

## Yarraman Landfill (now closed)

Location: Mungindi Road (Carnarvon Highway), Moree NSW 2400 Environment Protection Licence Number: 5903 (Surrender approved by EPA 9 April 2020.)

Previous activities: Waste disposal to land and waste processing

Licensee under Protection of Environment Operations Act 1997 (POEO Act): Moree Plains Shire Council, PO Box 420, Moree NSW 2400

The internet link to Licence No. 5903 is <https://apps.epa.nsw.gov.au/prpoeoapp/ViewPOEOLicence.aspx?DOCID=135442&SYSUID=1&LICID=5903>

Council is required to monitor methane, groundwater and leachate at various sampling points. As the facility is now closed, there is no longer leachate or building methane available for sampling. Council continues to monitor groundwater and surface methane. This document details recent results. To meet its obligation under Section 66 (6) of the POEO Act, a link to the current version of this document is available on Council's website.

Locations of the groundwater monitoring wells are shown on the adjacent figure. Historical names are used. TMB stands for Tip Moree Bore. [A bore hole is an investigative hole. When casing and screen are installed for monitoring, it is called a monitoring well.] Corresponding Environment Protection Authority (EPA) Identification Numbers are provided below.

### Groundwater monitoring wells

EPA No. 1	TMB1
EPA No. 2	TMB2
EPA No. 3	TMB3
EPA No. 4	TMB4
EPA No. 5	TMB5
EPA No. 6	TMB6
EPA No. 7	TMB7

### Leachate quality monitoring

EPA No. 8 - in active cell  
(no longer exists)

### Methane monitoring

EPA No. 9	Surface
EPA No. 10	Building



Map plotted on Google Earth Pro 2020.

Monitoring results for the last four years are presented on following pages – as required in the EPA publishing requirements.

**Groundwater quality analytes** are organised in the following tables according to chemical grouping. This assists chemical review. [Analytes are listed on the licence in alphabetical order.] The left-hand table provides the field test results. The field tests are conducted during sampling or in the case of alkalinity and free carbon dioxide on the sampling day. The right-hand table provides analytical results from the NATA registered laboratory. The date the laboratory issued the results is first, followed by the date by which results were placed on the Moree Plains Shire Council website.

Abbreviations made in the tables are provided here in alphabetical order:

Alk = Alkalinity measured as mg/L CaCO<sub>3</sub> equivalent; As = Arsenic; Cd = Cadmium; Cl = Chloride; Cr = Chromium; DO = Dissolved Oxygen; EC = Electrical Conductivity also called conductivity; Eh = Redox Potential; Fe = Iron; K = Potassium; Pb = Lead; LOR = Level of reporting; Mn = Manganese; NH<sub>3</sub> = Ammonia as a measure of ammonium ions; NO<sub>x</sub> = Nitrite + Nitrate; SO<sub>4</sub> = Sulphate; Temp = Temperature; TKN = Total Kjeldahl Nitrogen (organic nitrogen and ammonia); TN = Total Nitrogen; TOC = Total Organic Carbon.

Measures:

mg/L = milligram per litre (equivalent to ppm), µS/cm = microSiemens per centimetre; mV = millivolts; °C = degrees Celsius; ppm = parts per million; < = less than.

Choice of groundwater quality analytes:

Some analytes are tested because they give a general understanding of groundwater, surface water and leachate quality. The concentrations are usually greater in leachate than in groundwater and surface water. A simple comparison can tell us if landfill leachate may have escaped into groundwater or surface water. However, care is needed when reviewing these general results so that false conclusions are not made. The salt levels in groundwater are a case in point. EC is an indicator of salt levels. If the EC has previously been low, and then become high one would assume it is due to landfill leachate ingress into groundwater. The Yarraman Landfill groundwater has relatively low EC because it resides in gravel aquifers. In some wells, flood waters have increased the EC, and in the others decreased the EC. The increases have not been sufficient to say that they are due to landfill leachate.

Other analytes give us more specific information about the possible presence of landfill leachate in groundwater and surface water. Even with these we must carefully consider if their increased concentrations are definitely due to landfill leachate and are not from some other source.

- Nitrogen compounds indicate biodegradation of the plant and animal waste in our solid waste. They may also be due to fertilizer use on nearby properties. A general rule of thumb is that total nitrogen (TKN + NO<sub>x</sub>) should be <5 mg/L.
- Iron and manganese above 10 mg/L is an indicator that landfill leachate may be present in groundwater. However, these groundwater analytes may have increased due to leaching of iron and manganese from the soil after excessive rainfall or flood water infiltration.
- Organic analytes such as BTEX compounds are most likely to indicate landfill leachate, especially if they haven't been detected before.

So it is important to monitor on a regular basis to note any changes in water quality analyte concentrations and to judicially review the results. Increases in groundwater and surface water analyte concentrations due to landfill leachate intrusion are often at least three to four times the previous concentrations.

Comments on groundwater quality monitoring results: TMB2 is upgradient of the landfill. It regularly has higher TN concentrations that are common in cropping areas, but the well is upgradient from the landfill, hence the thought that the TN is from fertilizers rather than the landfill. TMB3 is very close to the landfill. It was inundated by flood water in April 2012. By September 2019, the well was dry and therefore had fallen by 5.72 metres. The total nitrogen concentrations are occasionally >5 mg/L, but dissipate once the well has been cleaned out. This indicates that the nitrogen contamination is localised and/or caused by gecko droppings in the well when the water column becomes shallow. Due to the drought, groundwater levels have declined considerably and all monitoring wells, and except for the deeper TMB5, are now dry. The Landfill now has its final engineered cover with a revegetation layer on top and the EPA on 9 April 2020 approved the surrender of its Environment Protection Licence. The Surrender Notice requires maintenance of the final cover, and groundwater and methane monitoring until 9 April 2022. No landfill leachate contamination of concern has been noted since sampling commenced in Year 2001.

**Table 1: Groundwater quality (TMB1, TMB2)**

Frequency required by licence	DO	EC	pH	Eh	Temp	Alk	Received from laboratory	Accessible on Council website	SO <sub>4</sub>	Cl	K	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	As	Cd	Cr	Pb	Mn	Fe	TOC
									mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
<b>TMB1</b> Quarterly							<b>TMB1</b>															
04/03/14	2.68	1180	6.45	-28	26.4	387	17/03/14	31/03/14	48	157	3	0.37	0.01	0.8	0.8	0.004	<0.0001	<0.001	<0.001	12.3	2.57	1
14/07/14	Insuffi cient		groun dwater																			
27/11/14	DRY																					
16/10/16	Only 1 cm		water																			
21/05/17	DRY																					
23/09/17	DRY																					
25/03/18	DRY																					
14/08/18	DRY																					
06/03/19	DRY																					
28/09/19	DRY																					
26/05/20	DRY																					
28/09/20	DRY																					
22/02/21	DRY																					
13/09/21	Only 1.5 cm		water																			
18/03/22	DRY																					
<b>TMB2</b> Quarterly							<b>TMB2</b>															
04/03/14	1.18	864	6.51	+75	24.8	230	17/03/14	31/03/14	86	50	3	0.04	14.1	<0.1	14.1	<0.001	<0.0001	<0.001	<0.001	0.023	<0.05	2
14/07/14	5.55	853	6.56	+193	21.2	210	23/07/14	01/08/14	75	53	3	0.02	15.8	2.9	18.7	<0.001	<0.0001	<0.001	<0.001	0.011	<0.05	5
27/11/14	0.77	920	6.57	+99	27.7	253	11/12/14	23/12/14	81	51	2	0.04	13.9	1.9	15.8	<0.001	<0.0001	<0.001	<0.001	0.008	<0.05	1
21/05/17	2.71	771	6.15	+291	22.6	190	30/05/17	19/06/17	49	41	2	<0.01	20.0	5.7	25.7	<0.001	<0.0001	<0.001	<0.001	0.024	<0.05	4
23/09/17	2.73	768	6.87	+130	22.7	183	29/09/17	20/10/17	47	37	2	0.02	19.0	3.7	22.7	<0.001	<0.0001	<0.001	<0.001	0.054	<0.05	2
25/03/18	3.70	878	6.94	+105	18.3	173	05/04/18	25/04/18	53	40	2	0.03	20.3	1.0	21.3	<0.001	<0.0001	<0.001	<0.001	0.002	<0.05	2
14/08/18	2.61	828	8.22	+132	23.1	183	23/08/18	12/09/18	55	45	2	0.05	22.4	1.2	23.6	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.05	3
06/03/19	1 cm		water																			
28/09/19	DRY																					
26/05/20	3 cm		water																			
28/09/20	2 cm		water																			
22/02/21	2 cm		water																			
13/09/21	5.11	877	6.39	+69	21.7	253	23/09/21	13/10/21	88	49	3	<0.01	23.4	2.6	26.0	<0.001	<0.0001	<0.001	<0.001	0.015	<0.05	11
18/03/22	3.70	856	6.36	97	25.7	157	31/03/22	22/04/22	61	43	2	0.06	24.0	2.5	26.5	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.05	6

**Table 2: Groundwater quality (TMB3 and TMB4)**

Frequency required by licence	DO	EC	pH	Eh	Temp	Alk	Received from laboratory	Accessible on Council website	SO <sub>4</sub>	Cl	K	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	As	Cd	Cr	Pb	Mn	Fe	TOC		
Measure	mg/L	µS/cm	1-14	mV	°C	mg/L			mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		
<b>TMB3</b> Quarterly							<b>TMB3</b>																	
04/03/14	1.46	1310	6.64	-22	24.0	500	17/03/14	31/03/14	29	111	9	8.19	8.12	11.2	19.3	0.004	0.0001	<0.001	<0.001	8.44	0.29		21	
14/07/14	5.28	1476	6.92	+31	22.4	900	23/07/14	01/08/14	28	141	4	0.61	<0.01	2.3	2.3	0.004	0.0002	<0.001	<0.001	6.89	0.09		22	
27/11/14	7.03	1411	7.14	+40	28.5	545	11/12/14	23/12/14	33	113	4	0.79	0.02	2.5	2.5	0.003	0.0005	<0.001	<0.001	5.94	<0.05		10	
21/05/17	Insufficient groundwater																							
23/09/17	4.48	1032	6.42	+147	24.1	367	29/09/17	20/10/17	35	70	2	0.10	6.94	0.7	7.6	0.004	<0.0001	<0.001	<0.001	4.63	0.12		5	
25/03/18	DRY																							
14/08/18	DRY																							
06/03/19	1 cm water																							
28/09/19	DRY																							
26/05/20	DRY																							
28/09/20	DRY																							
22/02/21	DRY																							
13/09/21	5.54	1022	6.61	+82	21.5	337	23/09/21	13/10/21	60	55	3	0.25	15.6	3.8	19.4	<0.001	<0.0001	<0.001	<0.001	5.75	<0.05		10	
18/03/22	2 cm water																							
<b>TMB4</b> Quarterly							<b>TMB4</b>																	
04/03/14	2.20	1398	6.45	-105	26.8	583	17/03/14	31/03/14	30	130	3	1.06	0.01	2.3	2.3	0.038	<0.0001	<0.001	<0.001	13.70	13.80		8	
14/07/14	1.25	1869	6.45	-78	23.3	607	23/07/14	01/08/14	183	159	3	2.88	0.02	4.4	4.4	0.065	<0.0001	<0.001	<0.001	14.00	18.7		36	
27/11/14	Insufficient groundwater																							
21/05/17	DRY																							
23/09/17	DRY																							
25/03/18	DRY																							
14/08/18	DRY																							
06/03/19	DRY																							
28/09/19	DRY																							
26/05/20	DRY																							
28/09/20	DRY																							
22/02/21	DRY																							
13/09/21	DRY																							
18/03/22	DRY																							



**Table 3: Groundwater quality (TMB5 and TMB6)**

Frequency required by licence		DO	EC	pH	Eh	Temp	Alk	Received from laboratory	Accessible on Council website	SO <sub>4</sub>	Cl	K	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	As	Cd	Cr	Pb	Mn	Fe	TOC
Measure		mg/L	µS/cm	1-14	mV	°C	mg/L			mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
<b>TMB5</b>	Quarterly							<b>TMB5</b>															
04/03/14		0.42	1460	6.51	-64	25.4	560	17/03/14	31/03/14	61	154	2	0.19	0.01	1.4	1.4	0.059	<0.0001	<0.001	<0.001	6.28	4.96	12
14/07/14		0.71	1546	6.44	-45	23.9	581	23/07/14	01/08/14	68	152	2	0.30	<0.01	1.6	1.6	0.092	<0.0001	<0.001	<0.001	5.37	5.92	20
27/11/14		3.65	1515	6.48	-55	28.4	617	11/12/14	23/12/14	73	145	2	0.26	0.01	1.2	1.2	0.047	<0.0001	<0.001	<0.001	4.70	4.22	10
21/05/17		0.47	1262	6.52	-5	24.9	477	30/05/17	19/06/17	56	110	2	0.02	0.01	0.6	0.6	0.003	0.0002	<0.001	<0.001	1.99	0.70	10
23/09/17		0.32	1256	6.50	-3	30.7	477	29/09/17	20/10/17	50	108	2	0.02	0.01	0.5	0.5	0.003	0.0002	<0.001	<0.001	1.67	0.58	10
25/03/18		1.01	1235	6.44	+15	29.4	463	05/04/18	25/04/18	51	98	2	0.02	2.06	0.6	2.7	0.002	0.0008	<0.001	<0.001	1.05	0.09	8
14/08/18		1.06	1180	6.89	+98	22.2	487	23/08/18	12/09/18	48	94	2	0.03	1.68	0.6	2.3	0.001	0.0005	<0.001	<0.001	1.13	<0.05	7
06/03/19		1.03	919	6.62	+74	29.2	353	14/03/19	03/04/19	29	66	2	0.01	0.29	<0.1	0.3	0.001	0.0002	0.001	<0.001	0.449	<0.05	9
28/09/19		1.07	881	6.41	+133	27.1	337	14/10/19	01/11/19	27	72	2	0.01	0.07	<0.1	<0.1	<0.001	0.0003	<0.001	<0.001	1.03	<0.05	<1
26/05/20		0.90	935	6.59	+119	24.0	370	08/06/20	26/06/20	34	80	3	<0.01	0.03	0.1	0.1	<0.001	0.0003	<0.001	<0.001	0.913	0.05	<2
28/09/20		5.63	792	6.57	+135	24.0	300	09/10/20	29/10/20	29	75	2	<0.01	0.25	0.2	0.4	0.002	0.0002	<0.001	<0.001	0.183	<0.05	10
22/02/21		0.53	897	6.58	+45	25.4	400	03/03/21	23/03/21	29	73	2	0.01	0.01	0.1	0.1	0.002	0.0003	<0.001	<0.001	1.09	0.10	9
13/09/21		0.70	1259	6.52	-115	23.3	620	23/09/21	13/10/21	39	120	4	0.07	0.02	0.6	0.6	0.002	<0.0001	<0.001	<0.001	2.16	0.71	12
18/03/22		1.36	1229	6.54	-21	26.8	587	31/03/22	22/04/22	46	104	2	0.04	0.01	0.4	0.4	0.002	<0.0001	<0.001	<0.001	2.20	0.42	12
<b>TMB6</b>	Quarterly							<b>TMB6</b>															
04/03/14		0.38	835	6.45	+100	23.6	295	17/03/14	31/03/14	48	69	1	0.03	1.55	0.6	2.2	<0.001	<0.0001	<0.001	<0.001	0.009	<0.05	<1
14/07/14		0.45	690	6.27	+135	22.6	281	23/07/14	01/08/14	33	44	<1	0.02	2.54	0.5	3.0	<0.001	<0.0001	<0.001	<0.001	0.032	<0.05	3
27/11/14		2.97	707	6.13	+92	27.0	212	11/12/14	23/12/14	48	68	1	0.03	1.21	0.4	1.6	0.001	<0.0001	<0.001	<0.001	0.010	<0.05	2
21/05/17		DRY																					
23/09/17		DRY																					
25/03/18		DRY																					
14/08/18		DRY																					
06/03/19		DRY																					
28/09/19		DRY																					
26/05/20		DRY																					
28/09/20		DRY																					
22/02/21		DRY																					
13/09/21		DRY																					
18/03/22		DRY																					

**Table 4: Groundwater quality (TMB7)**

Frequency required by licence	DO	EC	Ph	Eh	Temp	Alk	Received from laboratory	Accessible on Council website	SO <sub>4</sub>	Cl	K	NH <sub>3</sub>	NO <sub>x</sub>	TKN	TN	As	Cd	Cr	Pb	Mn	Fe	TOC
Measure	mg/L	µS/cm	1-14	Mv	°C	mg/L			mg/L	mg/L	mg/L	mg/L as N	mg/L as N	mg/L as N	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
<b>TMB7</b> Quarterly							<b>TMB7</b>															
04/03/14	2.05	1127	6.34	+56	25.3	430	17/03/14	31/03/14	15	124	2	0.25	<0.01	1.4	1.4	0.001	<0.0001	<0.001	<0.001	13.10	0.16	4
14/07/14	Insuffi cient		groun dwater																			
27/11/14	DRY																					
14/08/15	DRY																					
11/03/16	DRY																					
16/10/16	DRY																					
21/05/17	Insuffi cient		groun dwater																			
23/09/17	DRY																					
25/03/18	DRY																					
14/08/18	DRY																					
06/03/19	DRY																					
28/09/19	DRY																					
26/05/20	DRY																					
28/09/20	DRY																					
22/02/21	DRY																					
13/09/21	DRY																					
18/03/22	DRY																					

**Methane** is a colourless, odourless gas that is flammable and explosive. It is generated approximately three months after the deposition of putrescible solid waste and once oxygen is depleted. Testing is conducted above ground surfaces to assure that none is escaping to air, and in buildings to assure against asphyxiation and explosion. No buildings remain on the Yarraman Landfill, so no building methane monitoring is required.

Comments on surface methane monitoring results: Methane is occasionally detected on covered areas of the landfill, but is remediated with soil cover, usually by the next day.

**Table 5: Methane detections (surface only – no buildings remain)**

Frequency required by licence	Detection locations	Methane (CH <sub>4</sub> ) by volume in air	Methane (CH <sub>4</sub> ) by volume in air	Methane (CH <sub>4</sub> ) as % LEL (Lower Explosive Limit)	Accessible on Council website
Measure		ppm CH <sub>4</sub> in air	% CH <sub>4</sub> in air	% LEL	
6 monthly					
04/03/14	Nil detected				31/03/14
14/07/14	Nil detected				01/08/14
27/11/04	Nil detected				23/12/14
14/08/15	Nil detected				09/09/15
11/03/16	In NE corner test pit	565	0.056%	1.12%	13/04/16
16/10/16	Nil detected				15/11/16
21/05/17	Nil detected				19/06/17
23/09/17	Nil detected				20/10/17
25/03/18	Nil detected				25/04/18
14/08/18	Nil detected				12/09/18
06/03/19	Nil detected				03/04/19
28/09/19	Nil detected				01/11/19
26/05/20	Nil detected				26/06/20
28/09/20	Nil detected				29/10/20
22/02/21	Nil detected				23/03/21
13/09/21	Nil detected				13/10/21
18/03/22	Nil detected				22/04/22

Note: 500 ppm CH<sub>4</sub> by volume in air = 0.05% CH<sub>4</sub> by volume in air = 1% LEL