only. Peak water production is within the first 12 to 18 months.</p> <p>Estimated produced water volume</p> <p>See Appendix 4 Simulations prepared indicate that peak produced water extraction for the exploration and appraisal program will be approximately 1.3ML/day. This estimation is contingent on the timing</p>	

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	<p>for commencement of pilot activities and may change depending on timing of approvals and other operational considerations.</p> <p>Managing water from previous operations See Appendix 5. Noted that 10 megs have gone into Tintsville ponds since start-up of the Tintsville wells, this year.</p> <p>Average water quality concentrations across Narrabri Gas Development See Appendix 6</p> <p>Diagrammatic overview of produced water infrastructure See Appendix 7 In addition to the monitoring outlined for the Leewood Produced Water Management Facility, the ponds will be subject to the surveillance requirements for prescribed dams, including the preparation of a Surveillance Report. This report requires inspection and reporting of the condition of the ponds including embankment slopes, crest and spillway, presence of any erosion, vegetation, seepage and monitoring instrumentation.</p> <p>The design, construction and operation of the High Density Poly-Ethylene (HDPE) flowlines are undertaken in accordance with the Australian Pipeline Industry Association's <i>Code of Practice for Upstream Polyethylene Gathering Networks - CSG Industry</i> (March 2013). This includes detailed quality control measure requirements to ensure the integrity during the construction process. After construction and prior to commissioning, the entire flowline is required to be pressure tested and once operating, ongoing pressure monitoring using remote telemetry occurs.</p>	<p>Santos to provide the most recent data on water quality concentrations across Narrabri Gas Development</p>

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	<p>Desalination and Amendment of water for beneficial uses See Appendix 8 Chemical amendment is sometimes undertaken to lower the sodium adsorption ratio (SAR) of the produced water to acceptable levels for the desired beneficial uses. Amendment of permeate from RO treatment is likely to involve SAR adjustment using Gypsum and/or Magnesium Sulphate.</p> <p>Reverse Osmosis (RO) desalination typically involves several steps that include: - Pre-treatment by filtration, clarification, ion exchange and bio-fouling control; - Desalination; and - Post treatment as required by final water use (potentially including ammonia removal, dechlorination, calcium and magnesium addition to achieve required sodium adsorption ratio (SAR) and pH adjustment).</p> <p>Providing a 'new source' of water for beneficial re-use Following treatment, produced water may be directed to beneficial uses that could include:</p> <ul style="list-style-type: none"> • Dust suppression, use in construction and drilling and firefighting; • Irrigation; and/or • Discharge to surface water as environmental flows <p>Ensuring good quality control and assurance processes Key records associated with this PWMP that will be stored and managed will include:</p> <ul style="list-style-type: none"> • Inspection and monitoring records for facilities and dams; • Operational monitoring and performance data for treatment systems; • Water sampling and laboratory analytical reports; • Calibration records for field instruments and continuous water quality monitoring systems; 	

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	<ul style="list-style-type: none"> Waste Transportation and Disposal Certificates; Annual Inspection reports and/or certifications of storages. <p>Q. Committee member: The total dissolved solids you have stated is coming through the produced water at an average concentration of 12,000 – 16,000. I have another recent report that Santos have submitted to the government in the past suggesting that this concentration is 21,000 parts per million. Why has it changed from 21,000 to 12,000?</p> <p>A. Santos: 12,000 – 16,000 is the current concentration that we are getting from the latest wells that are on board particularly our appraisal program. The 21,000 document was given back in February. You need to keep in mind that we have only just turned on the wells and this is coming from those wells recently turned on, Tintsfeld and Bibblewindi West are giving readings of 12,000 – 16,000.</p> <p>Q. Committee member: Does that mean that you may have fresher water sitting on top of the saltier water in these wells? The 200,000L of water that you used in the drilling fluids, where does that go?</p> <p>A. Santos: It gets recycled at our facility at Chinchilla in Queensland and the drill cuttings come out of it. We will re-use the recycled water and put it into a hole (well).</p> <p>Q. Committee member: Why haven't you gotten rid of your brine to a facility already?</p> <p>A. Santos: We have 150 ML of water that is brine mixed with produced water. It's a bit less salty than sea water. It will get put into the main processing stream at Leewood and be processed like any other produced water would be.</p> <p>Q. Committee member: Where are the VOC's in all this?</p> <p>A. Santos: We don't have anything else other than methane and a little bit of CO2. Santos has not found VOCs in our pond water.</p>	

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	<p>Q. Committee member: You have the produced water and its coming out of the well, where is it going first?</p> <p>A. Santos: It travels through a gas water separator prior to being centralised via a network of flow lines at Bibblewindi. Once at Bibblewindi, the water travels via a separate flow-line to Leewood. Then we have additional facilities onsite to make sure you're taking all the gas out of the water. The water can still contain minor concentrations of dissolved gas within it. Our flow lines have relieved points within it, where gas will collect in that and then vented. Very small amount.</p> <p>Santo is shown photographs of white material on roads in Queensland and asks for location. Answer: These photographs were taken in the area around Santos' Operation in Queensland Australia.</p> <p>Q. Committee member: In one of the Queensland areas, produced water that was supposedly good has been deposited on the road and there are salts all over the road. Is that likely to happen here with your produced water on the road?</p> <p>A. Santos: The water we use today for dust suppression comes from the Great Artesian Basin. The Great Artesian Basin has salts (approx. 200mg/L) within in it; it's not distilled water. This water has been used for dust suppression and naturally, similar to rainfall, once the water is evaporated, there will be a salt residue precipitated. In dust suppression it is actually preferable for the water being used to have a salt content. This helps bind the clay particles.</p> <p><i>Comment:</i> That means you will be introducing another element into the upper surface to rust out our vehicles. Santos: they use salt on the roads to assist driving in snow.</p>	

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	<p><i>Comment:</i> Produced Water Management Plan states Santos will only be using Leewood for the Exploration and Appraisal Programs of both Santos and CSG.</p> <p>Q. Committee member: Does this mean Santos will either have to build more Treatment facilities to cater for the Produced Water from the Proposed Production Development or will Santos be applying to transfer to these, other already approved produced water storage and treatment facilities at our facility at Chinchilla in Queensland from the exploration and appraisal programs to the production use without having to go through the process of applying to the Department of Planning and thus denying the public of NSW a chance to comment on the Water Treatment and its effect on the environment. A. Santos. I will take this on notice.</p> <p>Q. Committee member: You said you had 50 tonnes per day from 100 wells, is that correct? A. Santos: Based on operating 100-150 wells at any one time, yes that is what we are currently forecasting an average 20,000 tonnes per annum of mixed salt will be produced.</p> <p>Q. Committee member: Is this from wells with single or multi-level laterals? A. Santos: We will have both types operating at the same time; the combined numbers of both types are in the range of 100-150 wells that could be running at any one time.</p> <p>Q. Committee member: Will the produced water data from each well be on the water portal? A. Santos: As the treatment of water focuses on cumulative water (not well by well), all monitoring of water quality will take place at Leewood. There are sampling points where we can access the water. The important part is what we are doing with the water. It's all about the centralisation and what you do with it when it all mixes together.</p>	<p>Santos to respond to question raised regarding CCC chance to comment on the transportation, treatment (RO Plants) and storage of produced water from the exploration phase to production phase.</p>

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	<p>Q. Committee member: How often would you test the brine and produced water?</p> <p>A. Santos: Regularly. We have two types of testing. Testing as part of Licensing and Regulatory operational requirements. At the end of the day it's a product we are putting through a multimillion dollar kit so we want to also know what's in it.</p> <p><i>Comment:</i> Santos's treated water must have no more impact on the existing groundwater than what's already been done underground by nature.</p> <p><i>Comment:</i> There is a problem around Leewood with Acid Soils and Alkaline stock and domestic water.</p> <p>Q. Committee member: Is the production phase REF for 150 wells?</p> <p>A. Santos: No the EIS goes in for 850 wells over a 25yr period. There may be anywhere between 100-150 wells on line at any one time. It's an evolving process and rates can go up or down depending on the water and gas produced, and the market demand.</p> <p>Q. DRE: When you go through and you have more definitive numbers is that reported and how?</p> <p>A. Santos: Yes. Those reports are due within 2-3 months of anniversary date of the licence. It's available to the government but we also put it up on our water portal site.</p> <p>Q. Chairman: Has Santos made a decision on how the water is going to be reused?</p> <p>A. Santos: We will address that in the REF for Leewood Phase 2 process and that will hopefully be discussed at the June meeting. Though, we do plan on using it for irrigation.</p>	
4. Previous meeting's minutes and General Business	<p>The chair then went through outstanding actions.</p> <p>- Full soil analysis for Leewood is not complete. Missing pages 14-21. Santos has taken this on</p>	Santos to provide full soil and bacteria

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	<p>notice to complete.</p> <ul style="list-style-type: none"> - Option to formalise the committee is still waiting on the letter of recommendation by the department. This committee will continue until such time when the framework is sorted. - Committee accepted the notion of a proxy for Namoi Water at this time before the committee is formalised. However they need to be aware that a huge amount of information has been covered by this committee that they (proxies) might not be party to. They will need to familiarise themselves with the content that's been covered and not come to the meeting and go over old territory. <p><i>Comment:</i> As far as I'm concerned institutions pick their own alternate, but community representatives, if you're on you're on, if you're not you're not.</p> <p><i>Comment:</i> We are trying to avoid a situation where people can't get into the committee and you have 4 or 5 people that don't show up and there are not enough people to constitute a meeting.</p> <ul style="list-style-type: none"> - The occurrence of Uranium we reported to the EPA back in March 2013 by Santos. One of the monitoring wells had elevated salts and a concentration of Uranium, 337 parts per million (337 ug/litre). The drinking water standard is 17 micrograms/litre. The Uranium comes naturally from the soil in trace elements, 700 mg/kg in soil (There are also similar natural occurrences in the Namoi river along with traces of pesticides). The carbonate rich waters leached elements out of the soil and into the water solution at Bibblewindi Pond 3. The government have subsequently provided a fact sheet on where it was and that it was isolated. Santos didn't introduce Uranium; it was Uranium already existing there in the underlying soil. 	analysis of Leewood

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	<p>Q. Committee member: In the report from the EPA it says that you based your natural levels on soil samples taken from cores for drilling at both Leewood and Bibblewindi. Could I see your Uranium levels in those core samples?</p> <p>A. Santos: The results are in a table within the Bibblewindi Hydrogeological Assessment which I understand the Wilderness Society has a copy of. I can certainly provide the extracts from it. The reason we have not provided it previously was because it was under an EPA investigation. I will take it on notice now that that investigation is over.</p> <p>- Response regarding aquifer contamination. Santos will take on notice.</p> <p>Q. Committee member: Santos says it is going to decommission No.2 and No3. dams at the Bibblewindi Facility, but you still have these dams listed for use in your produced water reports. Are you going to rely on that 5 ML tank to be able to hold the amount of produced water that is going to come out of your existing wells? How long will that hold water for?</p> <p>A. Santos: It's required to be included in the plan. The PWMP reflects operations as they currently stand today, hence inclusion of Bibblewindi 2 and 3 ponds. The tank won't hold the water for long. The tank has a maximum holding capacity. If this is reached and no other storage or treatment options are available, the field will be shut in.</p> <p>Q. Committee member: You know how you said it was reported in The Land that the perched aquifer at Bibblewindi can't be fixed. Where does the pumped water go?</p> <p>A. Santos: The report in The Land was factually incorrect. The NSW government has asked Santos to bale it out (remove water intercepted in the well), so twice a week a guy comes and bales that water out and it goes back into the pond #3.</p> <p>Q. Committee member: You said you never found any Uranium in your produced water but</p>	<p>Santos to respond to whether they can provide a copy of the Bibblewindi Hydrogeological Assessment</p> <p>Santos to respond to question raised regarding recent aquifer contamination</p>

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	<p>there was a concentration of 0.0001mg/L in your presentation.</p> <p>A. Santos: That is natural concentration. That detection of 0. 0001ug/L is very, very low and as it is near the level of detection, it is most likely representative of a background source. .</p> <p>Q. Committee member: Why would you drill 8 wells into the aquifer?</p> <p><i>Comment:</i> You put down 8 wells over that entire area so 13 metres, 8 more down at 20 metres, 8 more down at 14.</p> <p>Q. Committee member: Did they all show contaminated water?</p> <p>A. Santos: Only the upper and the lower shallow perched zones at the north-west corner of Bibblewindi Pond #3 – which occur within the only perched aquifer present. It was believed an adjacent monitoring bore, Bibblewindi 2, installed prior to Santos acquisition may have acted as a conduit between the perched zones. This monitoring bore has now been decommissioned, limiting any connection between the perched zones. It was actually screened across those three layers and therefore provided a pathway to any impacted water to get down. So what one of the first things we did was decommission it.</p> <p>Q. Committee member: Is that the one related to stock water?</p> <p>A. Santos: No. Stock water generally comes from the Pilliga Sandstone. The Pilliga sandstone is approximately 65 metres below the pond and starts rising up the further east you go.</p> <p>- Santos to provide further details on the erosion management plan for the flow line project.</p>	<p>Santos to provide further details on the erosion management plan for the flow line project</p>

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	<p><i>Comment:</i> It doesn't add up that in the April minutes it was stated that NSC spends 7 million on Tourism.</p> <p><i>Comment:</i> Fact: NSC spends around \$660,000/year on Tourism.</p> <p>Committee agreed that the minutes from last meeting were an acceptable reflection of what was discussed.</p> <p>- A committee member asked if somebody from the EPA or OCSG could attend a CCC meeting. A copy of the Trade and Investment fact sheet was distributed and Santos have made a full request to the Office of CSG for them to attend to address Pilliga ponds incident and they are considering Santos's requests.</p> <p>- Santos: In regards to compensation to landholders. After taking recommendations from the CCC that the brochures were ambiguous we re-wrote it into a fact sheet. The land value of \$1000/hectare is used in this area as an example. The land access compensation for a land holder associated with exploration program gets 120% of the value of their land in the first year, based on the valuation of their rates notice and \$30,000 for the services agreement.</p> <p>- GHD in relation to the agriculture impact statement: most of the interviews for this have been completed. However, GHD will accept any written submissions from the committee within a maximum of ten working days.</p> <p>Q. Committee member: If I have feedback from the public should I be bringing it up here or coming to see you as a group?</p> <p>A. Santos: Table your question to the Chairman and I will address it.</p>	<p>Action on Chairman and Secretary to include correct figure of Tourism expenditure in April minutes and rectify with Santos and Social Impact Assessment firm GHD</p>

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Next Meeting Topics: Leewood Phase 2

Date of next meeting: 11 June 2014

Meeting Closed: 7:56pm

Appendix 1: Questions for Santos from the Produced Water Plan Document & also Tintsville Water Management Plan

Appendix 2: Committee member questions on water management plan

Appendix 3: Stages of produced water and coal seam gas production

Appendix 4: Estimated produced water volume

Appendix 5: Managing water from previous operations

Appendix 6: Average water quality concentrations across Narrabri Gas Development

Appendix 7: Diagrammatic overview of produced water infrastructure

See Appendix 8: Desalination and Amendment of water for beneficial uses

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Attachment 1: Actions

Action Raised	Date Raised	Progress Made
Action for Santos to provide committee with full soil analysis including analysis of bacteria of the Leewood site next year when it is available. As well as providing regular soil checks to ensure no contamination is occurring.	11 th December 2012	Ongoing
Action for Santos to explore the option of formalising the committee.	18 th June 2013	Ongoing waiting on response from DRE
Santos to provide further details on the erosion management plan for the flow line project. Including slopes, creeks and gullies.	18 th September 2013	Ongoing
Santos to respond to questions raised regarding recent aquifer contamination and associated questions within 10 days	12 th April 2014	Ongoing
Santos to respond to question raised regarding CCC chance to comment on the transportation, treatment (RO Plants) and storage of produced water from the exploration phase to production phase.	14 th May 2014	
Santos to respond to questions raised in Appendix 1 and 2 regarding the Produced Water Management Plan Document and & also Tintfield Water Management Plan	14 th May 2014	
Santos to respond to whether they can provide a copy of the Bibblewindi Hydrological Assessment	14 th May 2014	
Action on Chairman to work out correct figure of Tourism expenditure and rectify with Santos and Social Impact Assessment firm GHD	14 th May 2014	
Santos to provide the most recent data on water quality concentrations across Narrabri Gas Development	14 th May 2014	



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Santos Community Consultative Committee – Narrabri Shire Meeting

Wednesday 14th April – 5:30 pm to 7:30 pm

Narrabri Golf Club

1.	Welcome, apologies and introductions	5:30 – 5:35	All
2.	Previous meeting minutes	5:35 – 5:50	David Ross
3.	Produced Water Management Plan	5:50 – 7:00	Glenn Toogood
4.	General Business <ul style="list-style-type: none">• Feedback on chairing• Next meeting and issue to discuss	7:00 – 7:30	All

Questions to table for Produced Water Management Plan

From: Namoi Water [email address]

Sent: Wednesday, 14 May 2014 3:02 PM

To: Toogood, Glenn

Subject: Questions to table for Produced Water Management Plan

Hi Glenn

Just in case David is travelling I am assuming you are presenting tonight to the CCC – here are some questions I had that I would like to table. I suspect many will be answered in the meeting.

Cheers

Jon

Questions:

Report suggests that Santo has been exploring since 2008 is this not ESG?

On page 9 are the figures of estimated volumes of water per well set or per well?

How many wells are considered active producing gas and water in current operation?

How much water per day is being produced from these wells? Suggested that it is 1.3 meg per day but how many wells is this for 18? (500 megs per year)

What is the process for approval of this water management plan?

Currently have 150 megs of brine to be treated? Given the TDS and salt of this water what level of sodium bicarb is expected in this treatment process?

If the water is treated what standard is it treated to? Who sets this standard? If ANZECC is the answer can there be some discussion around the fit for purpose considerations and the ability of company to treat water consistently to this standard.

Produced water quality is averaged on page 11 – what are the ranges ? What is the maximum!

Good to see monitoring program is being but in place how does this manage potential for leakage of the pipelines? How often are the periodic inspections carried out? How do you determine where a leak has occurred if inflow outflow shows difference?

Why does the Bibblewindi transfer tank not have a cement bund? What happens in fire situation?

How is the daily monitoring of bibblewindi pond achieved? What happens if the monitoring network fails?

Produced water has the potential to produce a number of bi products how are these being managed? Bicarb/salts Brine

Ro plan is for desal only how does this plan look at other treatment methods including ultraviolet treatment?

Dilution of water with other sources what water does Santos hold to undertake this? Ie: other groundwater licences?

Brine : plan still does not include how the company plans to deal with brine other than store it?

Disposal of salt is transferring the problem assuming this proposed recycling facility is in Qld yet to be built – how does the company plan to deal with this issue long term?

The web based access to water reporting subject to QA QC poses some questions around independence will NSW Office of water have access to live feed (prior to clean up of data?).

Dust suppression photos reportedly from Santos operations in Qld show salt load on soil where produced water has been used for this purpose and also have copy of a receiving creek shows what appears to be salts.



Response to Questions

1. Report suggests that Santo has been exploring since 2008 is this not ESG?

Santos: 2008 refers to the time in which Santos has been exploring in the Gunnedah Basin

2. On page 9 are the figures of estimated volumes of water per well set or per well?

Santos: Estimated volumes of water per well set

3. How many wells are considered active producing gas and water in current operation?

Santos: As at 10 June, Tintsville 2-7 Pilot (6 wells) is the only pilot currently online. Bibblewindi East and Bibblewindi West pilots are off-line for the workover program.

4. How much water per day is being produced from these wells? Suggested that it is 1.3 meg per day but how many wells is this for 18? (500 megs per year)

Santos: Over the 10 weeks to 10 June 2014, the cumulative water production from both Tintsville pilot and the Bibblewindi West pilot (when it was on-line for a short period of time) is 13ML

5. What is the process for approval of this water management plan?

Santos: The Produced Water Management Plan is approved through the Office of Coal Seam Gas.

6. Currently have 150 megs of brine to be treated? Given the TDS and salt of this water what level of sodium bicarb is expected in this treatment process?

Santos: Sodium bicarbonate accounts for approximately 50% of the salt content within the existing production water held in storage. Therefore, if the average concentration of this water is 30,000mg/L, at 50%, 15,000mg/L would account for the sodium bicarbonate content.

- 7. If the water is treated what standard is it treated to? Who sets this standard? If ANZECC is the answer can there be some discussion around the fit for purpose considerations and the ability of company to treat water consistently to this standard.**

Santos: Water will be treated to a standard which is suitable for its proposed use. In respect to irrigation or surface water discharge, the framework is not only defined within ANZECC, but also there are requirements set within an Environmental Protection Licence.

- 8. Produced water quality is averaged on page 11 – what are the ranges? What is the maximum!**

Santos: There are maximums and minimums for each analyte however, when developing the PWMP, it was important to understand the average analyte concentration within water. Developing a PWMP for each individual source of water would not be feasible.

- 9. Good to see monitoring program is being put in place how does this manage potential for leakage of the pipelines? How often are the periodic inspections carried out? How do you determine where a leak has occurred if inflow outflow shows difference?**

Santos: This has been addressed at previous CCC meetings. Please refer to the previous meeting minutes of Narrabri CCC – May 2013.

- 10. Why does the Bibblewindi transfer tank not have a cement bund? What happens in fire situation?**

Santos: The Bibblewindi transfer tank has an earthen bund. We do not believe an earthen bund poses a fire risk.

- 11. How is the daily monitoring of Bibblewindi pond achieved? What happens if the monitoring network fails?**

Santos: The Bibblewindi Ponds has live telemetry systems to record pond levels and is also subject to a daily inspection on site by a Site Operator.

- 12. Produced water has the potential to produce a number of bi-product. How are these being managed? Bicarb/salts Brine**

Santos: As detailed in the PWMP Sect. 4.5 'Concentrate Management', Santos is currently assessing the treatment options for brine.

- 13. RO plan is for desal only how does this plan look at other treatment methods including ultraviolet treatment?**

Santos: Depending on the beneficial use of the treated produced water, treatment options such as ultraviolet may be assessed.

- 14. Dilution of water with other sources - what water does Santos hold to undertake this? ie., other groundwater licences?**

Santos: Santos currently has no plans for water dilution, however, if required, appropriate Water Access licences will be procured.

- 15. Brine: plan still does not include how the company plans to deal with brine other than store it?**

Santos: As detailed in the PWMP Sect. 4.5 'Concentrate Management', Santos is currently assessing the treatment options for brine.

- 16. Disposal of salt is transferring the problem assuming this proposed recycling facility is in Qld yet to be built – how does the company plan to deal with this issue long term?**

Santos: If Santos was to dispose of salt to such a facility it would be to a constructed facility that was appropriately licenced.

17. *The web based access to water reporting subject to QA QC poses some questions around independence. Will NSW Office of water have access to live feed (prior to clean up of data?).*

Santos: All water analytical data is submitted and tested by independent NATA accredited laboratories. A copy of the independent laboratory reports typically accompanies all reports submitted for regulatory purposes.

18. *Dust suppression photos reportedly from Santos operations in Qld show salt load on soil where produced water has been used for this purpose and also have copy of a receiving creek shows what appears to be salts.*

Santos: This photo was tabled at the CCC meeting, however no location information was provided and the Chair accepted the item as a 'comment'. Please refer to the meeting minutes of Narrabri CCC - May 2014.

Attachment Two

Questions for Santos from the Produced Water Plan Document & also Tintsville Water Management Plan

From Page 3

1. Produced Water Management Plan states Santos will only be using Leewood for the Exploration and Appraisal Programs of both Santos and CSG.

Question – Does this mean Santos will either have to build more Treatment facilities to cater for the Produced Water from the Proposed Production Development or will Santos be applying to transfer these other Produced Water Storage and treatment facilities from the exploration and Appraisal Programs to the Production Use without having to go through the process of applying to the Department of Planning and thus deny the Public of NSW a chance to comment on the facilities?

2. Santos has said that as a minor partner of ESG that they knew nothing of ESG activities or had any influence on ESG in Operational matters.

Question – So how can Santos now claim the following “Santos began exploring for CSG in NSW in 2008, completing seismic surveys and drilling core holes to assist in the assessment of the geology of the area”?

From Page 5

3. If Santos is going to be carrying out Appraisal activities in PEL238, PAL2, and PPL for up to the next three years and the Produced Waters from these programs are going to Leewood or Wilga Port.

Question – Why then is Santos applying for a Production Licence off CSG now and again was Leewood built for Production use and will it be transferred across as per Question 1? Or is that application only to allow Santos to sell the PEL238 to another identity. The statement: *his information (Appraisal and evaluation) is essential to determine whether a commercial gas production project is viable within the Narrabri area and would be used to assist in the development planning of such a project.*”

From Page 7

4. Santos seems to be indicating that they will be evaluating and investigating ways to “treat” and reverse the treated Produced water. **Does this mean that Santos will be installing and trialling various methods? If so, where is more precise information regarding each method?**

Santos has stated: *“Produced water management infrastructure would be upgraded and/or designed and constructed in accordance with the project approval and this PWMP would be updated at that stage to reflect the arrangements for produced water management to be implemented.”*

Therefore, along with the other statements made Leewood was built with holding and treating in the Produced water from not only the exploration phase, but for the Production Phase and hence it can be taken that Santos has also gotten approval under the guise of exploration and appraisal activities to carry out treatment of the Produced Water and to trial various ways of using the “treated water” without actually having to put this information out for public comment.

5. **Question – Santos says it has an EIS being processed on this – will the public be able to comment? And to which NSW Government Agency, OESG or DoP?**

From Page 9

6. Will Santos provide the actual produced water figures from the existing pilots that assisted in making the estimates contained below and which pilots are they from? (The estimates refer to Produced Water Extraction Table on pages 9 and 10)
7. The Water Management Plan mentions the following documents:
"Groundwater Monitoring and Modelling Plan" July 2013
"Trigger Action Response Plan (TARP)"
Can we have a copy?

From Page 11

8. I do not see Lithium on the list, yet this accumulates in plants and can affect stock and thus saleability?
9. a) Beneficial Uses – Will the "treated produce" water be brought to some ground water levels or found near or at the location where the treated produced water is to be used?
I tender a photo taken in Queensland (Santos is fond of quoting Queensland) where the treated water is used for dust suppression and there is obviously a white sale covering. This cannot be natural.
- b) What about accumulative impacts of using treated water for irrigation if the chemical and salts value of the treated water is not the same as where the water is being used? Explain any compensation package available to the surrounding farmers if they cannot use their existing water - ground and surface – due to chemical and salt changes due to the use of treated water near them.
- c) If this treated water is discharges as "environmental flows" where will it be discharged and when (Bohena Creek does not flood very often), and how is the treated water valued compared with the values in the creek? Again as per above question, regarding compensation to people who use Bohena Creek on their water sources.
- d) Will the public be able to comment on the RO plant specifications at Leewood and the methods of water/brine disposal? Is this EIS going to the DoP or OCSG?
- e) Tintsville Downs on Wilga Park has been granted and RO operation under the Tintsville Water Management Plan of February 2010, and by the way, the daily production for the Tintsville pilot as per REF p20 was estimated at 480kL not 400kL as the PWMP states.

RESPONSE:

Note: As questions were tabled prior to the May 2014 meeting, a number of the questions were answered during the meeting, please refer to minutes for additional information.

Question 1

Produced Water Management Plan – exploration and appraisal phase and Production Phase

- Before activities can begin on the Narrabri Gas Project, separate approvals will be required from both the State and Commonwealth Governments.
- An Environmental Impact Statement (EIS) will be prepared and will include extensive studies covering a wide range of issues including, but not limited to, natural habitat, ecology, groundwater, surface water, agriculture, soil, cultural heritage and social impacts.
- The EIS will be lodged with the Commonwealth and State Governments for determination.
- If the Project is approved by both the State and Commonwealth Governments, it will be subject to numerous conditions requiring monitoring and ongoing management of our activities, as well as oversight by a number of NSW government agencies including the Environment Protection Authority.

- Community consultation will occur at various stages throughout the assessment process and there will be a number of opportunities for members of the public and stakeholders to have their say on the Project.

Question 2

Santos exploration activities in NSW

- Santos (as the Operator) began exploring for coal seam gas in NSW in 2008 mainly around Gunnedah and in the Upper Hunter in Petroleum Exploration Licence (PEL) areas 1 and 12. Santos completed seismic surveys and the drilling of core holes to assist in the assessment of the geology of the area.
- In November 2011, Santos completed its acquisition of Eastern Star Gas' (ESG) acreage and operations near Narrabri in PEL 238. With this acquisition, Santos became the Operator of PEL 238.

Question 3

Production licence application

- To be advised, ongoing

Question 4

Produced Water Management Plan – exploration and appraisal and production phase

- Refer to response for Question 1

Question 5

Environmental Impact Statement

- Refer to response for Question 1

Question 6

Produced water figures from pilot wells

- The Produced Water Management Plan includes estimates of produced water from pilot wells in the document.

Question 7

Groundwater Monitoring and Modelling Plan and Trigger Action Response Plan

- To be advised, ongoing

Question 8

Lithium

- Noted as a comment. Santos does not believe that Lithium is a contaminant of potential concern and therefore it is not part of the analytical suite at this stage.

Question 9

Beneficial Uses

a) Addressed at the meeting, refer to minutes

b) A comprehensive assessment of the Leewood soil profile has been undertaken by a specialist irrigation consultant. The treated water meets NSW irrigation guidelines.

c) The current plan for use of the treated water is to irrigate on site at Leewood. Should Santos wish to discharge treated water to a creek or river, this would be subject additional regulatory approval processes through NSW State Government.

d) The Leewood Phase 2 REF addresses information in relation to the proposed construction of a Reverse Osmosis plant at Leewood and information on the proposal will be presented to the Narrabri CCC at a future CCC meeting when the scope of the project has been finalised.

e) Addressed at the meeting, refer to minutes

Meeting Action Item Response

Reference:	140514_NCCC
Subject:	Meeting Action Items– May Meeting Narrabri CCC
Request date:	14 May 2014
Requested by:	David Ross Chair Narrabri CCC
Response:	<p>Question 1 – Santos to respond to question that was raised regarding CCC opportunity to comment on the transportation of water from the exploration phase to the production phase.</p> <ul style="list-style-type: none"> • Before activities can begin on the Narrabri Gas Project, separate approvals will be required from both the State and Commonwealth Governments. • An Environmental Impact Statement (EIS) will be prepared and will include extensive studies covering a wide range of issues including, but not limited to, natural habitat, ecology, groundwater, surface water, agriculture, soil, cultural heritage and social impacts. • The EIS will be lodged with the Commonwealth and State Governments for determination. • If the Project is approved by both the State and Commonwealth Governments, it will be subject to numerous conditions requiring monitoring and ongoing management of our activities, as well as oversight by a number of NSW government agencies including the Environment Protection Authority. • Community consultation will occur at various stages throughout the assessment process and there will be a number of opportunities for members of the public and stakeholders to have their say on the Project.
	<p>Question 2 – Santos to respond to questions raised in Appendix 1 and 2 regarding the Produced Water Management Plan document (incorporating Tintsville)</p> <ul style="list-style-type: none"> • Please see responses for Appendix 1 at Attachment One and Appendix 2 at Attachment Two.
	<p>Question 3 – Santos to respond to whether they can provide a copy of the Bibblewindi Hydrological Assessment.</p> <ul style="list-style-type: none"> • A copy of Hydrogeological Definition Study – Bibblewindi report will be

	<p>provided to members on a CD at the August 2014 meeting.</p> <ul style="list-style-type: none"> • This document is large (449 pages in length, 18MB) and is too large to email.
	<p>Question 4 – <i>Santos to provide the most recent data on water quality concentrations across Narrabri Gas Development.</i></p> <ul style="list-style-type: none"> • The most recent water quality information is available on the Santos Water Portal at http://www.santoswaterportal.com.au/
Briefing Officer:	Annie Moody Team Leader, Community and Land
Date:	4 August 2014

ANALYSIS REPORT SOIL

Project No:	EW120674	Date of Issue:	19/12/2012
Customer:		Report No:	1
Address:		Date Received:	12/10/2012
		Matrix:	SOIL
Phone:		Location:	Leewood
Fax:		Sampler ID:	Client Supplied
email:		Date of Sampling:	12/10/2012
		Sample Condition:	acceptable

Comments:

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

Stephanie Cameron

Signed: **Stephanie Cameron**
Laboratory Manager

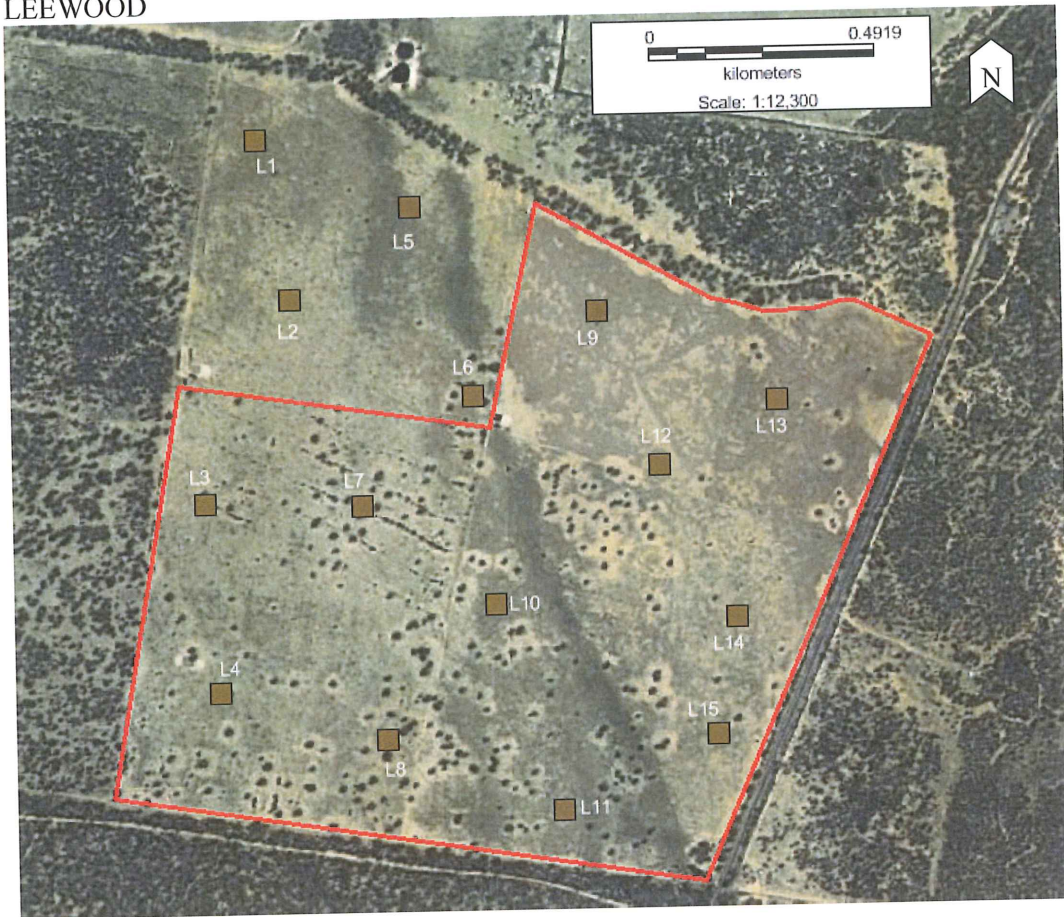
NATA Accredited Laboratory 15708

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025

*This analysis relates to the sample submitted and it is the client's responsibility to make certain the sample is representative of the matrix to be tested.
Samples will be discarded one month after the date of this report. Please advise if you wish to have your sample/s returned.*

LEEWOOD



Leewood

Pit Point	X	Y
L1	149.619611	-30.492679
L2	149.620305	-30.495764
L3	149.618323	-30.499676
L4	149.618587	-30.503364
L5	149.623045	-30.494047
L6	149.624427	-30.497722
L7	149.621901	-30.499799
L8	149.622375	-30.504347
L9	149.627284	-30.496134
L10	149.624872	-30.501775
L11	149.626358	-30.505810
L12	149.628633	-30.499140
L13	149.631326	-30.497950
L14	149.630354	-30.502125
L15	149.629871	-30.504405

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L2	L2	L4	L4
				0-15cm	15-30cm	0-15cm	15-30cm
				120674-1	120674-2	120674-3	120674-4
Chlorides	Probe	R&L 5A1	mg/kg	36.8	170	24.5	175
Electrical Conductivity	Soil:Water (1:5)	R&L 3A1	dS/m	0.07	0.24	0.04	0.21
pH (CaCl ₂)	Electrode	R&L 4B1	pH units	5.34	5.54	5.02	5.14
NO ₃ -Nitrogen Ex	Aqueous	In House	mg/kg	3.96	3.63	2.37	3.13
Phosphorus Ex	Colwell	R&L 9B1	mg/kg	12.8	19.2	14.7	11.8
Phosphorus Buffer Index	PBI (Col)	R&L 9I2a	mg/kg	81.9	76.8	80.3	70.1
Sulphur Ex	KCl-40	R&L 10D1	mg/kg	10.4	19.5	2.17	12.4
Organic Carbon	LECO	R&L 6B2	%	0.80	0.57	0.78	0.41
Copper Ex	DTPA	R&L 12A1	mg/kg	0.57	0.63	0.45	0.40
Zinc Ex	DTPA	R&L 12A1	mg/kg	0.28	0.21	0.39	0.23
Manganese Ex	DTPA	R&L 12A1	mg/kg	29.3	1.64	18.8	1.51
Iron Ex	DTPA	R&L 12A1	mg/kg	122	74.2	232	96.7
Boron Ex	CaCl ₂	R&L 12C2	mg/kg	0.44	0.38	0.44	0.50
Sol Calcium	SAR	In House	mg/kg	15.5	11.0	6.76	16.8
Sol Magnesium	SAR	In House	mg/kg	49.1	33.9	14.8	160
Sol Sodium	SAR	In House	mg/kg	88.2	260	45.8	314
SAR	calculation	-	meq/100g	3.76	11.1	1.95	13.4
Potassium Ex	Colwell	R&L 9B1	mg/kg	147	93.4	209	124
Potassium Ex	Colwell	R&L 9B1/AAS	meq/100g	0.38	0.24	0.54	0.32

				mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g
Potassium Ex	NH ₄ Cl	R&L 15A1	-	109	0.28	78	0.20	197	0.51	124	0.32
Calcium Ex	NH ₄ Cl	R&L 15A1	-	421	2.11	320	1.60	243	1.22	145	0.73
Magnesium Ex	NH ₄ Cl	R&L 15A1	-	638	5.32	1026	8.55	527	4.39	984	8.20
Sodium Ex	NH ₄ Cl	R&L 15A1	-	254	1.10	572	2.49	107	0.47	494	2.15
Ex Potassium %	Calc	Calc	%	3.17		1.55		7.68		2.79	
Ex Calcium %	Calc	Calc	%	23.9		12.5		18.5		6.36	
Ex Magnesium %	Calc	Calc	%	60.4		66.6		66.8		72.0	
Ex Sodium %	Calc	Calc	%	12.5		19.4		7.07		18.9	
ECEC	Calc	Calc	meq/100g	8.81		12.8		6.58		11.4	
Ca/Mg Ratio	Calc	Calc	meq/100g	0.40		0.19		0.28		0.09	

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L2	L2	L4	L4
				0-15cm	15-30cm	0-15cm	15-30cm
				120674-1	120674-2	120674-3	120674-4
Particle Size Analysis (Hydrometer)							
Clay	Hydrometer	ASTM D422-63	%	29.5	28.9	27.3	29.3
Silt	Hydrometer	ASTM D422-63	%	1.4	1.0	1.8	2.2
Fine Sand	Hydrometer	ASTM D422-63	%	27.4	31.0	28.9	35.1
Coarse Sand	Hydrometer	ASTM D422-63	%	41.7	39.0	41.8	33.3
Gravel	Hydrometer	ASTM D422-63	%	0.1	0.1	0.2	0.1
Saturated Hydraulic Cond.	30cm tension	ASTM F1815-97	mm/hr	0.004	0.003	0.002	0.0001
EAT	In water	In House	Class	1	1	3a	1
EAT	In SAR 6	In House	Class	6	6	6	6
Bulk Density	Clod/compaction	ASTMF1815	g/cm ³	1.51	1.41	1.48	1.51
Total Porosity	BD and PD	ASTMF1815	% v/v	47.6	46.3	39.8	42.1
Capillary Porosity	Calc	ASTMF1815	% v/v	22.4	22.9	25.4	28.3
Air Filled Porosity	Calc	ASTMF1815	% v/v	25.1	23.4	14.4	13.8
Water Retention	30cm tension	ASTMF1815	% v/v	14.9	16.2	17.1	18.8
Moisture	oven dry	ASTMF1815	% v/v	4.50	7.32	3.81	10.8
Texture	McDonald <i>et al</i>	In House	Class			FSCL	FSCL



Report Date: 19/12/2012

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L4	L4	L4	L4
				30-50cm	50-70cm	70-90cm	90-110cm
				120674-5	120674-6	120674-7	120674-8
Chlorides	Probe	R&L 5A1	mg/kg	275	700	800	700
Electrical Conductivity	Soil:Water (1:5)	R&L 3A1	dS/m	0.29	0.63	0.72	0.60
pH (CaCl ₂)	Electrode	R&L 4B1	pH units	5.19	5.31	5.41	5.49
NO ₃ -Nitrogen Ex	Aqueous	In House	mg/kg	2.99	3.81	3.22	3.63
Phosphorus Ex	Colwell	R&L 9B1	mg/kg	12.7	11.9	21.2	11.8
Phosphorus Buffer Index	PBI (Col)	R&L 9I2a	mg/kg	68.4	72.6	78.8	72.6
Sulphur Ex	KCl-40	R&L 10D1	mg/kg	20.9	74.2	86.0	56.5
Organic Carbon	LECO	R&L 6B2	%	0.39	0.31	0.23	0.25
Copper Ex	DTPA	R&L 12A1	mg/kg	0.35	0.47	0.59	0.62
Zinc Ex	DTPA	R&L 12A1	mg/kg	0.20	0.16	0.30	0.31
Manganese Ex	DTPA	R&L 12A1	mg/kg	2.86	1.53	<0.25	1.81
Iron Ex	DTPA	R&L 12A1	mg/kg	67.7	33.6	36.4	32.6
Boron Ex	CaCl ₂	R&L 12C2	mg/kg	0.48	0.37	0.40	0.27
Sol Calcium	SAR	In House	mg/kg	14.3	10.7	5.87	11.3
Sol Magnesium	SAR	In House	mg/kg	158	206	114	208
Sol Sodium	SAR	In House	mg/kg	404	795	753	744
SAR	calculation	-	meq/100g	17.2	33.9	32.1	31.7
Potassium Ex	Colwell	R&L 9B1	mg/kg	150	102	146	166
Potassium Ex	Colwell	R&L 9B1/AAS	meq/100g	0.38	0.26	0.37	0.43

				mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g
Potassium Ex	NH ₄ Cl	R&L 15A1	-	118	0.30	107	0.27	144	0.37	144	0.37
Calcium Ex	NH ₄ Cl	R&L 15A1	-	125	0.63	89	0.45	75.7	0.38	73.8	0.37
Magnesium Ex	NH ₄ Cl	R&L 15A1	-	1057	8.81	1592	13.3	1702	14.2	1771	14.8
Sodium Ex	NH ₄ Cl	R&L 15A1	-	643	2.80	102	0.44	1319	5.73	1343	5.84
Ex Potassium %	Calc	Calc	%	2.41		1.90		1.79		1.73	
Ex Calcium %	Calc	Calc	%	4.99		3.10		1.83		1.73	
Ex Magnesium %	Calc	Calc	%	70.3		91.9		68.6		69.2	
Ex Sodium %	Calc	Calc	%	22.3		3.07		27.8		27.4	
ECEC	Calc	Calc	meq/100g	12.5		14.4		20.7		21.3	
Ca/Mg Ratio	Calc	Calc	meq/100g	0.07		0.03		0.03		0.03	

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L4	L4	L4	L4
				30-50cm	50-70cm	70-90cm	90-110cm
				120674-5	120674-6	120674-7	120674-8
Particle Size Analysis (Hydrometer)							
Clay	Hydrometer	ASTM D422-63	%	29.2	31.2	28.8	33.4
Silt	Hydrometer	ASTM D422-63	%	2.7	2.6	4.4	5.5
Fine Sand	Hydrometer	ASTM D422-63	%	34.6	31.7	36.3	40.0
Coarse Sand	Hydrometer	ASTM D422-63	%	33.4	34.4	30.4	21.1
Gravel	Hydrometer	ASTM D422-63	%	0.1	0.1	0.1	0.0
Saturated Hydraulic Cond.	30cm tension	ASTM F1815-97	mm/hr	0.001	0.03	0.02	0.004
EAT	In water	In House	Class	1	2	2	2
EAT	In SAR 6	In House	Class	6	6	6	6
Bulk Density	Clod/compaction	ASTMF1815	g/cm ³	1.48	1.36	1.37	1.32
Total Porosity	BD and PD	ASTMF1815	% v/v	42.1	48.4	47.3	49.4
Capillary Porosity	Calc	ASTMF1815	% v/v	28.4	27.6	34.4	27.4
Air Filled Porosity	Calc	ASTMF1815	% v/v	13.7	20.9	12.9	22.0
Water Retention	30cm tension	ASTMF1815	% v/v	18.8	20.3	25.0	20.8
Moisture	oven dry	ASTMF1815	% v/v	11.3	13.1	13.6	15.3
Texture	McDonald <i>et al</i>	In House	Class	FSCL	CL	MC	MC



Report Date: 19/12/2012

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L4	L6	L6	L10
				110-130cm	0-15cm	15-30cm	0-15cm
				120674-9	120674-10	120674-11	120674-12
Chlorides	Probe	R&L 5A1	mg/kg	650	17.0	115	10.5
Electrical Conductivity	Soil:Water (1:5)	R&L 3A1	dS/m	0.56	0.03	0.19	0.02
pH (CaCl ₂)	Electrode	R&L 4B1	pH units	5.51	4.45	6.30	4.45
NO ₃ -Nitrogen Ex	Aqueous	In House	mg/kg	4.34	3.75	3.55	2.78
Phosphorus Ex	Colwell	R&L 9B1	mg/kg	11.2	14.5	12.2	15.8
Phosphorus Buffer Index	PBI (Col)	R&L 9I2a	mg/kg	75.8	82.7	70.5	83.0
Sulphur Ex	KCl-40	R&L 10D1	mg/kg	50.8	2.68	10.4	2.73
Organic Carbon	LECO	R&L 6B2	%	0.23	0.89	0.42	0.63
Copper Ex	DTPA	R&L 12A1	mg/kg	0.63	0.33	0.38	0.44
Zinc Ex	DTPA	R&L 12A1	mg/kg	0.32	0.27	0.34	0.30
Manganese Ex	DTPA	R&L 12A1	mg/kg	0.73	8.87	1.84	12.9
Iron Ex	DTPA	R&L 12A1	mg/kg	27.9	189	60.8	228
Boron Ex	CaCl ₂	R&L 12C2	mg/kg	0.18	0.28	0.56	0.38
Sol Calcium	SAR	In House	mg/kg	14.5	2.39	11.7	1.59
Sol Magnesium	SAR	In House	mg/kg	203	4.11	81.0	2.87
Sol Sodium	SAR	In House	mg/kg	725	23.8	231	13.9
SAR	calculation	-	meq/100g	30.9	1.01	9.84	0.59
Potassium Ex	Colwell	R&L 9B1	mg/kg	156	71.9	58.9	166
Potassium Ex	Colwell	R&L 9B1/AAS	meq/100g	0.40	0.18	0.15	0.43

				mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g
Potassium Ex	NH ₄ Cl	R&L 15A1	-	158	0.41	37.7	0.10	45.0	0.12	61.4	0.16
Calcium Ex	NH ₄ Cl	R&L 15A1	-	68.0	0.34	181	0.91	113	0.57	242	1.21
Magnesium Ex	NH ₄ Cl	R&L 15A1	-	1770	14.8	162	1.35	905	7.54	179	1.49
Sodium Ex	NH ₄ Cl	R&L 15A1	-	1343	5.84	58.7	0.26	554	2.41	37.6	0.16
Ex Potassium %	Calc	Calc	%	1.90		3.71		1.09		5.21	
Ex Calcium %	Calc	Calc	%	1.59		34.7		5.31		40.0	
Ex Magnesium %	Calc	Calc	%	69.1		51.8		70.9		49.4	
Ex Sodium %	Calc	Calc	%	27.4		9.79		22.7		5.41	
ECEC	Calc	Calc	meq/100g	21.3		2.61		10.6		3.02	
Ca/Mg Ratio	Calc	Calc	meq/100g	0.02		0.67		0.07		0.81	

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L4	L6	L6	L10
				110-130cm	0-15cm	15-30cm	0-15cm
				120674-9	120674-10	120674-11	120674-12
Particle Size Analysis (Hydrometer)							
Clay	Hydrometer	ASTM D422-63	%	32.3	21.8	25.2	20.1
Silt	Hydrometer	ASTM D422-63	%	7.3	0.7	1.2	0.6
Fine Sand	Hydrometer	ASTM D422-63	%	41.3	29.0	31.6	27.0
Coarse Sand	Hydrometer	ASTM D422-63	%	19.0	48.5	42.0	52.2
Gravel	Hydrometer	ASTM D422-63	%	0.0	0.0	0.0	0.1
Saturated Hydraulic Cond.	30cm tension	ASTM F1815-97	mm/hr	0.02	0.02	0.01	0.04
EAT	In water	In House	Class	2	8	1	8
EAT	In SAR 6	In House	Class	6	8	6	8
Bulk Density	Clod/compaction	ASTMF1815	g/cm ³	1.32	1.65	1.51	1.55
Total Porosity	BD and PD	ASTMF1815	% v/v	48.9	38.9	43.1	44.0
Capillary Porosity	Calc	ASTMF1815	% v/v	27.4	21.0	20.3	21.2
Air Filled Porosity	Calc	ASTMF1815	% v/v	22.0	17.9	22.8	22.8
Water Retention	30cm tension	ASTMF1815	% v/v	20.8	12.7	13.5	13.6
Moisture	oven dry	ASTMF1815	% v/v	13.3	2.52	7.26	2.87
Texture	McDonald <i>et al</i>	In House	Class	MC	*	*	*



Report Date: 19/12/2012

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L10	L12	L12	L12
				15-30cm	0-15cm	15-30cm	30-50cm
				120674-13	120674-14	120674-15	120674-16
Chlorides	Probe	R&L 5A1	mg/kg	8.50	26.0	95.0	183
Electrical Conductivity	Soil:Water (1:5)	R&L 3A1	dS/m	0.09	0.05	0.15	0.24
pH (CaCl ₂)	Electrode	R&L 4B1	pH units	4.60	4.53	5.01	5.27
NO ₃ -Nitrogen Ex	Aqueous	In House	mg/kg	2.37	2.63	3.72	4.43
Phosphorus Ex	Colwell	R&L 9B1	mg/kg	13.0	15.8	12.7	12.8
Phosphorus Buffer Index	PBI (Col)	R&L 9I2a	mg/kg	70.5	80.0	76.1	68.4
Sulphur Ex	KCI-40	R&L 10D1	mg/kg	1.59	6.84	7.94	17.0
Organic Carbon	LECO	R&L 6B2	%	0.54	0.81	0.70	0.49
Copper Ex	DTPA	R&L 12A1	mg/kg	0.22	0.26	0.38	0.43
Zinc Ex	DTPA	R&L 12A1	mg/kg	0.15	0.35	0.17	0.18
Manganese Ex	DTPA	R&L 12A1	mg/kg	4.46	13.5	3.82	1.23
Iron Ex	DTPA	R&L 12A1	mg/kg	135	125	107	61.9
Boron Ex	CaCl ₂	R&L 12C2	mg/kg	0.19	0.32	0.53	0.51
Sol Calcium	SAR	In House	mg/kg	2.47	8.12	16.7	10.2
Sol Magnesium	SAR	In House	mg/kg	4.78	24.4	208	125
Sol Sodium	SAR	In House	mg/kg	15.6	56.5	274	334
SAR	calculation	-	meq/100g	0.66	2.41	11.7	14.2
Potassium Ex	Colwell	R&L 9B1	mg/kg	52.4	96.4	69.4	71.0
Potassium Ex	Colwell	R&L 9B1/AAS	meq/100g	0.13	0.25	0.18	0.18

				mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g
Potassium Ex	NH ₄ Cl	R&L 15A1	-	18.7	0.05	79.1	0.20	59.3	0.15	66.2	0.17
Calcium Ex	NH ₄ Cl	R&L 15A1	-	125	0.63	265	1.33	141	0.71	111	0.56
Magnesium Ex	NH ₄ Cl	R&L 15A1	-	140	1.17	293	2.44	1120	9.33	1324	11.0
Sodium Ex	NH ₄ Cl	R&L 15A1	-	34.4	0.15	109	0.47	529	2.30	758	3.30
Ex Potassium %	Calc	Calc	%	2.41		4.56		1.22		1.13	
Ex Calcium %	Calc	Calc	%	31.4		29.8		5.64		3.69	
Ex Magnesium %	Calc	Calc	%	58.7		55.0		74.7		73.3	
Ex Sodium %	Calc	Calc	%	7.52		10.7		18.4		21.9	
ECEC	Calc	Calc	meq/100g	1.99		4.44		12.5		15.1	
Ca/Mg Ratio	Calc	Calc	meq/100g	0.54		0.54		0.08		0.05	

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L10	L12	L12	L12
				15-30cm	0-15cm	15-30cm	30-50cm
				120674-13	120674-14	120674-15	120674-16
Particle Size Analysis (Hydrometer)							
Clay	Hydrometer	ASTM D422-63	%	20.1	24.0	27.8	25.3
Silt	Hydrometer	ASTM D422-63	%	0.8	1.9	1.4	2.1
Fine Sand	Hydrometer	ASTM D422-63	%	27.3	30.0	33.1	31.9
Coarse Sand	Hydrometer	ASTM D422-63	%	51.7	44.0	37.7	40.3
Gravel	Hydrometer	ASTM D422-63	%	0.1	0.1	0.1	0.3
Saturated Hydraulic Cond.	30cm tension	ASTM F1815-97	mm/hr	0.01	0.003	0.01	0.01
EAT	In water	In House	Class	8	2	1	2
EAT	In SAR 6	In House	Class	6	6	6	6
Bulk Density	Clod/compaction	ASTMF1815	g/cm ³	1.66	1.62	1.44	1.42
Total Porosity	BD and PD	ASTMF1815	% v/v	37.5	39.6	43.9	42.0
Capillary Porosity	Calc	ASTMF1815	% v/v	19.6	18.1	18.1	18.8
Air Filled Porosity	Calc	ASTMF1815	% v/v	17.9	21.5	25.7	23.2
Water Retention	30cm tension	ASTMF1815	% v/v	11.8	11.2	12.6	13.2
Moisture	oven dry	ASTMF1815	% v/v	2.38	4.56	8.75	10.5
Texture	McDonald <i>et al</i>	In House	Class	*	FSCL	FSCL	FSCL



Report Date: 19/12/2012

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L12	L12	L12	L12
				50-70cm	70-90cm	90-110cm	110-130cm
				120674-17	120674-18	120674-19	120674-20
Chlorides	Probe	R&L 5A1	mg/kg	315	355	345	200
Electrical Conductivity	Soil:Water (1:5)	R&L 3A1	dS/m	0.35	0.34	0.35	0.24
pH (CaCl ₂)	Electrode	R&L 4B1	pH units	6.24	6.38	6.83	6.63
NO ₃ -Nitrogen Ex	Aqueous	In House	mg/kg	8.84	4.81	3.31	3.43
Phosphorus Ex	Colwell	R&L 9B1	mg/kg	12.2	14.3	17.3	13.7
Phosphorus Buffer Index	PBI (Col)	R&L 9I2a	mg/kg	67.0	67.4	67.9	61.3
Sulphur Ex	KCl-40	R&L 10D1	mg/kg	29.0	32.4	35.8	22.3
Organic Carbon	LECO	R&L 6B2	%	0.27	0.20	0.14	0.14
Copper Ex	DTPA	R&L 12A1	mg/kg	0.44	0.57	0.63	0.63
Zinc Ex	DTPA	R&L 12A1	mg/kg	0.16	0.44	0.23	0.28
Manganese Ex	DTPA	R&L 12A1	mg/kg	1.85	0.71	1.43	1.65
Iron Ex	DTPA	R&L 12A1	mg/kg	23.6	24.0	30.0	44.2
Boron Ex	CaCl ₂	R&L 12C2	mg/kg	0.43	0.33	0.32	0.32
Sol Calcium	SAR	In House	mg/kg	4.77	8.57	4.16	6.17
Sol Magnesium	SAR	In House	mg/kg	13.5	270	11.3	166
Sol Sodium	SAR	In House	mg/kg	339	521	338	313
SAR	calculation	-	meq/100g	14.4	22.2	14.4	13.3
Potassium Ex	Colwell	R&L 9B1	mg/kg	146	125	110	162
Potassium Ex	Colwell	R&L 9B1/AAS	meq/100g	0.37	0.32	0.28	0.42

				mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g	mg/kg	meq/100g
Potassium Ex	NH ₄ Cl	R&L 15A1	-	103	0.26	94.7	0.24	107	0.27	123	0.32
Calcium Ex	NH ₄ Cl	R&L 15A1	-	95.8	0.48	79.5	0.40	96.4	0.48	76.0	0.38
Magnesium Ex	NH ₄ Cl	R&L 15A1	-	1779	14.8	1888	15.7	1871	15.6	1711	14.3
Sodium Ex	NH ₄ Cl	R&L 15A1	-	1111	4.83	1159	5.04	1156	5.03	1046	4.55
Ex Potassium %	Calc	Calc	%	1.29		1.13		1.28		1.62	
Ex Calcium %	Calc	Calc	%	2.35		1.86		2.26		1.95	
Ex Magnesium %	Calc	Calc	%	72.7		73.5		72.9		73.1	
Ex Sodium %	Calc	Calc	%	23.7		23.5		23.5		23.3	
ECEC	Calc	Calc	meq/100g	20.4		21.4		21.4		19.5	
Ca/Mg Ratio	Calc	Calc	meq/100g	0.03		0.03		0.03		0.03	



Report Date: 19/12/2012

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L12	L12	L12	L12
				50-70cm	70-90cm	90-110cm	110-130cm
				120674-17	120674-18	120674-19	120674-20
Particle Size Analysis (Hydrometer)							
Clay	Hydrometer	ASTM D422-63	%	24.0	26.9	23.9	23.7
Silt	Hydrometer	ASTM D422-63	%	3.0	2.1	1.9	2.0
Fine Sand	Hydrometer	ASTM D422-63	%	32.7	32.7	32.2	32.2
Coarse Sand	Hydrometer	ASTM D422-63	%	40.3	38.3	42.0	42.1
Gravel	Hydrometer	ASTM D422-63	%	0.0	0.0	0.0	0.0
Saturated Hydraulic Cond.	30cm tension	ASTM F1815-97	mm/hr	0.01	0.01	0.01	0.01
EAT	In water	In House	Class	1	3a	3a	3a
EAT	In SAR 6	In House	Class	6	6	6	6
Bulk Density	Clod/compaction	ASTMF1815	g/cm ³	1.39	1.41	1.44	1.51
Total Porosity	BD and PD	ASTMF1815	% v/v	42.4	43.1	43.2	38.5
Capillary Porosity	Calc	ASTMF1815	% v/v	19.6	20.5	21.2	23.0
Air Filled Porosity	Calc	ASTMF1815	% v/v	22.8	22.6	22.0	15.5
Water Retention	30cm tension	ASTMF1815	% v/v	14.1	14.5	14.8	15.2
Moisture	oven dry	ASTMF1815	% v/v	13.7	15.1	14.1	15.6
Texture	McDonald <i>et al</i>	In House	Class	SC	SC	SC	SC



Report Date: 19/12/2012

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L13	L13	L15	L15
				0-15cm	15-30cm	0-15cm	15-30cm
				120674-21	120674-22	120674-25	120674-26
Chlorides	Probe	R&L 5A1	mg/kg	30.0	100	21.5	39.0
Electrical Conductivity	Soil:Water (1:5)	R&L 3A1	dS/m	0.05	0.18	0.04	0.07
pH (CaCl ₂)	Electrode	R&L 4B1	pH units	5.20	6.07	4.37	4.59
NO ₃ -Nitrogen Ex	Aqueous	In House	mg/kg	2.22	2.94	4.49	2.72
Phosphorus Ex	Colwell	R&L 9B1	mg/kg	15.6	13.0	14.1	16.7
Phosphorus Buffer Index	PBI _(Col)	R&L 9I2a	mg/kg	76.1	76.1	96.7	84.1
Sulphur Ex	KCl-40	R&L 10D1	mg/kg	3.36	6.58	10.5	2.94
Organic Carbon	LECO	R&L 6B2	%	0.68	0.48	1.11	0.68
Copper Ex	DTPA	R&L 12A1	mg/kg	0.55	0.48	0.34	0.34
Zinc Ex	DTPA	R&L 12A1	mg/kg	0.42	0.24	0.25	0.32
Manganese Ex	DTPA	R&L 12A1	mg/kg	20.6	2.68	11.9	3.82
Iron Ex	DTPA	R&L 12A1	mg/kg	89.6	69.0	163	153
Boron Ex	CaCl ₂	R&L 12C2	mg/kg	0.35	0.41	0.35	0.62
Sol Calcium	SAR	In House	mg/kg	15.3	11.6	6.54	40.7
Sol Magnesium	SAR	In House	mg/kg	59.8	43.6	21.8	7.9
Sol Sodium	SAR	In House	mg/kg	72.9	199	32.7	21.4
SAR	calculation	-	meq/100g	3.11	8.48	1.39	0.91
Potassium Ex	Colwell	R&L 9B1	mg/kg	74.7	69.4	116	518
Potassium Ex	Colwell	R&L 9B1/AAS	meq/100g	0.19	0.18	0.30	1.33
				mg/kg	meq/100g	mg/kg	meq/100g
Potassium Ex	NH ₄ Cl	R&L 15A1	-	45.6	0.12	61.8	0.16
Calcium Ex	NH ₄ Cl	R&L 15A1	-	329	1.65	309	1.55
Magnesium Ex	NH ₄ Cl	R&L 15A1	-	461	3.84	1115	9.29
Sodium Ex	NH ₄ Cl	R&L 15A1	-	128	0.56	484	2.10
Ex Potassium %	Calc	Calc	%	1.90	1.21	5.14	1.89
Ex Calcium %	Calc	Calc	%	26.70	11.8	27.7	8.33
Ex Magnesium %	Calc	Calc	%	62.4	70.9	59.2	75.4
Ex Sodium %	Calc	Calc	%	9.03	16.1	7.97	14.3
ECEC	Calc	Calc	meq/100g	6.16	13.1	4.56	9.3
Ca/Mg Ratio	Calc	Calc	meq/100g	0.43	0.17	0.47	0.11

ANALYSIS REPORT

Project No: EW120674

Location: Leewood

Test Parameter	Method Description	Method Reference	Sample ID Depth Units	L13	L13	L15	L15
				0-15cm	15-30cm	0-15cm	15-30cm
				120674-21	120674-22	120674-25	120674-26
Particle Size Analysis (Hydrometer)							
Clay	Hydrometer	ASTM D422-63	%	26.0	28.9	24.9	23.2
Silt	Hydrometer	ASTM D422-63	%	1.9	1.9	2.6	2.7
Fine Sand	Hydrometer	ASTM D422-63	%	30.8	33.2	35.6	36.6
Coarse Sand	Hydrometer	ASTM D422-63	%	41.3	35.9	36.8	37.4
Gravel	Hydrometer	ASTM D422-63	%	0.0	0.1	0.1	0.1
Saturated Hydraulic Cond.	30cm tension	ASTM F1815-97	mm/hr	0.001	0.002	0.002	0.003
EAT	In water	In House	Class	3a	1	3a	1
EAT	In SAR 6	In House	Class	6	6	8	6
Bulk Density	Clod/compaction	ASTMF1815	g/cm ³	1.55	1.43	1.56	1.57
Total Porosity	BD and PD	ASTMF1815	% v/v	41.4	45.5	39.1	33.8
Capillary Porosity	Calc	ASTMF1815	% v/v	20.8	19.8	22.0	22.5
Air Filled Porosity	Calc	ASTMF1815	% v/v	20.5	25.6	17.1	11.3
Water Retention	30cm tension	ASTMF1815	% v/v	13.5	13.90	14.1	14.4
Moisture	oven dry	ASTMF1815	% v/v	3.76	8.66	3.95	9.23
Texture	McDonald <i>et al</i>	In House	Class	*	*	*	*



Report Date: 19/12/2012

Santos Activities Update – May 2014

SANTOS UPDATE – May 2014

Proposed upcoming work program – Narrabri Area

Time frames are indicative as schedules are dependent on factors such as approval times, weather and rig availability.

Decommissioning of wells:

- There are no plug and abandon activities planned for May

Workovers:

- The workover program is continuing with work being undertaken at the Bibblewindi East and Bibblewindi West pilot wells during May
- The workover rig is used to install and/or maintain pumps on existing wells

Drilling of exploration core holes:

- There are no core hole activities planned for May

Pilot wells:

- Drilling continues on the Dewhurst 26 – 29 well sets
- Rig is currently at Dewhurst 29 and is expected to complete current work program in May
- Tintsville pilot and Bibblewindi East pilot are on-line with the Bibblewindi West pilot off-line for workover program

Leewood

- The transfer of water from the pond at Bibblewindi to Leewood will be ongoing throughout May
- Installation of the liner of the second pond cell at Leewood is also nearing completion

- Completion of the remaining pond cells is expected later in the year
- The Review of Environmental Factors (REF) for Leewood Phase 2 is being prepared
- The proposed activity involves the construction of treatment facilities for produced water and brine at Leewood
- Community consultation activities for Leewood Phase 2 will be undertaken when the scope of the project is finalised

Other work:

- Wilga Park Power Station has been re-commissioned but is presently off-line as there is no gas flowing from the Bibblewindi West pilot as work being undertaken as part of the workover program

Site visits:

- The next scheduled community site visit will take place on Thursday 22 May. If you are interested in attending or would like more information, please call Lesley Anderson on 6792 9035 or email lesley.anderson@santos.com

Community:

- Santos has donated a second hand vehicle to the Friendly Faces Helping Hands Foundation to assist with the great work of the organisation
- Santos Narrabri Blue Boars major sponsor day will be held on 24 May 2014 at Dangar Park at Narrabri with the Blue Boars vs Gunnedah
- Work on the extension of our Maitland Street shopfront has been completed and upgrades to the Narrabri Operations Centre are progressing well

Other:

- Intermittent protest action in operational areas

- The next meeting of the Santos Community Committee on CSG for the Narrabri Shire will be held on Wednesday 14 May

Environmental Protection Licence

- On 1 May 2014 the Environment Protection Authority issued an Environment Protection Licence (EPL) to Santos for its coal seam gas (CSG) exploration, assessment and production activities in the Pilliga area, south of Narrabri in New South Wales.
- The EPL includes over 75 conditions covering the drilling of wells and the operation and maintenance of CSG infrastructure including wells, pipelines, flares and access tracks, the transfer and storage of produced water and the monitoring of groundwater across the activity area.
- In 2013 the NSW Government passed legislation requiring all CSG exploration, assessment and/or production activities to hold an EPL under the *Protection of the Environment Operations Act 1997*.
- Many other industries are also required to hold an EPL for their activities, including irrigated agriculture (corporation), boat construction, intensive livestock operations, sawmilling, dairy processing, road construction, composting, and mining.

Meeting Action Item Response

Reference:	20140514_NCCC
Subject:	Meeting Action Items – Leewood Site Visit and April 2014 Meeting Narrabri CCC
Request date:	Various dates in April and May 2014
Requested by:	David Ross Chair Narrabri CCC
Background Request:	<ol style="list-style-type: none"> 1. A committee member noticed power cables around Bibblewindi and the well site and wants to know if Santos is supplying its own power 2. A committee member has asked for someone like the EPA, OCSG to come and talk at one of our meetings about the alleged spill.
Response:	<p>Item 1 - <i>A committee member noticed power cables around Bibblewindi and the well site and wants to know if Santos is supplying its own power</i></p> <ul style="list-style-type: none"> • The power cables onsite are used to power various items of equipment including instrumentation, pumps and associated control equipment. • Much of the smaller cabling that is evident on each site is used to provide operational data back to the control system that then relays the information via the telemetry units to our personnel. • Power at these sites is provided from the gas generators that we have at the various wells. • If gas is not available (typically during start up) then we use diesel generators on a temporary basis.
	<p>Item 2 - <i>A committee member has asked for someone like the EPA, OCSG to come and talk at one of our meetings about the alleged spill.</i></p> <ul style="list-style-type: none"> • [Clarified with Chair that this refers to the Pilliga Ponds incident] • A copy of the Department of Trade and Investment Fact Sheet was provided to the Narrabri CCC on 13 March 2014 • A request for consideration to provide a representative of the department to attend a future meeting of the Narrabri CCC has been sent to the NSW Office of Coal Seam Gas
Briefing Officer:	Annie Moody Team Leader, Community and Land
Date:	12 May 2014



A site in Queensland.

14/5/14

Tabled as comment. Tony P.