ENVIRONMENT
& HEALTH

John Holland Rail
Michael Hooper
Public Spaces – Portable Field XRF Measurements
Tamworth NSW 2240

Delivered: by email

Dear Michael,

Tarago Rail Corridor Lead Contamination – Assessment of Public Spaces by Portable XRF

Date 19/08/2020

Ramboll was engaged by John Holland Rail (JHR) on behalf of Transport for NSW (TfNSW) to assess and provide management advice relating to potential lead contamination originating from the rail corridor at Tarago, NSW. Lead contamination within the rail corridor at Tarago has resulted from historic load-out by rail of ore concentrate originating at the Woodlawn mine.

In November 2019 the site was notified to the NSW Environment Protection Authority (EPA) under Section 60 of the *Contaminated Land Management Act 1997* (CLM Act) and on 25 March 2020 the NSW EPA declared the site to be significantly contaminated under Section 11 of the CLM Act (Declaration Number: 20201102; Area Number 3455).The site was published on the EPA's list of notified sites as "contamination is regulated by the EPA under the CLM Act". The declaration defines the substance of concern ("the Contaminant") in soil as lead described as follows:

1. lead concentrations in soil within the rail corridor (Lot 22 DP1202608) exceed national guideline values for the protection of human health and the environment
2. lead contamination has impacted adjacent land at 106 Goulburn Street, Tarago (Lot 1 DP816626), with soil found to contain lead at concentrations exceeding national guideline values for the protection of human health and the environment
3. there are complete exposure pathways to lead for occupants of 106 Goulburn Street, as well as potentially complete exposure pathways for persons working within the rail corridor and
4. there are potentially complete exposure pathways for onsite and offsite ecological receptors.

A voluntary management proposal (VMP) was prepared to define how the Contaminant and associated risks would be managed and this was approved by the NSW EPA on 28 May 2020.

Ramboll
Level 2, Suite 18 Eastpoint
50 Glebe Road
PO Box 435
The Junction
NSW 2291
Australia

T +61 2 4962 5444
https://ramboll.com

Ramboll Australia Pty Ltd.
ACN 095 437 442
ABN 49 095 437 442

Principal features of the VMP as relate to assessment of the Contaminant include:

P1. Appoint a NSW EPA auditor accredited under the Contamination Land Management Act 1997.

P2. Collate and review data from third parties in relation to the Contaminant in soil and water in the Tarago area.

P3 Undertake delineation of the Contaminant within the site and at the Load-Out Complex.

P4. Install groundwater monitoring wells to assess impacts to groundwater from the Contaminant originating from the site.

P5. Assess the potential migration from the site of the Contaminant in surface waters and sediments.

P6. Prepare a Detailed Site Investigation report.

This report presents a summary of the assessment of lead in surficial soils in public spaces in the Tarago area and was completed as part of a Detailed Site Investigation (Ramboll 2020a) which has been prepared and submitted to the NSW EPA separately.

Objective

The objective of these works was to quantify the spatial distribution of lead in surface soils in the Tarago Area in order to assess the extent of ore migration, if any, from the rail corridor. Primary migration pathways were considered to be through dust and surface water pathways. The investigation also included the haul route for ore transport between the mine and the load out facility.

Scope of Works

The assessment of surficial soil in public spaces was completed using a portable x-ray fluorescence (XRF) metal analyser over the period 18 to 24 March 2020.

Measurements were collected at 181 locations and targeted nature strips and roads within Tarago and roadside verges along the route from the Woodlawn mine to the rail corridor1. Assessment locations are shown in **Attachment 1**.

Methodology

A ThermoFisher Scientific Niton™ XL3t XRF analyser was used for undertaking soil measurements. The instrument was used in soil mode and data was collected using 60 second dwell. The analyser uses a 50kV x-ray tube which provides sufficient flux to enable separation of spectra lines for highly accurate quantification of elements of interest.

XRF readings were completed by a suitably experienced scientist holding a NSW EPA license required for field based XRF testing. Testing was completed in accordance with relevant provisions described in US EPA method 6200 (USEPA 2007).

The XRF was used in-situ and measurements were taken by placing the XRF directly on the ground surface. The soil surface to be measured was cleared of debris and grass prior to taking the measurement. This was to ensure that there was no obstruction, the analyser window was protected and maintained the required contact with the sample surface during measurements. As moisture is

[1] Additional XRF testing also occurred within the rail corridor.

known to affect measured concentrations (see uncertainty section), visually dry surfaces were chosen for measurement.

Readings were recorded digitally on the XRF unit and are reported as a wet weight and are not directly comparable with the dry weight guideline concentration. However, correlation between field and laboratory testing (refer below) indicates a 95% correlation coefficient indicating near definitive results were achieved by the XRF. On this basis the XRF result was adopted as a directly comparable result to the HIL guideline discussed below.

Quality Control

Quality control measures implemented as part of this assessment are presented as **Attachment 2**.

Assessment Criteria

The NEPM (2013) provides health-based soil investigation levels (HILs) for various land uses.

For local public road reserves adjacent houses in Tarago HIL C – the health investigation level for recreational/open space was adopted. HIL C is intended as a tier 1 assessment criteria for land uses such as parks, playgrounds, playing fields, secondary schools and footpaths. This does not include undeveloped public open space where the potential for exposure is lower and where a site specific assessment may be more appropriate. HIL C was considered appropriate for public road reserves adjacent houses as footpaths and/or areas regularly used by pedestrians are present in these areas.

For local public road reserves along the haul route outside of Tarago HIL D – the health investigation level for commercial/industrial land use was adopted. HIL D is intended as a tier 1 assessment criteria for land uses such as shops, offices, factories and industrial sites. HIL D was considered appropriate for public road reserves outside of Tarago where frequent pedestrian activity was considered unlikely.

Results

Sample results were compared against health investigation levels (HILs) from the National Environmental Protection Council (NEPC) *National Environmental Protection (Assessment of Site Contamination) Measure 1999*, as Amended 2013 (NEPM, 2013) for lead in soils as follows:

1. Results for locations in and around Tarago were assessed against HIL C (600 mg/kg) relevant for open spaces such as parks, sporting fields and footpaths (NEPM 2013).
2. Results for locations along the route from the mine to the corridor (excluding those in developed areas of Tarago) were assessed against HIL D (1500 mg/kg).

Assessment of results against these criteria is presented as **Attachment 3** and in summary as **Table 1** and **Table 2** below.

Table 3: Summary of XRF results for lead in Tarago

Number of Samples	Min	Max	Number above Guideline (600 mg/kg)
167	<LOD	5993	20

Note: <LOD – less than Limit of Detection

Table 4: Summary of XRF results for lead on the mine haul route

Number of Samples	Min	Max	Number above Guideline (1500 mg/kg)
30	71	4321	3

Results indicate lead concentrations in surface soils in most areas assessed fall below the adopted criteria indicating widespread impacts from the lead ore within rail corridor have not occurred. However there are three areas identified with elevated concentrations as follows:

1. Along the route from the mine to the rail corridor
2. On Mulwaree Street and in table drain downstream
3. On an overland flow path from the rail corridor adjacent the Station Masters Cottage and across Boyd Street.

Area 3 appears related to the migration of lead ore from within the rail corridor by dust and in surface water and require further investigation to assess the extent of impact and potential risk to human and ecological health. Areas 1 and 2 appear unrelated to lead ore within the rail corridor for the following reasons:

1. Contamination in Areas 1 and 2 was observed to be separated from the rail corridor by areas where contaminant concentrations were observed to be low. This is inconsistent with potential migration pathways for contamination identified for rail corridor contamination which were identified to comprise airborne dust and surface water. Migration via these pathways could be expected to result in impacts and so contamination in Areas 1 and 2 (both geographically separated from the rail corridor) are considered unlikely to be related to the corridor.
2. Topography indicates that surface would not flow from the rail corridor to Areas 1 or 2 and assessment of contaminant distribution associated with migration via airborne dust and surface water indicates areas of potential impact do not include Areas 1 or 2.
3. Road haulage of ore presents a more plausible source for contamination in Areas 1 and 2

Additional evidence supporting these lines of reasoning is presented in the Tarago Rail Corridor and Tarago Area Detailed Site Investigation (Ramboll 2020a).

As exceedances of lead were detected in Areas 1 and 2, TfNSW should forward copies of this report to the land owner and to the NSW EPA for further consideration.

For further information please contact the undersigned.

Yours sincerely

Stephen Maxwell
Tarago Lead Investigation Project Manager

D+61 (2) 4962 5444
M+61 478 658 194
smaxwell@ramboll.com

Fiona Robinson
Principal Contaminated Land Specialist

D+61 (2) 4962 5444
+61 421 311 066
frobinson@ramboll.com

Attachments
Figure of sampling locations
XRF Results
XRF Calibration

Reference

NEPC 2013 *National Environment Protection Measure. Schedule B1: Guideline on investigation levels for soil and groundwater. National Environment Protection (Assessment of Site Contamination) Measure 1999*

US EPA 2007, *Method 6200, Field Portable X-Ray Fluoresence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment*

Laboratory report 711464

Laboratory report 713210

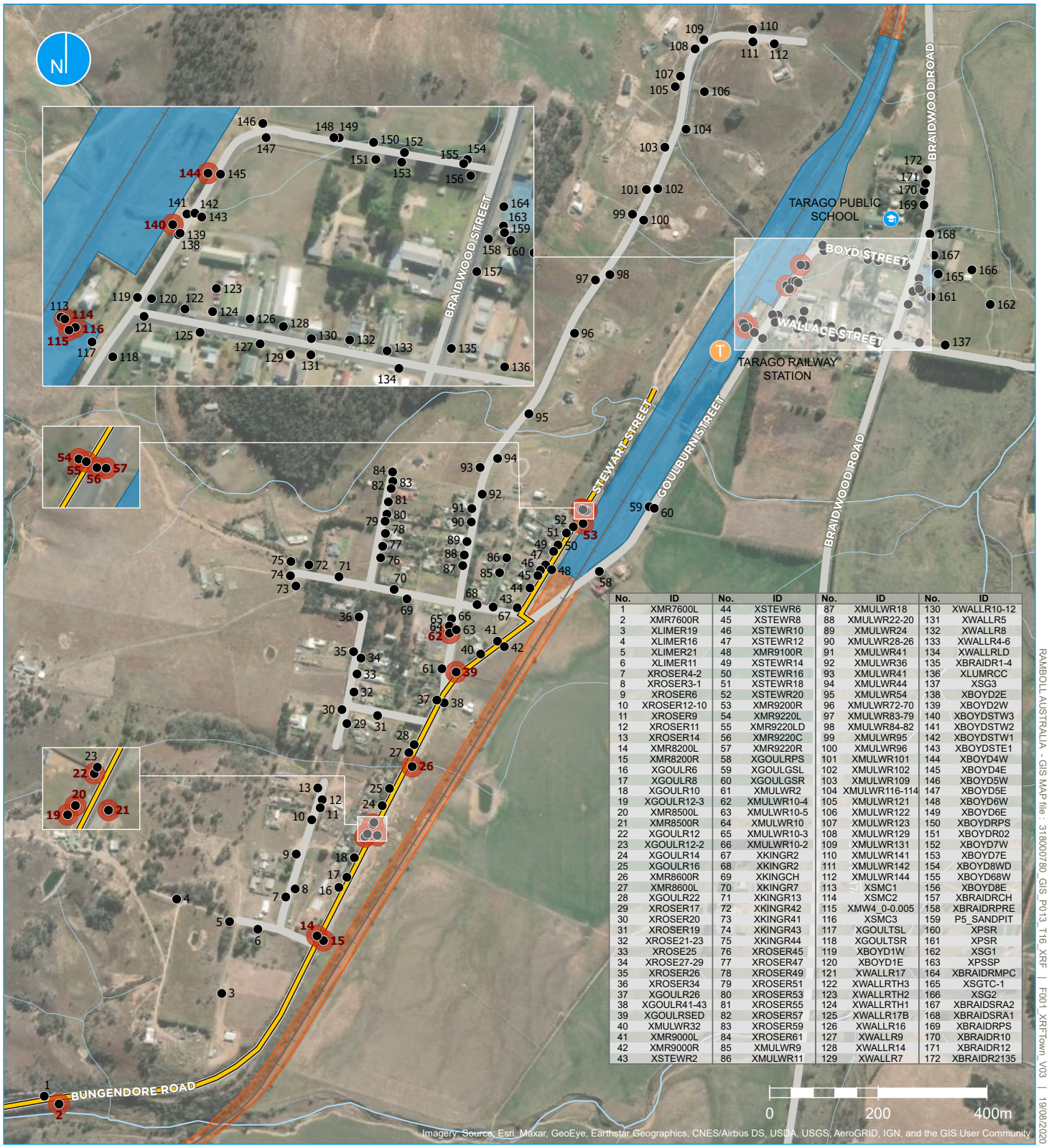
Laboratory report 710537

Ramboll (2020a) *Tarago Rail Corridor and Tarago Area Detailed Site Investigation*

Limitations

Ramboll Australia Pty Ltd prepared this report in accordance with the scope of work as outlined in our proposal to John Holland Rail and in accordance with our understanding and interpretation of current regulatory standards. A representative program of sampling and laboratory analyses was undertaken as part of this investigation. While every care has been taken, concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. We cannot therefore preclude the presence of materials that may be hazardous. Site conditions may change over time. This report is based on conditions encountered at the Site at the time of the report and Ramboll disclaims responsibility for any changes that may have occurred after this time. The conclusions presented in this report represent Ramboll's professional judgment based on information made available during the course of this assignment and are true and correct to the best of Ramboll's knowledge as at the date of the assessment. Ramboll did not independently verify all of the written or oral information provided to Ramboll during the course of this investigation. While Ramboll has no reason to doubt the accuracy of the information provided to it, the report is complete and accurate only to the extent that the information provided to Ramboll was itself complete and accurate. This report does not purport to give legal advice. This advice can only be given by qualified legal advisors.

ATTACHMENT 1
FIGURES



No.	ID	No.	ID	No.	ID	No.	ID
1	XMR7600L	44	XSTEWR6	87	XMULWR18	130	XWALLR10-12
2	XMR7600R	45	XSTEWR8	88	XMULWR22-20	131	XWALLR5
3	XLIMER19	46	XSTEWR10	89	XMULWR24	132	XWALLR8
4	XLIMER16	47	XSTEWR12	90	XMULWR28-26	133	XWALLR4-6
5	XLIMER21	48	XMR9100R	91	XMULWR41	134	XWALLRLD
6	XLIMER11	49	XSTEWR14	92	XMULWR36	135	XBRAIDR1-4
7	XROSER4-2	50	XSTEWR16	93	XMULWR41	136	XLUMRCC
8	XROSER3-1	51	XSTEWR18	94	XMULWR44	137	XSG3
9	XROSER6	52	XSTEWR20	95	XMULWR54	138	XBOYD2E
10	XROSER12-10	53	XMR9200R	96	XMULWR72-70	139	XBOYD2W
11	XROSER9	54	XMR9220L	97	XMULWR83-79	140	XBOYDSTW3
12	XROSER11	55	XMR9220LD	98	XMULWR84-82	141	XBOYDSTW2
13	XROSER14	56	XMR9220C	99	XMULWR95	142	XBOYDSTW1
14	XMR8200L	57	XMR9220R	100	XMULWR96	143	XBOYDSTE1
15	XMR8200R	58	XGOULRPS	101	XMULWR101	144	XBOYD4W
16	XGOULR6	59	XGOULGSL	102	XMULWR102	145	XBOYD4E
17	XGOULR8	60	XGOULGSR	103	XMULWR109	146	XBOYD5W
18	XGOULR10	61	XMULWR2	104	XMULWR116-114	147	XBOYD5E
19	XGOULR12-3	62	XMULWR10-4	105	XMULWR121	148	XBOYD6W
20	XMR8500L	63	XMULWR10-5	106	XMULWR122	149	XBOYD6E
21	XMR8500R	64	XMULWR10	107	XMULWR123	150	XBOYDRPS
22	XGOULR12	65	XMULWR10-3	108	XMULWR129	151	XBOYDR02
23	XGOULR12-2	66	XMULWR10-2	109	XMULWR131	152	XBOYD7W
24	XGOULR14	67	XKINGR2	110	XMULWR141	153	XBOYD7E
25	XGOULR16	68	XKINGR2	111	XMULWR142	154	XBOYD8WD
26	XMR8600R	69	XKINGCH	112	XMULWR144	155	XBOYD68W
27	XMR8600L	70	XKINGR7	113	XSMC1	156	XBOYD8E
28	XGOULR22	71	XKINGR13	114	XSMC2	157	XBRAIDRCH
29	XROSER17	72	XKINGR42	115	XMW4_0-0.005	158	XBRAIDRPRE
30	XROSER20	73	XKINGR41	116	XSMC3	159	P5_SANDPIT
31	XROSER19	74	XKINGR43	117	XGOULTSL	160	XPSR
32	XROSE21-23	75	XKINGR44	118	XGOULTSR	161	XPSR
33	XROSE25	76	XROSER45	119	XBOYD1W	162	XSG1
34	XROSE27-29	77	XROSER47	120	XBOYD1E	163	XPSSP
35	XROSER26	78	XROSER49	121	XWALLR17	164	XBRAIDRMPC
36	XROSER34	79	XROSER51	122	XWALLRTH3	165	XSGTC-1
37	XGOULR26	80	XROSER53	123	XWALLRTH2	166	XSG2
38	XGOULR41-43	81	XROSER55	124	XWALLRTH1	167	XBRAIDSRA2
39	XGOULRSED	82	XROSER57	125	XWALLR17B	168	XBRAIDSRA1
40	XMULWR32	83	XROSER59	126	XWALLR16	169	XBRAIDRPS
41	XMR9000L	84	XROSER61	127	XWALLR9	170	XBRAIDR10
42	XMR9000R	85	XMULWR9	128	XWALLR14	171	XBRAIDR12
43	XSTEWR2	86	XMULWR11	129	XWALLR7	172	XBRAIDR2135

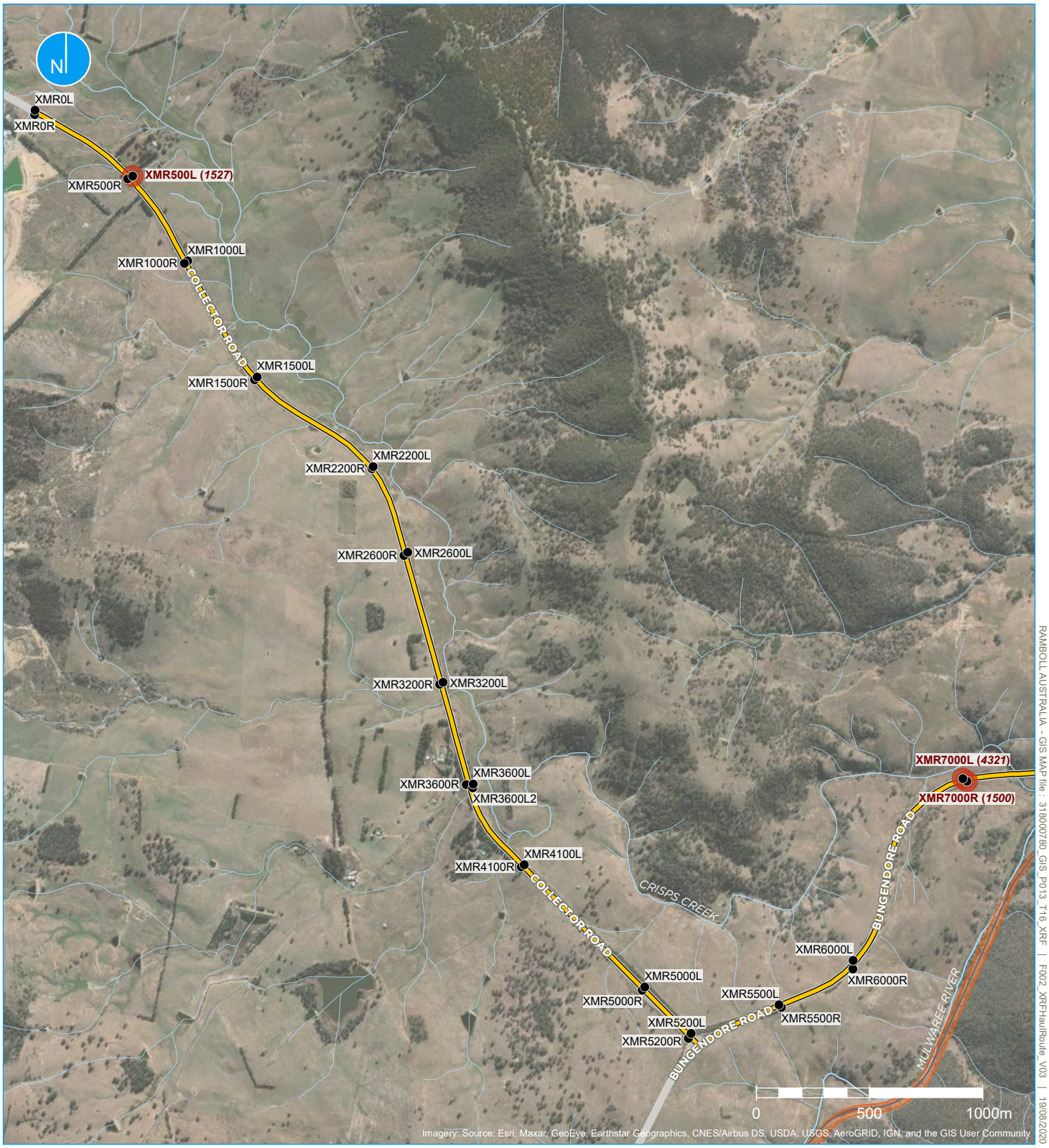
RAMBOLL AUSTRALIA - GIS MAP file : 318000780_GIS_P013_T16_XRF | F001_XRFTown_V03 | 19/08/2020

A4
1:10,000

Legend

- Site boundary
- Rail corridor
- XRF (X-Ray Fluorescence) sample location
- Lead reading exceeding relevant NSW EPA endorsed guideline (HIL C)
- Hauling route

Figure 1 | Public road reserve XRF sampling locations - Tarago Town



RAMBOLL AUSTRALIA - GIS MAP file : 318000780_GIS_P013_T16_XRF | F002_XRFHaulRoute_V03 | 19/08/2020

A4
1:24,000

Legend

- Rail corridor
- XRF (X-Ray Fluorescence) sample location
- Lead reading exceeding relevant NSW EPA endorsed guideline (HIL D)
- Hauling route

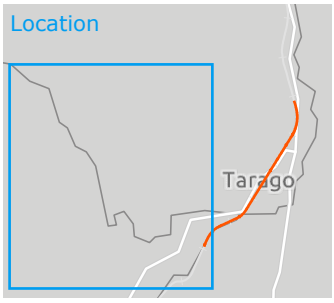


Figure 2 | Public road reserve XRF sampling locations - Haul Route

ATTACHMENT 2
QUALITY CONTROL

The following was conducted to ensure quality of the data collected:

1. Daily system checks and internal calibration as recommended by the instrument manual.
2. Measurement of blank reference material (silicon dioxide, SiO_2) – this was done at the start of the day and repeated every 10 samples. This ensured that cross-contamination of samples were not occurring. The analyser window was also cleaned regularly to prevent cross-contamination. The SiO_2 analysis results for all measurements was less than limit-of-detection.
3. Certified reference materials were also measured to check instrument response and calibration. This was conducted every 20 samples. The analysis results and relative percent difference is shown in **Table 1**. The certificate of analysis for the certified reference material and blank is provided in **Attachment 4**.
4. Precision – the precision of the XRF results can be improved by extending the dwell time of the measurement. A dwell of 60 seconds was considered to provide sufficient precision for the sampling program. The analyser precision was calculated using data from the reference samples. The following equation provided by USEPA (2007) was used:

$$Precision\ RSD = \frac{Standard\ Deviation}{Mean\ concentration} \times 100$$

The precision relative standard deviation (RSD) calculated using reference results was about 2%. Some replicate samples were also taken which further provides an indication of precision and sample heterogeneity (**Table 2**).

Table 1: Lead concentrations measured in the field compared with expected concentrations for certified reference material

Sample	Certified Reference Material*	Measured (mg/kg)	Expected (mg/kg)	Relative Percent Difference (RPD)
RCRAPP-test	QC Material 180-661 RCRA1	482	500	4
RCRAPP-cal		478	500	5
RCRAPP-2		468	500	7
RCRAPP-3		472	500	6
RCRAPP-4		454	500	10
USGS-1	QC Material 180-673 USGS SAR-M	956	982	3
USGS-2		938	982	5
USGS-3		969	982	1
USGS-4		935	982	5
USGS-5		927	982	6
USGS-6		943	982	4

*was supplied with the XRF

Table 2: Results of replicate measurements

Sample Number	Replicate Results (mg/kg)
XBOYD4W	787
	779
XWINCH-S2	8178
	8140
XKINGR2	15
	12
XMULWR84-82	10
	11
XPSR	21
	<LOD

Note: XWINCH-S2 was collected from a known area of high lead within the rail corridor to improve the basis for assessing correlation between XRF and laboratory analyses.

5. Calibration against laboratory results:

Quality control sampling included soil samples collected from approximately 10% of the XRF locations that were sent to laboratory for analysis. The primary laboratory selected was accredited for the assessment of lead in soil by the National Association of Testing Authorities (NATA). The laboratory report is presented as **Attachment 5**.

The correlation between field XRF and laboratory results was assessed as an indicator of the quality of the XRF data and is summarised in **Figure 1** below.

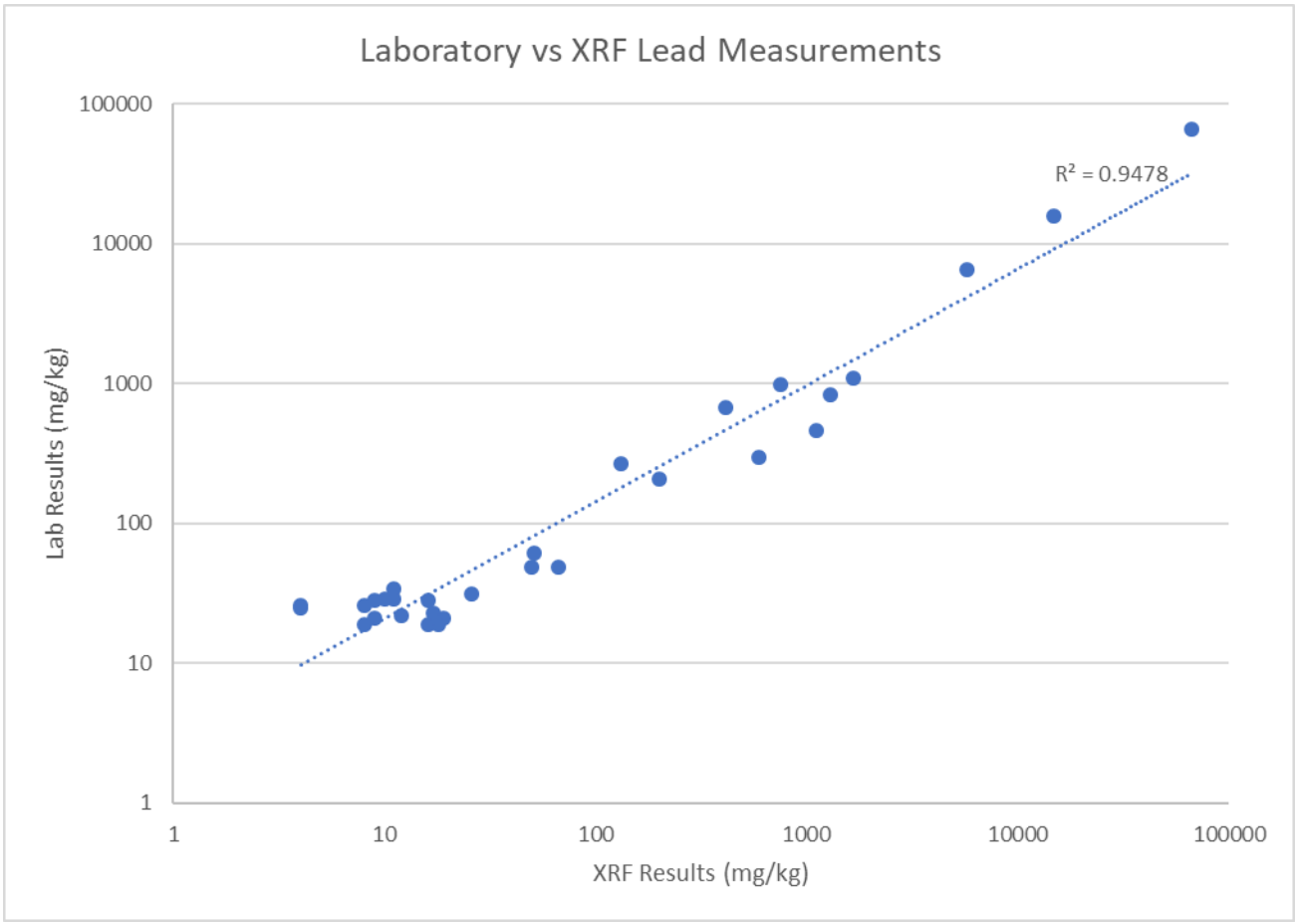


Figure 1: Correlation of lead results from portable XRF and laboratory analyses

Note: Three samples were collected from known areas of high lead within the rail corridor to improve the basis for assessing correlation between XRF and laboratory analyses. The results of these analyses are plotted in Figure 1 above though are not considered as part of the primary data set in this assessment (which otherwise excludes the rail corridor).

The correlation between field XRF and laboratory analyses from this assessment is defined by a correlation coefficient (R^2) value of 0.95. Section 9.7 of the US EPA XRF test method (USEPA 2007) prescribes that the R^2 value for the results should be 0.7 or greater for the field portable XRF data to be considered screening level data. If the R^2 is 0.9 or greater and inferential statistics indicate the field portable XRF data and the confirmatory data are statistically equivalent at a 99 percent confidence level, the data could potentially meet definitive level data criteria. Based on the observed R^2 of 0.95 the XRF data is considered suitable for use in screening potential risks associated with lead in public surface soils tested.

Uncertainties

The XRF analysis, like analytical techniques, can suffer from a number of interferences and factors that can introduce uncertainties in the results. This can affect the accuracy and precision of the instrument. Some of the important factors that were considered were:

1. Moisture – sample moisture can cause results of the analysis to be under reported. This can be accounted for by measuring the sample moisture content and applying moisture correction to the results. However, as sampling was conducted *insitu* this was not possible. Sample area was chosen that was visually dry and the final XRF results was calibrated against laboratory results

that were moisture corrected. While laboratory results only measures acid soluble component, the XRF measures total elemental composition. The final calibration showed very good correlation with laboratory results and therefore moisture effects and relative proportions measured by the two techniques was taken to be having minimal impact.

2. Sample heterogeneity can also a source of uncertainty. A number of samples were taken in close proximity to each other from different residential blocks. This was taken to sufficiently account for natural heterogeneity in surface soil concentrations. 10% of XRF measurement locations were also collected for laboratory analysis. This sampling collected representative samples from the location and given the results of the calibration, it sufficiently accounted for sample heterogeneity. Some replicate samples were also taken which also provides an indication of sample heterogeneity.
3. Inconsistent positioning of the XRF analyser can cause deviations in signal path distances, which can introduce errors. To eliminate this source of error, it was ensured that the XRF positioning was consistent between samples and always in contact with the surface.
4. XRF can also suffer from spectra interferences where spectral lines from different elements can overlap. The Niton analyser uses a 50kV x-ray source to provide sufficient resolution to accurately quantify lead spectral lines.

ATTACHMENT 3
XRF LEAD RESULTS

XRF Lead Results – Tarago (inc the haul route within the town)

Sample ID	Date	Lead (mg/kg)	Error (mg/kg)	Easting	Northing
XBOYD1E	18-03-20	162	8	741874	6116040
XBOYD1W	18-03-20	168	8	741863	6116041
XBOYD2E	18-03-20	61	6	741893	6116087
XBOYD2W	18-03-20	195	9	741895	6116088
XBOYD4E	18-03-20	213	9	741924	6116131
XBOYD4W	**18-03-20**	**779**	**17**	**741915**	**6116132**
XBOYD5E	18-03-20	100	7	741958	6116158
XBOYD5W	18-03-20	113	7	741955	6116169
XBOYD68W	18-03-20	<LOD	0	742103	6116139
XBOYD6E	18-03-20	135	7	742012	6116158
XBOYD6W	18-03-20	233	9	742008	6116158
XBOYD7E	18-03-20	139	7	742058	6116140
XBOYD7W	18-03-20	170	7	742060	6116147
XBOYD8E	18-03-20	80	6	742109	6116130
XBOYD8WD	18-03-20	10	3	742106	6116142
XBOYDR02	18-03-20	265	10	742039	6116142
XBOYDRPS	18-03-20	130	7	742037	6116155
XBOYDSTE1	18-03-20	459	14	741910	6116100
XBOYDSTW1	18-03-20	412	14	741905	6116103
XBOYDSTW2	18-03-20	364	14	741900	6116102
XBOYDSTW3	**18-03-20**	**751**	**16**	**741889**	**6116094**
XBRAIDR10	18-03-20	16	4	742142	6116269
XBRAIDR12	18-03-20	67	6	742145	6116282
XBRAIDR1-4	18-03-20	66	6	742094	6116003
XBRAIDR2135	18-03-20	33	5	742148	6116308
XBRAIDRCH	18-03-20	47	6	742113	6116060
XBRAIDRMPC	18-03-20	15	4	742133	6116107
XBRAIDRPRE	18-03-20	18	4	742122	6116084
XBRAIDRPS	18-03-20	13	4	742142	6116243
XBRAIDSRA1	18-03-20	70	6	742153	6116189
XBRAIDSRA2	18-03-20	29	5	742161	6116150
XGOULGSL	24-03-20	371	13	741636	6115687
XGOULGSR	24-03-20	304	12	741645	6115684
XGOULR10	23-03-20	285	11	741093	6115040
XGOULR12	**23-03-20**	**629**	**16**	**741127**	**6115102**
XGOULR12-3	**23-03-20**	**1107**	**21**	**741113**	**6115079**
XGOULR14	23-03-20	16	5	741144	6115136
XGOULR16	23-03-20	221	10	741158	6115168
XGOULR22	23-03-20	43	5	741203	6115249
XGOULR26	23-03-20	297	11	741245	6115331

Sample ID	Date	Lead (mg/kg)	Error (mg/kg)	Easting	Northing
XGOULR41-43	23-03-20	55	6	741259	6115325
XGOULR6	23-03-20	234	10	741065	6114986
XGOULR8	23-03-20	166	9	741079	6115004
XGOULRPS	24-03-20	211	9	741544	6115568
XGOULRSED	**23-03-20**	**1667**	**27**	**741281**	**6115382**
XGOULTSL	24-03-20	196	9	741830	6116008
XGOULTSR	24-03-20	257	10	741845	6115997
XKINGCH	23-03-20	76	6	741190	6115517
XKINGR13	19-03-20	<LOD	0	741065	6115558
XKINGR2	19-03-20	15	4	741349	6115502
XKINGR2	19-03-20	12	4	741319	6115507
XKINGR41	19-03-20	<LOD	0	740985	6115541
XKINGR42	19-03-20	6	4	741009	6115580
XKINGR43	19-03-20	8	4	740975	6115560
XKINGR44	19-03-20	10	4	740976	6115586
XKINGR7	19-03-20	33	5	741166	6115535
XLIMER11	23-03-20	53	6	740915	6114909
XLIMER16	23-03-20	<LOD	0	740766	6114964
XLIMER19	23-03-20	<LOD	0	740849	6114790
XLIMER21	23-03-20	14	4	740863	6114923
XLUMRCC	18-03-20	41	5	742134	6115989
XMULWR10	23-03-20	517	14	741268	6115465
XMULWR101	19-03-20	<LOD	0	741631	6116271
XMULWR102	19-03-20	6	4	741652	6116273
XMULWR10-2	23-03-20	185	8	741272	6115481
XMULWR10-3	23-03-20	329	11	741268	6115467
XMULWR10-4	**23-03-20**	**1191**	**23**	**741268**	**6115454**
XMULWR10-5	23-03-20	219	9	741281	6115460
XMULWR109	19-03-20	7	4	741665	6116349
XMULWR11	23-03-20	42	5	741374	6115593
XMULWR116-114	19-03-20	<LOD	0	741704	6116382
XMULWR121	19-03-20	8	4	741684	6116461
XMULWR122	19-03-20	25	5	741738	6116451
XMULWR123	19-03-20	13	4	741694	6116480
XMULWR129	19-03-20	9	4	741721	6116530
XMULWR131	19-03-20	13	4	741737	6116547
XMULWR141	19-03-20	10	4	741826	6116566
XMULWR142	19-03-20	<LOD	0	741827	6116543
XMULWR144	19-03-20	<LOD	0	741866	6116540
XMULWR18	23-03-20	<LOD	0	741293	6115578

Sample ID	Date	Lead (mg/kg)	Error (mg/kg)	Easting	Northing
XMULWR2	23-03-20	172	8	741254	6115388
XMULWR22-20	23-03-20	13	4	741295	6115598
XMULWR24	23-03-20	11	4	741300	6115623
XMULWR28-26	23-03-20	10	4	741308	6115659
XMULWR32	23-03-20	150	8	741326	6115416
XMULWR36	23-03-20	7	4	741329	6115710
XMULWR41	23-03-20	<LOD	0	741325	6115759
XMULWR41	23-03-20	6	4	741309	6115683
XMULWR44	23-03-20	6	4	741357	6115776
XMULWR54	23-03-20	<LOD	0	741415	6115858
XMULWR72-70	23-03-20	8	4	741499	6116006
XMULWR83-79	19-03-20	18	4	741537	6116105
XMULWR84-82	19-03-20	11	4	741564	6116114
XMULWR9	23-03-20	57	5	741360	6115565
XMULWR95	19-03-20	7	4	741605	6116226
XMULWR96	19-03-20	7	4	741626	6116215
XMW4_0-0.005	**19-03-20**	**2098**	**30**	**741813**	**6116016**
XPSR	24-03-20	21	5	742155	6116073
XPSR	24-03-20	<LOD	0	742138	6116083
XPSSP	24-03-20	<LOD	0	742133	6116093
XROSE21-23	23-03-20	8	4	741092	6115345
XROSE25	23-03-20	39	5	741098	6115379
XROSE27-29	23-03-20	133	8	741105	6115408
XROSER11	23-03-20	21	5	741034	6115147
XROSER12-10	23-03-20	<LOD	0	741015	6115110
XROSER14	23-03-20	<LOD	0	741026	6115169
XROSER17	23-03-20	15	4	741079	6115287
XROSER19	23-03-20	8	4	741136	6115302
XROSER20	23-03-20	<LOD	0	741070	6115313
XROSER26	23-03-20	254	11	741092	6115420
XROSER3-1	23-03-20	33	5	740984	6114983
XROSER34	23-03-20	<LOD	0	741101	6115484
XROSER4-2	23-03-20	<LOD	0	740967	6114968
XROSER45	23-03-20	16	4	741142	6115593
XROSER47	23-03-20	35	4	741145	6115614
XROSER49	23-03-20	148	8	741150	6115638
XROSER51	23-03-20	21	5	741150	6115660
XROSER53	23-03-20	11	4	741153	6115673
XROSER55	23-03-20	18	4	741156	6115696
XROSER57	23-03-20	38	5	741161	6115720
XROSER59	23-03-20	28	5	741164	6115734
XROSER6	23-03-20	<LOD	0	740986	6115047

Sample ID	Date	Lead (mg/kg)	Error (mg/kg)	Easting	Northing
XROSER61	23-03-20	9	4	741163	6115751
XROSER9	23-03-20	13	4	741030	6115132
XSG1	24-03-20	39	5	742264	6116059
XSG2	24-03-20	57	6	742230	6116123
XSG3	24-03-20	52	6	742181	6115985
XSGTC-1	24-03-20	24	5	742168	6116115
XSMC1	18-03-20	332	9	741807	6116026
XSMC2	**18-03-20**	**1052**	**20**	**741810**	**6116025**
XSMC3	**18-03-20**	**1298**	**24**	**741817**	**6116019**
XSTEWR10	18-03-20	24	5	741436	6115570
XSTEWR12	18-03-20	73	6	741445	6115580
XSTEWR14	18-03-20	88	7	741460	6115605
XSTEWR16	18-03-20	37	5	741468	6115616
XSTEWR18	18-03-20	238	10	741484	6115639
XSTEWR2	18-03-20	51	5	741393	6115501
XSTEWR20	18-03-20	45	5	741496	6115650
XSTEWR6	18-03-20	70	6	741416	6115537
XSTEWR8	18-03-20	48	5	741431	6115560
XWALLR10-12	18-03-20	217	10	741991	6116010
XWALLR14	18-03-20	116	7	741971	6116019
XWALLR16	18-03-20	115	7	741946	6116025
XWALLR17	18-03-20	174	8	741868	6116027
XWALLR17B	18-03-20	110	8	741909	6116015
XWALLR4-6	18-03-20	81	7	742047	6116001
XWALLR5	18-03-20	191	10	741991	6115998
XWALLR7	18-03-20	327	12	741976	6115999
XWALLR8	18-03-20	110	7	742019	6116009
XWALLR9	18-03-20	132	8	741954	6116006
XWALLRLD	18-03-20	112	8	742056	6115988
XWALLRTH1	18-03-20	89	7	741918	6116030
XWALLRTH2	18-03-20	178	9	741921	6116047
XWALLRTH3	18-03-20	281	11	741898	6116032
XMR9220R	**24-03-20**	**1551**	**25**	**741521**	**6115679**
XMR9220LD	**24-03-20**	**3441**	**42**	**741514**	**6115681**
XMR9220L	**24-03-20**	**5993**	**60**	**741511**	**6115682**
XMR9220C	**24-03-20**	**1050**	**23**	**741518**	**6115679**
XMR9200R	**24-03-20**	**1228**	**21**	**741514**	**6115656**
XMR9100R	24-03-20	395	12	741456	6115571
XMR9000R	24-03-20	497	14	741369	6115429
XMR9000L	24-03-20	222	10	741357	6115439
XMR8600R	**24-03-20**	**1178**	**23**	**741199**	**6115208**
XMR8600L	24-03-20	570	15	741193	6115234

Sample ID	Date	Lead (mg/kg)	Error (mg/kg)	Easting	Northing
XMR8500R	**24-03-20**	**5606**	**55**	**741135**	**6115081**
XMR8500L	**24-03-20**	**848**	**18**	**741117**	**6115084**
XMR8200R	**24-03-20**	**5146**	**49**	**741036**	**6114888**
XMR8200L	**24-03-20**	**1060**	**20**	**741024**	**6114896**
XMR7600R	**24-03-20**	**1737**	**26**	**740549**	**6114587**
XMR7600L	24-03-20	57	6	740522	6114601

XRF Lead Results – Haul Route

Sample ID	Date	Lead (mg/kg)	Error (mg/kg)	Easting	Northing
XMR7000R	**24-03-20**	**1500**	**25**	**739903**	**6114515**
XMR7000L	**24-03-20**	**4321**	**48**	**739885**	**6114526**
XMR6000R	24-03-20	1236	23	739399	6113685
XMR6000L	24-03-20	352	12	739400	6113723
XMR5500R	24-03-20	260	11	739083	6113515
XMR5500L	24-03-20	263	10	739072	6113526
XMR5200R	24-03-20	100	7	738672	6113378
XMR5200L	24-03-20	215	9	738684	6113400
XMR500R	23-03-20	481	15	736194	6117178
XMR500L	**23-03-20**	**1527**	**24**	**736216**	**6117190**
XMR5000R	24-03-20	1116	21	738468	6113591
XMR5000L	24-03-20	640	17	738479	6113605
XMR4100R	24-03-20	219	10	737934	6114136
XMR4100L	23-03-20	757	16	737946	6114145
XMR3600R	23-03-20	396	13	737690	6114500
XMR3600L2	23-03-20	1065	22	737719	6114486
XMR3600L	23-03-20	1286	23	737721	6114502
XMR3200R	23-03-20	416	13	737573	6114943
XMR3200L	23-03-20	196	9	737588	6114952
XMR2600R	23-03-20	71	6	737415	6115513
XMR2600L	23-03-20	335	12	737431	6115527
XMR2200R	23-03-20	146	8	737273	6115896
XMR2200L	23-03-20	365	12	737278	6115906
XMR1500R	23-03-20	163	9	736754	6116290
XMR1500L	23-03-20	412	13	736766	6116302
XMR1000R	23-03-20	447	13	736444	6116804
XMR1000L	23-03-20	600	16	736459	6116815
XMR0R	23-03-20	541	16	735783	6117462
XMR0L	23-03-20	299	12	735784	6117481

ATTACHMENT 4
ANALYSES FOR XRF REFERENCE MATERIAL

Thermo Scientific™ Niton™ XRF Analyzers

CERTIFICATE OF ANALYSIS

Type P/N Element	RM 180-646 Till-4	CRM 180-649 NIST 2709a	Blank 180-647 SiO2 99.995%	QC Material 180-673 USGS SAR-M	QC Material 180-661 RCRA1
Ba Barium 56	395	979	<10	801	1000
Cs Cesium 55	12		<10		
Te Tellurium 52			<10	<10	
Sb Antimony 51	<30	<30	<10	<30	
Sn Tin 50			<10	2.76	
Cd Cadmium 48		<10	<10	5.27	500
Ag Silver 47			<10	<10	500
Pd Palladium 46			<10		
Mo Molybdenum 42	16		<10	13.1	
Zr Zirconium 40	385	195	<10		
Sr Strontium 38	109	239	<10	151	
U Uranium 92	<20	<10	<10	<10	
Rb Rubidium 37	161	99	<10	146	
Th Thorium 90	17.4	10.9	<10	17.2	
Pb Lead 82	50	17.3	<10	982	500

Type P/N Element	RM 180-646 Till-4	CRM 180-649 NIST 2709a	Blank 180-647 SiO2 99.995%	QC Material 180-673 USGS SAR-M	QC Material 180-661 RCRA1
Au Gold 79	<10		<10	<10	
Se Selenium 34			<10	<10	500
As Arsenic 33	111	10.5	<10	38.8	500
Hg Mercury 80		0.9	<10		
Zn Zinc 30	70	103	<10	930	
W Tungsten 74	204		<10		
Cu Copper 29	237	33.9	<10	331	
Ni Nickel 28	<60	85	<10		
Co Cobalt 27		<50	<10	<50	
Fe Iron 26	39700	33600	<10	29900	
Mn Manganese 25	490	529	<10	5220	
Cr Chromium 24	<65	130	<10	79.7	500
V Vanadium 23	67	110	<10	67.2	
Ti Titanium 22	4840	3360	<10	3800	
Sc Scandium 21	<90	11.1	<10	<90	

—continued next page

Part Number: 410-014b
1-218 05/2013

Americas
Boston, MA U.S.A.
Phone: +1 978 670-7460
Toll Free: 800 875-1578 (USA)
Fax: +1 978 670-7430
E-mail: niton@thermofisher.com

Europe, Middle East, Africa and South Asia
Munich, Germany
Phone: +49 89 3681 380
Fax: +49 89 3681 3830
E-mail: niton.eur@thermofisher.com

Asia Pacific
New Territories, Hong Kong
Phone: +852 2885 4613
Fax: +852 2567 4447
E-mail: niton.asia@thermofisher.com

www.thermoscientific.com/niton

Thermo SCIENTIFIC

Thermo Scientific Niton XRF Analyzers

CERTIFICATE OF ANALYSIS — PAGE 2

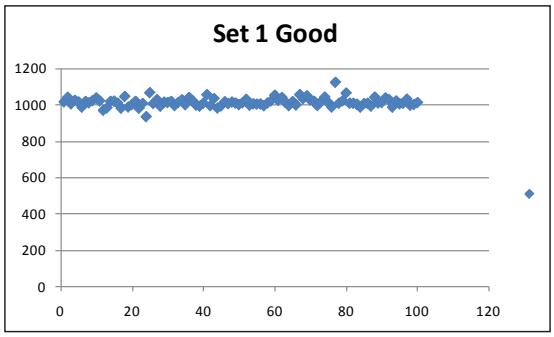
Use of reference materials

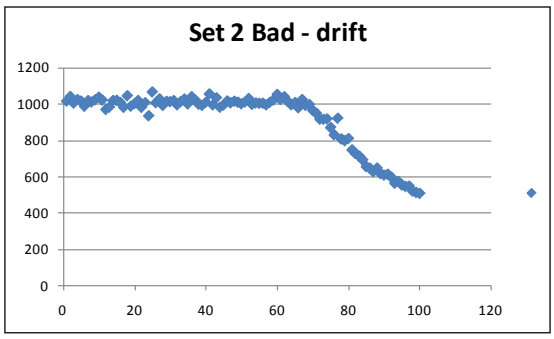
The reference materials provided with your analyzer are to help ensure the ongoing performance of your analyzer. These standards should be analyzed on a daily basis and the values obtained checked against this certificate of analysis. For quality assurance purposes you may wish to keep a running chart of the values obtained and monitor them for consistency.

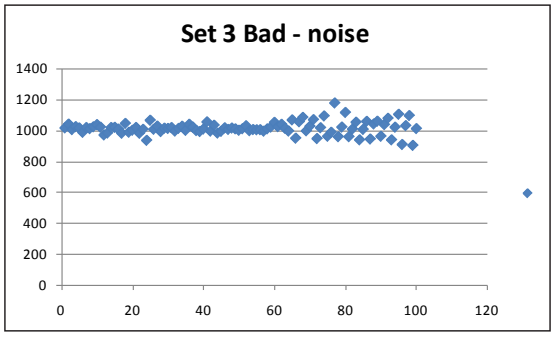
If one or more of the elements begins to change in terms of reported concentration outside of the normal expected variability, the sample may have become damaged or contaminated. This may occur for a number of reasons. For example, oils and salts may transfer from hand contact onto the surface, dust or lint from the surroundings may be deposited onto the sample, or the thin film on the front of the cup may have pinholes or have been torn. If the cup film has torn or has been damaged in any other way, it should be replaced immediately; this will prevent loss of the material and prevent contamination of the instrument and other samples.

If the film has been torn and the sample exposed for a period of time, then it may be best to assume the sample is contaminated. Dispose of it following your local regulations, and then replace it as soon as possible. Also check the front window of the instrument and clean or replace it if necessary.

Examples of daily quality assurance charts are shown below; learn to understand normal variance and recognize drift and noise. Results from your instrument may be as much as +/-20% of the listed values, depending on the model you have. However, by using the same integration time every time, your results should be consistent with themselves. If you have more questions, please refer to the Statistical Aspects of Spectrometry section of the manual under Reference Documents, or call our Customer Support group.







Type P/N Element	RM 180-646 Till-4	CRM 180-649 NIST 2709a	Blank 180-647 SiO2 99.995%	QC Material 180-673 USGS SAR-M	QC Material 180-661 RCRA1
Ca Calcium 20		19100	<10	6100	
K Potassium 19		21100	<10	29400	
Cl Chlorine 17					
S Sulfur 16	800		<10		
P Phosphorus 15	880	688	<10	70	
Si Silicon 14	303833	303000	467400	338000	
Al Aluminum 13	20400	73700	<10	63000	
Mg Magnesium 12	7598	14600	<10	5000	

Requires GOLDD technology for mining & minerals mode

Notes:

- All results are listed in ppm (mg/kg).
- To convert to %, divide by 10,000; e.g. 39700ppm Fe (Till-4) is 3.97%.
- Original certificates of analysis (if available) are on TOPS and can be requested from customer support.
- While every effort is made to ensure the high quality of these reference samples and their data, the use of the materials and interpretation of the results is the sole responsibility of the user.

Thermo SCIENTIFIC

Part of Thermo Fisher Scientific

ATTACHMENT 5
LABORATORY REPORT

Ramboll Environ Australia Pty Ltd
Level 3/100 Pacific Highway
North Sydney
NSW 2060

Attention: **Stephen Maxwell**

Report **713740-S-V2**
Project name 318000780
Received Date Apr 15, 2020

Client Sample ID			**MW2_1.0**	**XMW5_0.05**	**XMW5_0.5**	**XMW5_1.0**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M20-Ap20283**	**M20-Ap20284**	**M20-Ap20285**	**M20-Ap20286**
Date Sampled			**Mar 18, 2020**	**Mar 18, 2020**	**Mar 18, 2020**	**Mar 18, 2020**
Test/Reference	LOR	Unit				
Heavy Metals						
Lead	5	mg/kg	6600	300	270	26
% Moisture	1	%	5.4	7.0	8.6	3.9

Client Sample ID			**XMW5_1.5**	**XMW5_2.5**	**XMW6_0.05**	**XMW6_0.5**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M20-Ap20287**	**M20-Ap20288**	**M20-Ap20289**	**M20-Ap20290**
Date Sampled			**Mar 18, 2020**	**Mar 18, 2020**	**Mar 18, 2020**	**Mar 18, 2020**
Test/Reference	LOR	Unit				
Heavy Metals						
Lead	5	mg/kg	26	23	62	31
% Moisture	1	%	4.0	4.8	13	6.2

Client Sample ID			**XMW6_1.0**	**XMW6_1.5**	**XMW6_2.5**	**XMW7_0.05**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**M20-Ap20291**	**M20-Ap20292**	**M20-Ap20293**	**M20-Ap20294**
Date Sampled			**Mar 18, 2020**	**Mar 18, 2020**	**Mar 18, 2020**	**Mar 18, 2020**
Test/Reference	LOR	Unit				
Heavy Metals						
Lead	5	mg/kg	21	19	21	210
% Moisture	1	%	2.3	6.4	3.4	7.3

Client Sample ID			XMW7_0.5	XMW7_1.0	XMW7_1.5	XMW7_2.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M20-Ap20295	M20-Ap20296	M20-Ap20297	M20-Ap20298
Date Sampled			Mar 18, 2020	Mar 18, 2020	Mar 18, 2020	Mar 18, 2020
Test/Reference	LOR	Unit				
Heavy Metals						
Lead	5	mg/kg	49	29	34	29
% Moisture	1	%	8.9	7.9	9.4	14

Client Sample ID			XMW7_3.5	XMW7_4.5	WINCH N	WINCH S
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			M20-Ap20299	M20-Ap20300	M20-Ap20301	M20-Ap20302
Date Sampled			Mar 18, 2020	Mar 18, 2020	Mar 18, 2020	Mar 18, 2020
Test/Reference	LOR	Unit				
Heavy Metals						
Lead	5	mg/kg	49	25	66000	16000
% Moisture	1	%	12	9.8	1.9	1.3

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Heavy Metals	Sydney	Apr 15, 2020	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
% Moisture	Melbourne	Apr 15, 2020	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins | Environment Testing

ABN – 50 005 085 521 web : www.eurofins.com.au e.mail : EnviroSales@eurofins.com

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

New Zealand

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
North Sydney
NSW 2060

Project Name: 318000780

Order No.:
Report #: 713740
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Apr 15, 2020 1:37 PM
Due: Apr 20, 2020
Priority: 1 Day
Contact Name: Stephen Maxwell

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Lead	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							X
Sydney Laboratory - NATA Site # 18217						X	
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	MW2_1.0	Mar 18, 2020		Soil	M20-Ap20283	X	X
2	XMW5_0.05	Mar 18, 2020		Soil	M20-Ap20284	X	X
3	XMW5_0.5	Mar 18, 2020		Soil	M20-Ap20285	X	X
4	XMW5_1.0	Mar 18, 2020		Soil	M20-Ap20286	X	X
5	XMW5_1.5	Mar 18, 2020		Soil	M20-Ap20287	X	X
6	XMW5_2.5	Mar 18, 2020		Soil	M20-Ap20288	X	X
7	XMW6_0.05	Mar 18, 2020		Soil	M20-Ap20289	X	X
8	XMW6_0.5	Mar 18, 2020		Soil	M20-Ap20290	X	X
9	XMW6_1.0	Mar 18, 2020		Soil	M20-Ap20291	X	X
10	XMW6_1.5	Mar 18, 2020		Soil	M20-Ap20292	X	X
11	XMW6_2.5	Mar 18, 2020		Soil	M20-Ap20293	X	X

eurofins | Environment Testing

ABN – 50 005 085 521 web : www.eurofins.com.au e.mail : EnviroSales@eurofins.com

Australia

Melbourne
6 Monterey Road
Dandenong South VIC 3175
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

New Zealand

Auckland
35 O'Rorke Road
Penrose, Auckland 1061
Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Ramboll Australia Pty Ltd
Address: Level 3/100 Pacific Highway
North Sydney
NSW 2060

Project Name: 318000780

Order No.:
Report #: 713740
Phone: 02 9954 8118
Fax: 02 9954 8150

Received: Apr 15, 2020 1:37 PM
Due: Apr 20, 2020
Priority: 1 Day
Contact Name: Stephen Maxwell

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						Lead	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							X
Sydney Laboratory - NATA Site # 18217						X	
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
12	XMW7_0.05	Mar 18, 2020		Soil	M20-Ap20294	X	X
13	XMW7_0.5	Mar 18, 2020		Soil	M20-Ap20295	X	X
14	XMW7_1.0	Mar 18, 2020		Soil	M20-Ap20296	X	X
15	XMW7_1.5	Mar 18, 2020		Soil	M20-Ap20297	X	X
16	XMW7_2.5	Mar 18, 2020		Soil	M20-Ap20298	X	X
17	XMW7_3.5	Mar 18, 2020		Soil	M20-Ap20299	X	X
18	XMW7_4.5	Mar 18, 2020		Soil	M20-Ap20300	X	X
19	WINCH N	Mar 18, 2020		Soil	M20-Ap20301	X	X
20	WINCH S	Mar 18, 2020		Soil	M20-Ap20302	X	X
Test Counts						20	20

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Heavy Metals									
Lead			mg/kg	< 5			5	Pass	
LCS - % Recovery									
Heavy Metals									
Lead			%	96			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Heavy Metals				Result 1					
Lead	M20-Ap20287	CP	%	95			75-125	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Lead	M20-Ap20297	CP	%	96			75-125	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead	M20-Ap20283	CP	mg/kg	6600	7500	13	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M20-Ap20291	CP	%	2.3	3.1	31	30%	Fail	Q15
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Lead	M20-Ap20293	CP	mg/kg	21	23	14	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M20-Ap20301	CP	%	1.9	1.9	<1	30%	Pass	

Comments

New version of retests with special requested Sydney method.

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Andrew Black	Analytical Services Manager
Gabriele Cordero	Senior Analyst-Metal (NSW)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.