Preliminary Site Contamination Report

Planning Proposal to amend the Byron Local Environmental Plan (BLEP) 2014 to formalise the use of the existing dwelling Lot 5 DP585928 No 55 Settlement Road Main Arm

HEALTH SCIENCE ENVIROMENTAL EDUCATION
ENVIRONMENTAL AUDITOR

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Planning Proposal to amend the Byron Local Environmental Plan (BLEP) 2014 to formalise the use of the existing dwelling Lot 5 DP585928 No 55 Settlement Road Main Arm

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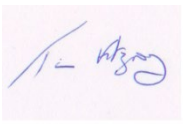

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1. Introduction

Tim Fitzroy & Associates (TFA) has been engaged by Glenn Wright (the client) to undertake a preliminary site investigation to accompany the Planning Proposal to Byron Shire Council (BSC) to amend the Byron Local Environmental Plan (BLEP) 2014 to formalise the use of the existing dwelling located at Lot 5 DP585928, No 55 Settlement Road Main Arm.

This report should be read in conjunction with TFA's General limitations to environmental information in Section 1.5.

1.1 Background

The planning proposal comprises:

- An application to BSC to amend the Byron Local Environmental Plan (BLEP) 2014 to formalise the use of the existing dwelling located at Lot 5 DP585928, No 55 Settlement Road, Main Arm.

1.2 Objectives

This report has been prepared to accompany a Planning Proposal to BSC to specifically address potential contamination issues from past and current uses on No 55 Settlement Road, Main Arm (Lot 5 DP585928).

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) relates to contaminated land issues. Clause 7(1) of SEPP 55 sets out the obligations a planning authority must consider when granting a development application. Clause 7 relevantly provides:

7 Contamination and remediation to be considered in determining development application

(1) A consent authority must not consent to the carrying out of any development on land unless:
(a) it has considered whether the land is contaminated, and
(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and
(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.
(2) Before determining an application for consent to carry out development that would involve a change of use on any of the land specified in subclause (4), the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned carried out in accordance with the contaminated land planning guidelines.
(3) The applicant for development consent must carry out the investigation required by subclause (2) and must provide a report on it to the consent authority. The consent authority may require the applicant to carry out, and provide a report on, a detailed investigation (as referred to in the contaminated land planning guidelines) if it considers that the findings of the preliminary investigation warrant such an investigation.

(4) The land concerned is:
(a) land that is within an investigation area,
(b) land on which development for a purpose referred to in Table 1 to the contaminated land planning guidelines is being, or is known to have been, carried out,
(c) to the extent to which it is proposed to carry out development on it for residential, educational, recreational, or childcare purposes, or for the purposes of a hospital—land:
(i) in relation to which there is no knowledge (or incomplete knowledge) as to whether development for a purpose referred to in Table 1 to the contaminated land planning guidelines has been carried out, and
(ii) on which it would have been lawful to carry out such development during any period in respect of which there is no knowledge (or incomplete knowledge).

As the land has been used for agricultural activities (banana plantation and passionfruit production) therefore clause 7 applies. This report has been prepared to satisfy Council that the site is suitable for the use proposed in the planning proposal.

1.3 Summary

The subject site covers an area of about 23.85ha approximately 1.8km south of the Main Arm village. The site is accessed via Settlement Road. Site improvements include a three bedroom dwelling, a shed, a dam and fencing.

The site is an irregular shape and is located on the southern side of Settlement Road. The site is undulating ranging from 130m AHD in the south to 40m AHD in the north interspersed with a series of gullies. The vast bulk of site (estimated at over 80%) is covered with vegetation. A portion of the central and north western portion of the site has been partially cleared whereupon the dwelling, shed and dam are located.

A search of the NSW Department of Primary Industry (DPI) Cattle Dip Site Locator tool (https://www.dpi.nsw.gov.au/animals-and-livestock/beef-cattle/health-and-disease/parasitic-andprotozoal- diseases/ticks/cattle-dip-site-locator) indicated that the former Durrumbil cattle dip site has been decommissioned and is located on the northern side of Settlement Road, approximately 173m north west of the existing dwelling on the subject site and therefore within the 200m radius NSW EPA investigation zone.

This investigation is Tier 1 - preliminary site investigation, which is required to determine if contamination of the site's soil has occurred from past land usage in accordance with NEPM 1999 (2013), DUAP and EPA (1998). The investigation includes obtaining a history of land usage on the site which confirmed the previous use of the site for banana and passionfruit production and proximity of the former Durrumbil cattle dipsite and therefore a preliminary soil-sampling regime was undertaken. The results of the soil analysis are compared with the Health Investigation Levels (HILA) and Ecological Investigation Levels (EILs) outlined in NEPM 1999 (2013).

A total of sixteen boreholes (TFA1-TFA16 plus 2 QA samples) within proximity of the existing dwelling and shed were analysed for 16 metals (silver, arsenic, lead, cadmium, chromium, copper, manganese, nickel, selenium, zinc, mercury, iron, aluminium, beryllium, boron and cobalt), organochlorine pesticides (OCPs) and organophosphorus pesticides (OP's).

All of the soil samples show contaminant levels well below the most stringent Australian and New Zealand Environment and Conservation Council (ANZECC), National Environment Protection Measure (NEPM 2013) HILA Residential with garden/accessible soil and Ecological Soil Investigation Levels (NEPM 2013).

Based on the outcomes of this PSI there is no impediment to approval of the Planning Proposal to amend the Byron Local Environmental Plan (BLEP) 2014 to formalise the use of the existing dwelling located at Lot 5 DP585928, No 55 Settlement Road, Main Arm.

1.4 Scope of Works

The objective of this preliminary investigation has been to determine if land contamination has occurred from historical and current land use activities occurring on site or immediately nearby. To determine if the site poses a significant risk of harm to end users (and nearby sensitive receptors), available historical information has been reviewed and a number of soil and groundwater samples have been collected and analysed for a range of contaminants typically associated with the land uses identified as having occurred on site including metals, hydrocarbons, asbestos and BTEXN.

The results of the soil analysis are compared to relevant National Environmental Protection Measure (NEPM 1999 updated 2013) guidelines in order to assess the significance of risk. This investigation is considered to be Stage 1 of the Managing Land Contamination Planning Guidelines (DUAP and EPA, 1998) or a Preliminary Site Investigation (PSI; NEPM 1999). If contamination levels exceed the adopted EPA acceptable levels, a detailed investigation is then required (i.e., a Stage 2 investigation or Detailed Site Investigation (DSI). If the contamination levels are below the relevant acceptable levels, and information gathered as part of the investigation also supports that contamination was unlikely to have occurred; only a Stage 1 (or PSI) investigation would be required.

This preliminary investigation has been used to identify the following:

- Past and present potentially contaminating activities occurring on or near the site; and
- The presence of Potential Contaminants of Concern associated with the identified land uses.

The investigation will also:

- Discuss the site condition;
- Provide a preliminary assessment of the site's contamination status; and
- Assess the need for further investigations.

Relevant documents considered in the preparation of this investigation included:

- ANZECC and NHMRC (1992) Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites;
- Council of Standards Australia (2005) AS 4482.1-2005 Guide to the sampling and investigation of potentially contaminated soil – Non-volatile and semi-volatile compounds;
- NSW DEC (2006) Contaminated Sites – Guidelines for the NSW Site Auditor Scheme 2nd Edition;
- NSW EPA (1995) Contaminated Sites – Sampling Design Guidelines;
- NSW EPA (2011) Guidelines for Consultants Reporting Contaminated Sites; and

- National Environment Protection Council (NEPC) (2013) National Environment Protection (Assessment of Site Contamination) Measure

This preliminary assessment report is written in accordance with the new Contaminated land guidelines (NSW Environment Protection Authority 2020) and the Northern Rivers Regional Councils (NRRC) Regional Policy for the Management of Contaminated Land (NRRC 2006).

1.5 General limitations to environmental information

TFA has conducted the services in a manner consistent with the appropriate levels of care and rigour expected of members of the environmental assessment profession. No warranties or guarantees, expressed or implied, are made.

The findings of this report are strictly limited to identifying the environmental conditions associated with the subject property in regard to site contamination, and does not seek to provide an opinion regarding other aspects of the environment not related to site contamination, or to the suitability of the site in regard to: landuse planning and legal use of the land; and/or regulatory responsibilities or obligations (for which a legal opinion should be sought); and/or the occupational health and safety legislation; and/or the suitability of any engineering design. Reviews of such information are only in relation to the contaminated land aspects of any project or site. If specialist technical review of such documents is required, these should be obtained by an appropriate specialist.

The reporting and conclusions are based on the information obtained at the time of the assessments. Changes to the subsurface conditions may occur subsequent to the investigation described, through natural processes or through the intentional or accidental addition of contaminants, and these conditions may change with space and time.

Furthermore, the test methods used to characterise the contamination at each sampling location are subject to limitations and provide only an approximation of the contaminant concentrations. Monitoring and chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

The absence of any identified hazardous or toxic materials at the site should not be interpreted as a warranty or guarantee that such materials do not exist at the site. Therefore, future work at the site which involves subsurface excavation or removal of structures or parts thereof, should be conducted based on appropriate management plans. These should include, inter alia, environmental management plans, including unexpected findings protocols, hazardous building materials management plans, and occupational health and safety plans.

2. Site identification and Surrounds

2.1 Site Description

The subject site covers an area of about 23.85ha approximately 1.8km south of the Main Arm village. The site is accessed via Settlement Road. Site improvements include a three bedroom dwelling, a shed, a dam and fencing.

The site is an irregular shape and is located on the southern side of Settlement Road. The site is undulating ranging from 130m AHD in the south to 40m AHD in the north interspersed with a series of gullies. The vast bulk of site (estimated at over 80%) is covered with vegetation. A portion of the central and north western portion of the site has been partially cleared whereupon the dwelling, shed and dam are located.

A site locality diagram that shows the subject site is provided in **Figure 1**.

2.2 Zoning

Under the Byron Local Environmental Plan (BLEP 2014) (see **Appendix A**)The subject site is zoned:

- RU2 Rural Landscape;
- E2 Environmental Conservation; and
- DM Deferred Matter.

2.3 Surrounding Landuse

North	Rural residence and vegetation
South	Vegetation
West	Rural residence and vegetation
East	Banana Plantation and rural property

2.4 Surrounding Environment

The Brunswick River is situated about 450m to the east of the site. Three gullies drain from the subject site to the Brunswick River which is located to the east of Main Arm Road. The Brunswick River releases to the Coral Sea, South Pacific Ocean approximately 17km to the east of the site.

The marine river environment of the Brunswick River is considered to be a sensitive ecological receptor. The terrestrial and aquatic ecosystems and associated dependent species would be potential environmental receptors. Sensitive receptors also include humans, where primary contact (e.g., swimming) and secondary contact (e.g., boating) recreational uses would be potential human receptors of the river.

2.5 Current Use

The subject site is currently used for residential use and cattle agistment in the north western portion. The remainder of the site is a mix of native and exotic vegetation.

3. Environmental Setting

3.1 Local Meteorology

A summary of the climatic data from the Ballina Airport AWS (located approximately 47.5 km from the site) is shown in Table 3.1.

Table 3.1 Climate Summary Ballina Airport Weather Station

	Temperature ^{0}C		Rainfall mm	Mean number of raindays
	Minimum	Maximum	Average monthly	
January	21.3	28.0	153.4	14.6
February	21.1	27.6	156.1	14.9
March	20.2	26.6	150.9	16.9
April	17.6	24.0	168.5	15.1
May	15.1	21.5	89.5	13.2
June	13.2	19.4	174.9	14.3
July	12.3	18.9	80.9	11.4
August	13.1	20.1	72.4	7.8
September	15.3	22.1	52.0	9.3
October	16.9	23.6	91.4	12.6
November	18.6	25.3	87.6	11.2
December	19.9	26.6	123.0	13.5

3.2 Topography and Hydrology

The site is undulating ranging from 130m AHD in the south to 40m AHD in the north interspersed with a series of gullies. The site drains in a north and north easterly direction via a series of gullies to the Brunswick River.

3.3 Geology and Soils

3.3.1 Geology

Based on the NSW Department of Planning & Environment Soil Landscapes of Central and Eastern NSW mapping (accessed October 2021), the local geological conditions comprise 3 different geological units:

- Southern section:
  - are described as Lismore Basalt
- Middle section
  - are described as Neranleigh-Fernvale beds
- Northern section
  - are described as Undifferentiated alluvial deposits; sand, silt, clay and gravel; some residual and colluvial deposits

3.3.2 Soils

(50–100 cm), poorly drained Yellow Podzolic Soils (Gn2.34, Dy3.21) on quartzites and phyllites.
Moderately deep (100–150 cm),moderately well-drained Red Podzolic Soils (Dr2.31,Dr3.21, Gn3.74) with Yellow Podzolic Soils (Dy2.51,Dy3.21) on fine-grained sediments. Deep (>150 cm), moderately well-drained Red Earths (Uf4, Uf6) and Red Podzolic Soils (Dr2.21) on lower slopes.

3.4 Acid Sulfate Soils

Based on the Atlas of Australian Acid Sulfate Soils, the site is mapped as an area of *Class B Low Probability of occurrence: 6-70% chance of occurrence.*

3.5 Hydrogeology

There are no registered groundwater bores on the subject site. A search of NSW Department of Primary Industries Office of Water licensed bores within a 2km radius of the site identified 49 registered bores. The results of the groundwater bore search are summarised in **Table 3.2** and below and included in full in **Appendix A**.

Table 3.2 Registered Groundwater Drillers Logs in the Locale

Groundwater Boreholes

Boreholes within the dataset buffer:

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m bgl)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW303945	30BL180384	Bore	Private	Domestic	Domestic		03/12/2002	27.00	27.00	220	10.00	1.010		86m	North West
GW307045	30BL185863	Bore	Private	Farming	Farming		22/01/2012	36.60	36.60	105	18.00	1.263		192m	North East
GW306766	30BL180808	Bore	Private	Domestic, Stock	Domestic, Stock		01/01/1992	36.50			35.60	0.200		233m	South West
GW306231	30BL184454	Bore	Private	Domestic	Domestic		20/09/2007	30.50	30.50	140	12.00	0.632		256m	North East
20210012					UNK								66.80	387m	South West
GW301324	30BL176989	Bore		Domestic	Domestic			24.00	24.00	Good	6.00	0.505		463m	South West
GW037039		(Unknown)	Other Govt		General Use		01/01/1968	29.50	29.60					507m	East
GW053777	30BL122276, 30BL178740	Excavation	Private	Domestic, Irrigation, Stock	Irrigation		01/02/1963	3.00	3.00	0-500 ppm				562m	South
GW302968	30BL179165	Bore		Domestic, Stock	Domestic, Stock		10/12/2000	42.00	42.00	200	12.00	1.000		623m	East
GW061667	30BL134081	Excavation	Private	Domestic, Stock	General Use			1.80						753m	South East
GW301485	30BL178039	Bore		Domestic	Domestic		07/05/1998	35.00	35.00		9.80	0.688		803m	South
GW068138	30BL139891	Bore	Private	Domestic, Stock			09/08/1989	19.50	19.50	Good	3.00	0.470		814m	South
GW303617	30BL181010	Bore		Domestic	Domestic		13/12/2002	30.50	30.50	120	9.00	5.052		818m	North East
GW067125	30BL144721			Domestic	Domestic		06/12/1991	36.00	36.00	Good	20.00	0.708	75.00	873m	North East
GW064405	30BL136481	Bore	Private	Domestic, Stock	Domestic, Stock		01/09/1967	25.00	25.00	Good				956m	South East
GW064596	30BL136554	Bore	Private	Domestic	Domestic		01/07/1967	27.00	27.00					962m	South East
20210007					UNK								32.47	1082m	North
GW302064	30BL178195	Bore	Private	Domestic	Domestic, Irrigation									1192m	South West
GW300548	30BL177501	Bore		Domestic	Domestic		30/11/1996	31.00	31.00	Good	8.00	7.578		1275m	South West
GW307025	30WA307417	Bore	Private	Domestic	Domestic		14/10/2011	18.00	18.00		7.50	0.320		1304m	North
GW068148	30BL139950	Bore	Private	Domestic			23/08/1989	12.00	12.00		4.00	0.300		1311m	North
GW071397	30BL153320	Bore		Domestic	Domestic		26/10/1993	41.00	41.00	Good	23.00	0.354		1315m	East
GW300589	30BL177400	Bore		Domestic	Domestic		21/11/1996	15.25	15.25		6.50	0.375		1357m	North
GW301453	30BL177764	Bore		Domestic	Domestic		04/08/1997	13.70	13.70		5.80	0.750		1418m	North
GW304016	30BL181170	Bore	Private	Domestic	Domestic		31/12/1996	15.00	15.00		10.00	5.500		1437m	South West
GW305699	30BL180737	Bore	Private	Stock	Domestic, Stock		08/10/2005	24.00	24.00			1.000		1454m	East
GW306088	30BL184037	Bore	Local Govt	Monitoring Bore	Monitoring Bore		03/10/2006	7.50	7.50		3.80			1457m	East

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m bgl)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW304661	30BL179971	Bore	Local Govt	Monitoring Bore	Monitoring Bore		25/02/2002	3.50	3.50					1475m	East
GW303247	30BL179958	Bore		Domestic, Stock	Domestic, Stock		23/04/2002	17.00	17.00					1520m	South West
GW303446	30BL180342	Bore		Domestic, Farming, Irrigation, Stock	Domestic, Farming, Irrigation, Stock		01/06/2002	48.80	48.80			2.970		1561m	South West
GW305334	30BL183922	Bore		Domestic, Farming, Irrigation	Domestic, Stock		13/09/2005	30.00	30.00	90	16.00	0.700		1573m	South West
GW306086	30BL184037	Bore	Local Govt	Monitoring Bore	Monitoring Bore		03/10/2006	7.00	7.00		4.00			1586m	South East
GW063658	30BL135210	Bore	Private	Domestic, Stock	Domestic, Stock		01/10/1986	4.00	4.00					1612m	South East
GW301417	30BL177217	Bore		Domestic, Stock	Domestic, Stock		05/02/1996	22.00	22.00	Good	6.00	0.300		1625m	South West
GW064135	30BL136176	Bore	Private	Domestic, Stock	Domestic, Stock		01/02/1987	14.00	17.00					1638m	South East
GW306087	30BL184037	Bore	Local Govt	Monitoring Bore	Monitoring Bore		03/10/2006	7.00	7.00		4.50			1681m	South East
GW304662	30BL179971	Bore	Local Govt	Monitoring Bore	Monitoring Bore		25/02/2004	5.80	5.80					1694m	South East
GW070565	30BL150663	Bore	Private	Domestic	Domestic		01/09/1992	22.00	22.00	Good	10.00	0.590	30.00	1696m	South East
GW307060	30BL181223	Bore	Private	Domestic	Domestic		04/07/2002	50.00	50.00	280	15.00	0.500		1712m	North
GW303378	30BL179759	Bore		Domestic	Domestic		01/06/2002	3.20			2.00	1.000		1717m	East
GW303129	30BL179667	Bore		Domestic	Domestic		21/11/2001	32.00	32.00					1833m	North
GW304264	30BL181500	Bore	Private	Domestic	Domestic		03/09/2003	26.00	26.00		15.00	0.531		1842m	North
GW071390	30BL152942	Bore		Domestic, Stock	Domestic, Stock		21/09/1993	55.00	55.00	Good	30.00	0.700		1857m	North
GW306081	30BL184036	Bore	Local Govt	Monitoring Bore	Monitoring Bore		04/10/2006	6.00	6.00		1.20			1872m	South East
GW301459	30BL177813	Bore		Domestic, Farming, Stock	Domestic, Farming, Stock		25/10/1997	25.90	25.90		4.00	2.250		1892m	North West
20210010					UNK								37.23	1896m	North
GW304767	30BL180876	Bore		Domestic	Domestic		05/06/2004	54.00	54.00		2.50	2.500		1955m	North
202001					UNK								17.31	1960m	South East
GW306080	30BL184036	Bore	Local Govt	Monitoring Bore	Monitoring Bore		04/10/2006	7.50	7.50		4.50			1972m	South East

4. Site History

4.1 Historical Aerial Photography Review

A search of historical aerial photographs was conducted of the subject site in an attempt to identify past uses on or about the future building envelopes. Aerial photographs were reviewed for the followings years: 1942, 1958, 1966, 1971, 1979, 1987, 1997, 2006, 2010, 2014 and 2020 see **Appendix A**). Information garnered from the historical photographs is summarised in **Table 4.1** below:

Table 4.1 Review of Historical Aerial Photographs

Photograph	Site Observations
1942	The 1942 photograph shows the site predominately cleared with what appears to be banana cultivation in the southern and eastern portion of the site with the exception of the steeper slopes to the south. The northern portion of the site is cleared and there appears to be a structure (possibly a dwelling) in the northern east of the site. The adjoining land to the east and west on north facing slopes appears to be under banana cultivation
1958	In the 1958 photograph it appears that the bulk of land has reverted to grazing. It is difficult to identify any horticultural activity. The structure identified as a potential dwelling in the 1958 photograph is no longer visible. The Durrumbil cattle dip site can be identified about 40m north of the north west boundary of the subject site.
1966	Apart from regrowth of native vegetation there is no significant changes
1971	Recommencement of what appears to be banana cultivation on the eastern side of the site in conjunction with banana cultivation on the adjoining property to the east. The north east portion of Lot 4

Photograph	Site Observations
	DP 585928 No 34 Settlement Road has bene cleared for quarrying
1979	The 1979 photograph shows cleared area on the western side of the site (possibly bananas or passionfruit (as advised by current owner Glenn Wright). Bananas continue to be cropped on the eastern portion of the site in conjunction with banana cultivation on the adjoining property to the east. The quarry remains on No 34 Settlement Road
1987	By 1987 banana cultivation had desisted in the eastern portion. The western portion remained is under cultivation (possibly passionfruit and bananas) The quarry remains on No 34 Settlement Road
1997	In 1997 the aerial photography shows banana cultivation recommenced in the eastern portion and some cropping remains in the eastern portion. A shed is now located in the south eastern portion and evidence of a small structure (current dwelling) in the mid-eastern portion. The Durrumbil cattle dip site is no longer visible. The quarry remains on No 34 Settlement Road
2006	In 2006 banana cultivation has ceased in the eastern portion but has continued in the adjoining property to the east. The dwelling in mid-east section has expanded. Passionfruit appears to have been retained along the mid-western boundary, however there is no evidence of banana production onsite. Regrowth continues over formerly cultivated land. The quarry remains on No 34 Settlement Road
2010	By 2010 the photograph does not show any evidence of cropping onsite. There is a new driveway (turning circle) to the west of the dwelling. Regrowth of native vegetation continues to occur. The quarry remains on No 34 Settlement Road

Photograph	Site Observations
2014	In 2014 there are no significant changes to the subject site.
2020	In 2020 there are no significant changes to the subject site. The quarry is no longer visible on No 34 Settlement Road

4.2 Australian and NSW Heritage Register
On 15 September 2021 a search of the:

- Australian Heritage Trust database did not reveal any heritage listed items on within close proximity of the subject site
- Commonwealth Heritage List did not reveal any heritage listed items on within close proximity of the subject site
- NSW State Heritage Items did not reveal any heritage listed items on within close proximity of the subject site
- Byron Local Environmental Plan Heritage Items did not reveal any heritage listed items on within close proximity of the subject site

State and Local Authority Records

4.3 Contaminated Land Record Search
4.3.1 Contaminated Land Record
A search of the Contaminated Land Record (EPA 2010b) for the Byron Shire Council Local Government Area (LGA) did not identify any notices on or near the site. (see **Appendix A**).

4.3.2 Protection of the Environmental Operations Act Licenses
A search of the current list (EPA 2010c) of licensed activities as per Schedule 1 of the Protection of the Environment Operations Act 1997 did not identify any licensed activities on, or within close proximity of the subject site.

4.4.3 Cattle Tick Dip Sites
A search of the NSW Department of Primary Industry (DPI) Cattle Dip Site Locator tool

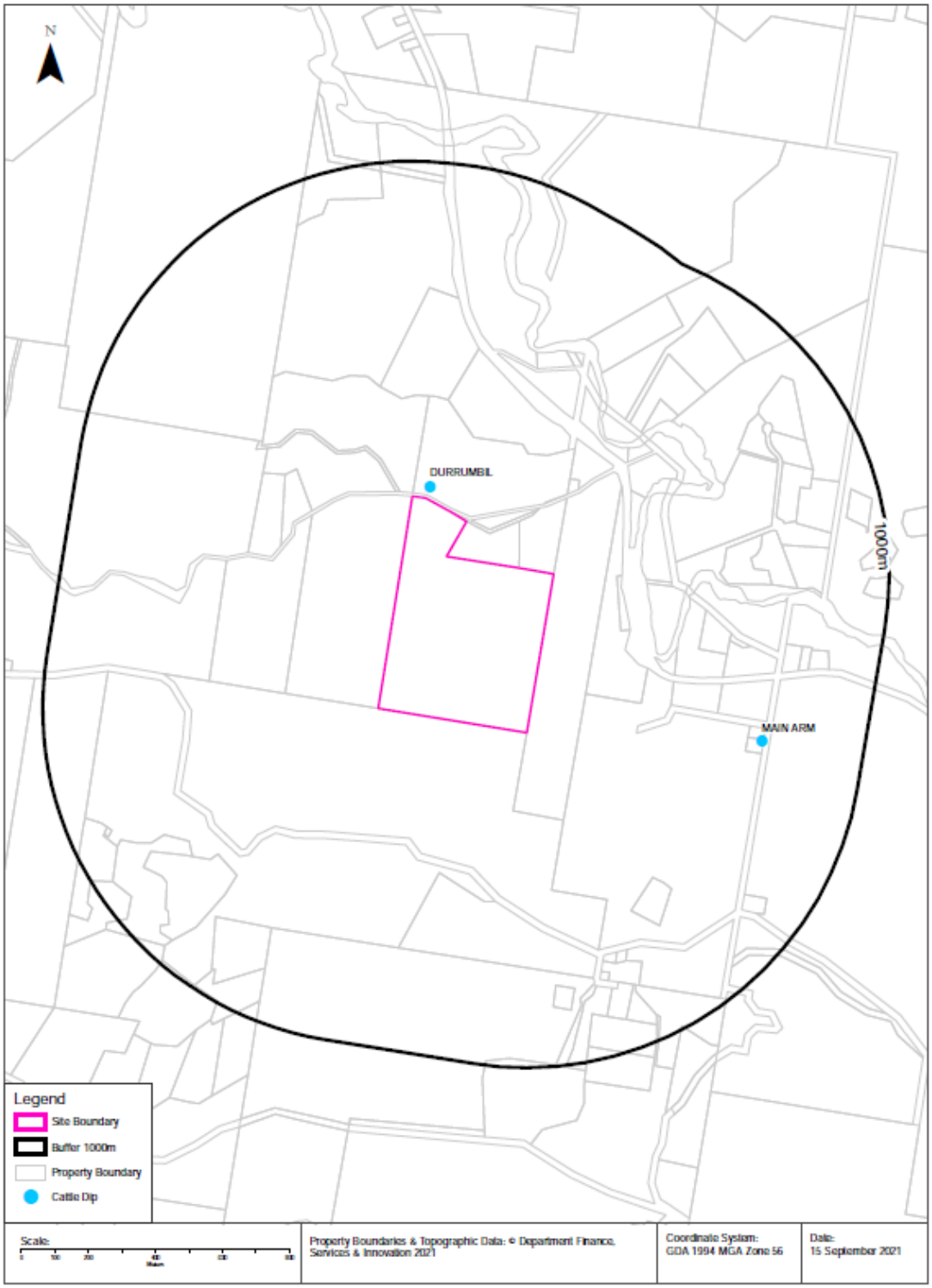
(https://www.dpi.nsw.gov.au/animals-and-livestock/beef-cattle/health-and-disease/parasitic-andprotozoal- diseases/ticks/cattle-dip-site-locator) indicated that the former Durrumbil cattle dip site has been decommissioned and is located on the northern side of Settlement Road, (Lot 4 DP 585928) approximately 173m north west of the existing dwelling on the subject site and therefore within the 200m radius NSW EPA investigation zone.

According to the NSW DPI *Decommissioned* – means all the standing structures, shed, fencing and roof have been dismantled. The bath itself, if present, is emptied of all chemical fluid and may have contaminated timbers from the roof and draining pen put into it and then is capped with concrete lids. The bath may have already been demolished prior to decommissioning in which case it is usually smashed and buried. An information plaque is attached to one of the concrete lids to indicate its

Departmental file number, dip name and direction of the dipping. Clean soil may be spread around the bath to run flush with the bath edge and then grassed. The draining pen concrete floor is usually left intact so as not to disturb the possibly contaminated soil.

Cattle Dips of the Northern Rivers Region

55 Settlement Road, Main Arm, NSW 2482



A series of chemicals including arsenic, DDT, Dioxathion, Dioathion Chlordimeform and Amitraz were used in the dipsite from 1945 until 1976.

Chemical Details

IMPORTANT NOTE: *Chemical history has been retrieved from a copied laboratory log. In some cases it may be confirmed by entries in the hard copy lease folder but generally the chemical record is based on this single lab document. It is possible that there are inaccuracies as well as errors made*

Chemicals used in dip bath	Date first used
ARSENIC	8/45
DDT	12/60
DIOXATHION	10/62
DIOXATHION CHLORDIMEFORM	10/73
AMITRAZ	12/76

4.5 Underground services and stormwater

Underground assets such as electricity and communications provide preferential pathways for contaminant migration.

4.6 Integrity Assessment

The site history information documented above is generally consistent with the aerial photographs, and the physical condition of the site. Based on the information available, TFA considers that sufficient historical information and site condition information has been obtained to allow for a thorough investigation of the environmental condition of the site.

5. Sampling & Quality Assurance Plan

5.1 Overview of DQO Process

The DQOs process is a planning tool developed to ensure that any data collected is of sufficient quality and quantity to support defensible decision making. It is a process used to define the type, quantity and quality of data needed to support decisions relating to the environmental condition of a site and provides a systematic approach for defining the criteria that a data collection design should satisfy.

It is recognised that the most efficient way to accomplish these goals is to establish criteria for defensible decision making before the data collection begins, and then develop a data collection design based on these criteria. By using the DQOs process to plan the investigation effort, the relevant parties can improve the effectiveness, efficiency and defensibility of a decision in a resource and cost-effective manner. DQOs have been developed to detail the type of data that is needed to meet the overall objectives of this project. The DQO's presented in this document have been developed with procedures stated in the following guidelines:

Prior to conducting site works, TFA undertook the data quality objectives (DQOs) planning process.

Table 5.1 DQOs Planning Process Output – Estimation Process

<table>
<tr><td colspan="8">Step 1 – State the problem
Summarise the contamination problem that will require new environmental data and identify the resources available to resolve the problem.</td></tr>
<tr><td>1.1</td><td colspan="7">Write a brief summary of the contamination problem:
A Preliminary Site Investigation under SEPP 55 has been triggered by the the Planning Proposal to Byron Shire Council (BSC) to amend the Byron Local Environmental Plan (BLEP) 2014 to formalise the use of the existing dwelling. The subject site is located on land used for bananas and passionfruit cultivation where herbicides, pesticides and fertilisers have been applied, the soil therefore has the potential to have associated contamination, as well as being located within the EPA Investigation zone for the former Durrumbil cattle dipsite.

Potential contaminants of concern include pesticides, herbicides, OCP, OPP, and heavy metals.</td></tr>
<tr><td rowspan="4">1.2</td><td colspan="7">Identify members of the planning team:</td></tr>
<tr><td colspan="2">Person</td><td colspan="2">Organisation</td><td colspan="2">Role</td></tr>
<tr><td colspan="2">Tim Fitzroy</td><td colspan="2">TFA</td><td colspan="2">Project Director</td></tr>
<tr><td colspan="2">Jacob Fitzroy</td><td colspan="2">TFA</td><td colspan="2">Environmental Economist</td></tr>
<tr><td>1.3</td><td colspan="7">Develop/refine the conceptual site model (CSM) (see Figure 3):
A graphical representation of the conceptual site model for the site is included as Figure 3.
Details are included of historical land use and areas of concern.</td></tr>
<tr><td rowspan="3">1.4</td><td colspan="7">Define the summary exposure scenarios (Y/N)*:</td></tr>
<tr><td>Soil/Dust</td><td>Y</td><td>Groundwater</td><td>Y</td><td>Surface Water</td><td>Y</td></tr>
<tr><td>Dermal</td><td>R/M</td><td>Dermal</td><td></td><td>Dermal</td><td>-</td></tr>
</table>

Step 1 – State the problem Summarise the contamination problem that will require new environmental data and identify the resources available to resolve the problem.						
	Ingestion	R/M	Ingestion		Ingestion	-
	Inhalation	R/M	Inhalation		Inhalation	-
	Ecological	-	Ecological	R/M	Ecological	Y
	* R = residential, RC = recreational, C = commercial worker, M = maintenance worker (i.e., during site works/construction); B = local bores add additional if required					

Step 2 - Identify the decision To identify the decision that requires new environmental data to address the contamination problem.	
2.1	If identified Contaminants of Concern are detected in soils or groundwater exceed Tier 1 or Tier 2 Risk Assessment Criteria. If the 95% UCL does not exceed Tier 1 of Tier 2 Risk Assessment Criteria a Human health/ ecological pathway is considered to not exist.

Step 3 – Identify the inputs to the decision To identify the information that will be required to support the decision and specify which inputs require new environmental measurements.	
3.1	Identify the information that will be required to resolve the decision statements, including existing information and new environmental data, and identify the sources for each item of information required:
	Existing information:
	No previous reports for this property
	New environmental data:
	Measurements of soil, groundwater contamination concentrations with potential contaminants of concern (PCOCs). Soil 16 metals (silver, arsenic, lead, cadmium, chromium, copper, manganese, nickel, selenium, zinc, mercury, iron, aluminium, beryllium, boron and cobalt), organochlorine pesticides (OCPs) and organophosphorus pesticides (OP's).
3.2	Identify the information needed to establish the action level: For soil HIL A residential in NEPM, 2013 has been applied
3.3	Confirm that appropriate analytical methods exist to provide the necessary data: Feasible analytical methods, both field and laboratory will be consistent with existing guidance including being in accordance with NEPM, 1999. Laboratories to be used are NATA accredited and use analytical methods based on USEPA and APHA methods.

Step 4 - Define the boundaries of the study To define the spatial and temporal boundaries that the data must represent to support the decisions.	
4.1	Specify the characteristics that define the population of interest: The investigation area is currently limited areas on the site to the areas that are currently not occupied by building structures and underground services Investigation areas are presented in Figure 2.
4.2	Define the geographic area and media to which the decision statement applies: The investigation boundary is shown on Figure 1. Media is also stratified depending on the nature of the material encountered (i.e., fill material/natural soil)
4.3	When appropriate, divide the populations into strata that have relatively homogenous characteristics: Populations consist of, fill material, natural soil, and groundwater beneath the site.
4.4	Determine the time frame to which the decision applies: This timeframe may be affected by other external factors, which may include the following: Access to Driller Inclement weather delaying progress
4.5	Determine when to collect data: Rain or flood conditions will likely limit access. Works will be undertaken during normal working hours.
4.6	Define the scale of the decision making: Update as required
4.7	Identify any practical constraints on data collection: The following constraints are likely to impact data collection: Rain and flood conditions will likely limit access Presence of underground services Advancement into areas cleared of building structures and underground services grass areas only

Step 5 - Develop the analytic (statistical) approach Develop a logical "if …, then …, else …" statement that defines the conditions that would cause the decision maker to choose among alternative actions.	
5.1	Specify the statistical parameter that characterises the population of interest, such as mean, median, maximum or proportion, etc.: The 95% UCL for will be the key characteristic. Other data evaluation will entail: No sample will exceed 250% of the criteria Standard deviation will be < 50% criteria 95% UCL is < criteria
5.2	Specify the action level for the decision: Analytical actions levels based on residential criteria with garden/accessible soil (home-grown produce < 10% fruit and vegetable and no poultry) in NEPM 1999, amended 2013. The criteria is not clean-up criteria; therefore, exceedances will be screened to determine whether further investigation is required.
5.3	Confirm that measurement detection will allow reliable comparisons with the action level: Samples will be collected and submitted for NATA accredited laboratory analysis to determine site conditions. Standard limits of reporting (LOR) are less than the criteria.
5.4	Combine the outputs from the previous DQOs steps and develop an "if ..., then ..., else ..." theoretical decision rule based on the chosen action level: If the statistical parameters of the data exceed applicable action levels, further remediation/assessment or management will be required at the site. If not, no further remediation will be required at the site.

Step 6 – Specify performance or acceptance criteria To specify probability limits for false rejection and false acceptance decision errors.	
6.1	Specify the decision rule as a statistical hypothesis test:

Step 6 – Specify performance or acceptance criteria To specify probability limits for false rejection and false acceptance decision errors.	
	Null hypothesis (HO) is the 95% UCL for concentration for soil is > action level; and Alternative hypotheses (HA) the 95% UCL for concentration for soil is ≤ action level.
6.2	Examine consequences of making incorrect decisions from the test: False rejection or Type I error of determining the site is suitable when it is not (wrongly rejects a true HO). Consequence is potential risks to human health and/or the environment. False acceptance or Type II error of determining the site is not suitable when it is (wrongly accepts a false HO). Consequence is unnecessary expenditure of resources or a site not being used for its highest value.
6.3	Place acceptable limits on the likelihood of making decision errors: Decision errors occur when accurate analytical results generated from tiny samples (sampling unit) are assumed to represent the concentrations of much larger volumes of matrix, but that extrapolation is invalid because confounding variables have not been acknowledged or controlled. No sample result will exceed 250% of the criteria. Standard deviation will be < 50% criteria. 95% UCL is < criteria.

Step 7 – Optimise the design for obtaining data To identify a resource effective sampling and analysis design for generating data that are expected to satisfy the DQOs.				
7.1	Document the final sampling and analysis design, along with a discussion of the key assumptions underlying this design: Refer to SAQP section of report.			
7.2	Detail how the design should be implemented, together with contingency plans for unexpected events: Refer to SAQP section of report.			
7.3	Determine the quality assurance and quality control (QA/QC) procedures that would be performed to detect and correct problems to ensure defensible results: The field QA, and the field and laboratory QC, are described in the sampling, analysis and quality plan (SAQP). In summary, the following QC soil and groundwater samples are proposed in accordance with the NEPM 2013.			
	Field QC samples		Lab QC samples	
	Blind duplicate	≥ 5%	Lab blank	≥ 1/lab batch
	Blind triplicate	≥ 5%	Surrogate spike	
	Rinsate sample	≥ day	LCS	≥ 1/lab batch
	Trip blank (vol)	≥ 1/field batch	Matrix spike	≥ 1/media type
	Trip spike (vol)	≥ 1/field batch	Lab duplicate	≥ 10%
7.4	Document the operational details and theoretical assumptions of the selected design in the sampling, analysis, and quality plan (SAQP):			

5.2 Possible Contaminant Sources

Despite the lack of recent use of chemicals at the site, historical use is likely at the site. **Table 5.2** below lists the sources of potential contamination at the site and their associated contaminants of concern. The site has been subject to a number of lands uses that have the potential to be contaminating activities. Based on the site history

information, site inspection and surrounding land uses, the potentially contaminating activities were identified as:

- Pesticides, Herbicides, OCP, OPP, and heavy metals used on banana and passionfruit
- Herbicides used on cattle grazing land

Table 5.2 Potential Contaminants of Concern for Identified Activities

Potential contaminants of concern (PCOC) related to these suspected activities are presented below

Potential contaminants of concern (PCOC)	Suspected Activities (source)
Organochlorine/organophosphorus pesticide	used in pesticides for cropping
Heavy Metals	metals including arsenic, cadmium, chromium, copper, lead, nickel, zinc, mercury. Found in pesticides, and many waste products.

Technical guidance considered in preparing these DQOs **includes:**

- NSW EPA (formerly Office of Environment and Heritage (OEH) (2011) Guidelines for Consultants Reporting on Contaminated Sites.
- NSW EPA (2017) Guidelines for the NSW Site Auditor Scheme (3rd edition).
- NSW EPA (2012) Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases.
- National Environment Protection Council (NEPC) National Environment Protection
- (Assessment of Site Contamination) Measure 1999 (ASC NEPM (2013) – Schedule
- B2: Guideline on Site Characterisation (2013).

5.3 Relevant Environmental media

The environmental media considered relevant for the investigation consisted of site soil.

5.4 Relevant Environmental Criteria

5.4.1 Soil (General Contaminates)

For soil, the appropriate and adopted criteria are based on the ASC NEPM 2013, in particular the health investigation levels (HILs), environmental investigation levels (EILs), environmental screening levels (ESLs) applicable for residential A land use.

Residential land use criteria has been adopted as the proposed development will be residential for both HIL and HSL

HSLs and ESLs – soil type

Based on the nature of the soil, clay soil criteria have been used as the soil type for deriving the HSLs and ESLs.

6. Site Assessment

6.1 Preliminary Site Investigations

The field work was undertaken in general accordance with the DQOs. Field works were conducted on:

- 14 October 2021 for the soil investigation

All fieldwork was completed by Tim Fitzroy. The sampling and analytical strategy and methodology are described below. The results of the assessment are provided in Section 7. Soil sample locations are shown on **Figure 5**. On the days of the site assessments the weather was fine. Photographs of the subject site can be seen in **Appendix B**.

6.2 Visible Signs of Contamination

The Investigation Area was assessed on foot in order to identify any signs of contamination. In general, no obvious signs of contamination (such as plant stress, surface spills, waste materials, odours etc.) were evident during the site investigation.

6.3 Odours

There were no obvious odours akin to contamination observed during site inspections.

6.4 Flood Potential

There is no likely of flooding on the subject site.

6.5 Presence of Drums, Wastes and Fill Material

There was no evidence of drums, waste and fill material.

6.6 Methodology

The objective of this preliminary investigation is to gather information with regard to the type, location, concentration and distribution of contaminants to determine if the subject site represents a risk of harm to end users and sensitive receptors. To determine this, soil sampling and laboratory analysis has been conducted upon surface soils collected from the study area.

The following sampling, analysis and data quality objectives have been adopted for this site investigation:

- to confirm the soils in the vicinity of the existing dwelling and farm shed at the site do not pose a risk to human health or the environment through soil contamination.
- to employ quality assurance when sampling, assessing and during evaluation of the subject soils.

- to ensure that decontamination techniques are applied during the sampling procedure and that no cross contamination of samples occurs.

6.6.1 Soil (general contaminates)

Soil sampling around the existing dwelling was restricted due to existing hard landscaping and decks and a gully to the east and north. Sampling was undertaken in close proximity of the dwelling to the west and south. NSW EPA, 1997 states that for a site of 2,000 sq. m, 8 sample points are required. The frequency of locations sampled is in line with the minimum sampling requirements for circular hotspots.

Soil sampling was also undertaken around the existing farm shed. While the farm shed is not to be used for residential purposes it was deemed prudent, given the previous use of the shed for packing bananas, that an assessment for contamination be undertaken. A total of 8 soil samples were collected from the vicinity of the shed.

The sample locations TFA1- TFA16 had representative samples collected from each location using the methodology described in the following sections. All samples were tested individually plus 2 QA samples (1 field sample and 1 laboratory duplicate).

Systematic sampling pattern was adopted within the vicinity of the proposed dwelling and farm shed sites (see **Figure 4A** and **4B**).

In accordance with the Sampling Design Guidelines, the following sampling method was used:

- The sampling procedure utilised in this investigation was in accordance with AS 4482.1 – 2005.
- Eight (8) surface soil samples were collected (TFA1-TFA8) from around the dwelling.
- Eight (8) surface soil samples were collected (TFA9-TFA16) from around the dwelling.
- Two Quality Assurance samples were also collected.
- All samples were collected from the surface soil horizon between 0 and 150 mm below the surface using a 70 mm diameter hand auger.
- The soil samples were sent to the Environmental Analysis Laboratory (EAL); for analysis and determination of residual metals, chemicals and organo-chlorines and organophosphate concentrations.
- All soil samples were placed into an esky with ice bricks, and delivered to the Environmental Analysis Laboratory at Southern Cross University, Lismore. Metals analysis was conducted by EAL and quality control. Analysis is conducted using a Perkin Elmer ELANDRC-e ICPMS (Inductively Coupled Plasma Mass Spectrometry). Chain of custody forms, laboratory quality assurance and laboratory quality control documentation are available on request.
- The analysis of pesticides was subcontracted to the NATA-registered Labmark laboratory.
- Chain of Custody forms, which identified the sample identification codes, the collection dates and the type of analysis to be undertaken were fully completed and delivered with the samples (see **Appendix C**).
- Residual samples were stored, frozen and retained by *Environmental Analysis Laboratory* pending the need for additional or repeat analysis.

- Laboratory Results are available in **Appendix D**.

6.7 Data Usability

A background to data usability is provided in **Appendix E.** All site work was completed in accordance with standard *TFA sampling protocols*, including a QA/QC programme and standard operating procedures.

A data usability assessment has been performed for the sampling undertaken during this investigation, as summarised in **Appendix E** and includes:

- Summary of field quality assurance/quality control
- Field quality control soil samples summary
- Summary of laboratory quality assurance/quality control.

Following this discussion, the data usability assessment shows that the data is of suitable quality to support the conclusions made in this report.

6.8 Conditions Encountered

The site is an irregular shape and is located on the southern side of Settlement Road. The site is undulating ranging from 130m AHD in the south to 40m AHD in the north interspersed with a series of gullies. Surface soil conditions comprised medium clay to clay loam.

- Dwelling

The existing dwelling is about 20 years old comprising, timber floor, metal roof and manufactured board. The perimeter of the dwelling is extensively landscaped to the north and east including paving plus a timber deck extending to the south. Soil sampling around the existing dwelling was restricted due to existing hard landscaping and decks and a gully to the east and north.

- Shed

The existing shed comprises timber floor, metal roof and manufactured board. It is our understanding that the shed was originally used for packing of bananas.

7. Analytical Results

7.1 Soil

Table 7.1 Summary Results Laboratory Analysis of Soil for Metals, OCs & OPs

Analyte	Health Criteria 0m to <1m	Ecological Criteria	Management Limits	Site Data			
	HIL/HSL mg/kg	EIL/ESL (mg/kg)	ML (mg/kg)	No. samples analysed	Number of exceedances	Max mg/kg	Meets Screening criteria?
Heavy Metals							
(Arsenic)	100	100	NA	18	0	26	Yes
(Lead)	300	1,100	NA		0	87	Yes
Cadmium	20	-	NA		0	<0.5	Yes
Chromium	100	410	NA		0	11	Yes
Copper	6,000	230	NA		0	45	Yes
Nickel	400	270	NA		0	11	Yes
Zinc	7,400	770	NA		0	230	Yes
Mercury	40	-	NA		0	0.13	Yes
(OCs)							
(Endrin)	10	NL	NA	18	0	<0.1	Yes
(Dieldrin)	6	NL	NA		0	<0.1	Yes
(DDD, DDE and DDT)	240	180	NA		0	<0.2	Yes

The analytical results are presented in the Soil Analytical Data Table 7.1 and in the laboratory, analysis indicate compliance with the Health Investigation Levels (HILA) and Ecological Investigation Levels (EILs) outlined in NEPM 1999 (2013) (see **Appendix D**).

8. Discussion and Conceptual Site Plan

8.1 Discussion

The results of preliminary assessment of the subject site indicate compliance with the National Environment Protection Measure (NEPM 2013) HILA *Residential with garden/accessible soil also includes children's day care centres, preschools and primary schools* and *Ecological Soil Investigation Levels* and Ecological Screening Levels (HSL's) (NEPM 2013).

A Conceptual Site model has been prepared with respect to detailed site investigation to accompany a future Development Application for residential subdivision.

8.2 Conceptual Site Model

The conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site, following the site investigation is detailed in Table 8.1 below.

Table 8.1 CSM Discussion

Element	Site Specific Information
Potential sources of contamination and contaminants of concern.	Metals, and chemicals may be present from banana and passionfruit production and cattle dip-site.
Potentially affected media, such as recovered aggregate and soil.	Media consists of soil.
Human and ecological receptors.	Potential human & ecological receptors include: • Construction workers; • Residents • Brunswick River
Potential and complete exposure pathway to human and/or environmental receptors.	• Subsurface infrastructure.

Based on the results of this assessment, the likelihood for chemical contamination to be present within proximity of the existing dwelling and shed is considered to be low.

9. Conclusions

This investigation is Tier 1 - preliminary site investigation, which is required to determine if contamination of the site's soil has occurred from past land usage in accordance with NEPM 1999 (2013), DUAP and EPA (1998). The investigation includes obtaining a history of land usage on the site and a preliminary soil-sampling regime. The results of the soil sample and groundwater analysis are compared with the Health Investigation Levels (HIL's) and Ecological Investigation Levels (EILs) outlined in NEPM 1999 (2013).

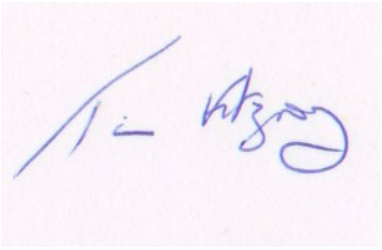
A search of the NSW Department of Primary Industry (DPI) Cattle Dip Site Locator tool (https://www.dpi.nsw.gov.au/animals-and-livestock/beef-cattle/health-and-disease/parasitic-andprotozoal- diseases/ticks/cattle-dip-site-locator) indicated that the former Durrumbil cattle dip site has been decommissioned and is located on the northern side of Settlement Road, Lot 4 DP 585928, approximately 173m north west of the existing dwelling on the subject site and therefore within the 200m radius NSW EPA investigation zone.

A total of sixteen boreholes (TFA1-TFA16 plus 2 QA samples) within proximity of the existing dwelling and shed were analysed for 16 metals (silver, arsenic, lead, cadmium, chromium, copper, manganese, nickel, selenium, zinc, mercury, iron, aluminium, beryllium, boron and cobalt), organochlorine pesticides (OCPs) and organophosphorus pesticides (OP's).

All of the soil samples show contaminant levels well below the most stringent Australian and New Zealand Environment and Conservation Council (ANZECC), National Environment Protection Measure (NEPM 2013) HILA Residential with garden/accessible soil and Ecological Soil Investigation Levels (NEPM 2013).

Based on the outcomes of this PSI there is no impediment to approval of the Planning Proposal to amend the Byron Local Environmental Plan (BLEP) 2014 to formalise the use of the existing dwelling located at Lot 5 DP585928, No 55 Settlement Road, Main Arm.

This report has been prepared by Tim Fitzroy of Tim Fitzroy & Associates.



Tim Fitzroy
Environmental Health Scientist
Environmental Auditor

References

Australia and New Zealand Environment and Conservation Council (ANZECC), 1992, Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, Australia and New Zealand Environment and Conservation Council.

Environment Protection Authority, 1995, Contaminated Sites Sampling Design Guidelines, Environment Protection Authority, Sydney.

National Environment Protection Council (2013) 'Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater

Council of Standards Australia (2005) AS 4482.1-2005 Guide to the sampling and investigation of potentially contaminated soil – Non-volatile and semi-volatile compounds

NSW DEC (2006) Contaminated Sites – Guidelines for the NSW Site Auditor Scheme 2nd Edition

NSW EPA (2011) Guidelines for Consultants Reporting Contaminated Sites

National Environment Protection Council (NEPC) (2013) National Environment Protection (Assessment of Site Contamination) Measure

Contaminated land guidelines (NSW Environment Protection Authority 2020)

Northern Rivers Regional Councils (NRRC) Regional Policy for the Management of Contaminated Land (NRRC 2006)

Copyright and Usage

Figures

Figure 1 Location map

Figure 2 Investigation Areas

Figure 3 Conceptual Site Plan

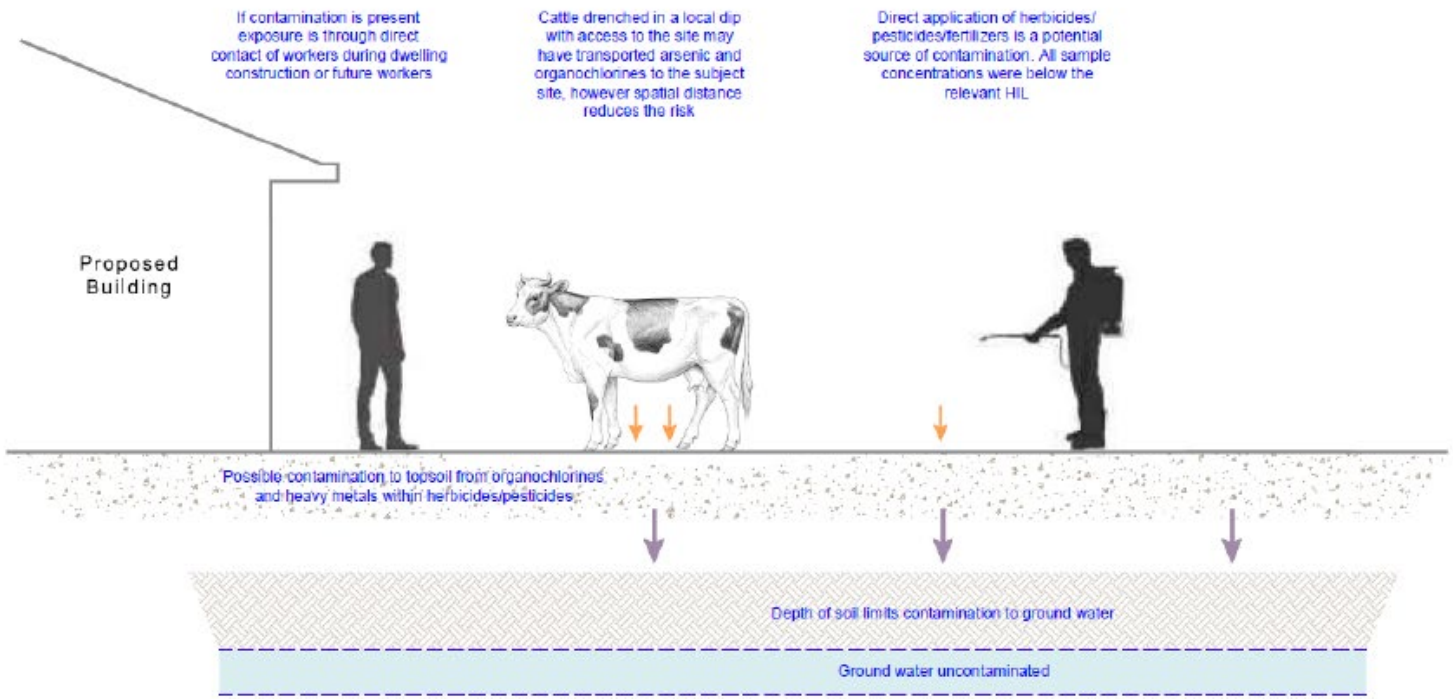


Figure 4A Soil Sample Locations Dwelling

Figure 4B Soil Sampling Locations Shed

A Lotsearch

B Site Photos

Photo A **Existing Dwelling looking south east**

Photo B **Western side of existing dwelling**

Photo C **Eastern side of Existing Dwelling**

Photo D **Farm Shed looking west**

Photo E **Looking north from Farm Shed across former cropped area**

C Chain of Custody

Environmental Analysis Laboratory

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www.scu.edu.au/eal
ABN: 41 995 651 524

Sample Receipt Notification (SRN)

Project:	**EAL/M2405**
Customer:	Tim Fitzroy & Associates Pty Ltd
Contact:	Tim Fitzroy
Client Job ID:	55/2020
No. of Samples	18 x Soil
Date Received:	14 OCT 2021
Comments:	20% discount as per Graham

Biller: **Tim Fitzroy & Associates Pty Ltd** - Tim Fitzroy

Test Request

Sample Text ID	Client Sample ID	Contaminated Site Assessment 1a	SS-PACK-005
M2405/001	TFA1	1	
M2405/002	TFA2	1	
M2405/003	TFA3	1	

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

Sample Receipt Notification (SRN) for EAL/M2405

		Contaminated Site Assessment 1a	SS-PACK-005
M2405/004	TFA4	1	
M2405/005	TFA5	1	
M2405/006	TFA6	1	
M2405/007	TFA7	1	
M2405/008	TFA8	1	
M2405/009	TFA9	1	
M2405/010	TFA10	1	
M2405/011	TFA11	1	
M2405/012	TFA12	1	
M2405/013	TFA13	1	

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ABN: 41 995 651 524

Sample Receipt Notification (SRN) for EAL/M2405

		Contaminated Site Assessment 1a	SS-PACK-005
M2405/014	TFA14	1	
M2405/015	TFA15	1	
M2405/016	TFA16	1	
M2405/017	TFA9 Field Duplicate	1	
M2405/018	TFA Lab Duplicate	1	
Total		18	

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
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www.scu.edu.au/eal
ABN: 41 995 651 524

Sample Receipt Notification (SRN) for EAL/M2405

Test Descriptions

Test List Item	Item Description
SS-PACK-005	**Contaminated Site Assessment 1a** Dry and Grind Basic Texture Metals (Cu, Pb, Cd, Zn, As, Se, Fe, Mn, Ag, Cr, Ni, Al, Hg, B, Co, Be) Pesticides (OPs, OCs) SUBCONTRACTED

EAL Environmental Analysis Laboratory

PO Box 157 (Military Road)
LISMORE NSW 2480
T: 02 6620 3678 E: eal@scu.edu.au W: www.scu.edu.au

Submitting Client Details

Quote Id:
Job Ref: 55/2020
Company: Tim Fitzroy & Associates
Contact: Tim Fitzroy
Phone:
Mobile: 044 848 3837
Email: tim@timfitzroy.com.au
Postal address: 61 Pine Ave East Ballina

Billing Client Details

X Tick if same as submitting details
ABN:
Company:
Contact:
Phone:
Mobile:
Email:
Postal address:

Payment Method:
□ Purchase Order
□ Cheque
□ Credit/Debit Card (EAL staff will phone for details)
X Invoice (prior approval)

Relinquished:
Received: PM

Date:
Date: 14/10

Preservation: none - ~~freezer bricks~~ - ice - acidified - filtered - other
Condition on receipt: ambient - cool - frozen - other

Comments:

1 lab duplicate, 1 field duplicate
Email quote from Graham Lancaster advising 20% reduction in lab analysis costs

Likelihood and nature of Hazardous material:

Lab ID	Sample ID	Sample Depth	Sampling Date	Sampler	Your Client	Crop ID	Total number of samples: Sample Type (e.g. water, leaf, soil)	Sample Analysis Request: Price list code (e.g. SW-PACK-06) SS-PACK-005						
							18							
1	TFA1	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x						
2	TFA2	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x						
3	TFA3	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x						
4	TFA4	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x						

Comments:

Likelihood and nature of Hazardous material:

Lab ID	Sample ID	Sample Depth		Sampler	Your client	Crop ID	Sample Type (e.g. water, leaf, soil)	Sample Analysis Request Price List Code (e.g. SW-PACK-06) SS-PACK-005					
5	TFA5	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
6	TFA6	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
7	TFA7	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
8	TFA8	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
9	TFA 9	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
10	TFA10	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
11	TFA11	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
12	TFA 12	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
~~13~~	~~TFA13~~	~~0-150mm~~	~~14/10/2021~~	~~Tim Fitzroy~~	~~Wright~~		~~Soil~~	~~x~~					
14	TFA14	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
15	TFA15	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
16	TFA16	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
17	TFA9 Field Duplicate	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					
18	TFA Lab Duplicate	0-150mm	14/10/2021	Tim Fitzroy	Wright		Soil	x					

SGS

CHAIN OF CUSTODY & ANALYSIS REQUEST

Page 1 of 1

SGS Environmental Services
Unit 16, 33 Maddox Street
Alexandria NSW 2015
Telephone No: (02) 85940400
Facsimile No: (02) 85940499
Email: au.samplereceipt.sydney@sgs.com

Company Name:	EAL	Project Name/No:	
Address:	PO Box 157	Purchase Order No:	M2405
	LISMORE NSW 2480	Results Required By:	
		Telephone:	02 6620 3678
Contact Name:	Graham Lancaster	Facsimile:	
		Email Results:	eal@scu.edu.au

Client Sample ID	Date Sampled	Lab Sample ID	WATER	SOIL	PRESERVATIVE	NO OF CONTAINERS	CL5 TRH/BTEX C6-C40	CL8 TRH/BTEX/PAH	CL11TRH/BTEX/PAH/ Phenols		SV3 OC/OP	SV6 OC/PCB Low Level	SV9 OC/OP/PCB		Speciated Phenolics	Total Cyanide	Asbestos ID	OC	TRH C10-C40	BTEX C6-C9	Hexavalent Cr Vi
M2405/1	-	1		+		1					+										
				+		↓					+										
				+							+										
				+							+										
				+							+										
				+							+										
				+							+										
M2405/18		18		+							L										

SGS EHS Sydney COC
SE224722

Relinquished By: Kerry	Date/Time: 15.10.21 1pm	Received By:	Date/Time 18.10.21 11:20
Relinquished By:	Date/Time:	Received By:	Date/Time
Samples Intact: (Yes) No	Temperature: Ambient / (Chilled) 2±.5	Sample Cooler Sealed: (Yes) No	Laboratory Quotation No:
	Comments:		

D Laboratory Analysis

RESULTS OF SOIL ANALYSIS

18 samples supplied by Tim Fitzroy & Associates Pty Ltd on 14/10/2021. Lab Job No. M2405.
Samples submitted by Tim Fitzroy. Your Job: 55/2020.
61 Pine Avenue EAST BALLINA NSW 2478

ANALYTE	METHOD REFERENCE	Sample 1 TFA1	Sample 2 TFA2	Sample 3 TFA3	Sample 4 TFA4	Sample 5 TFA5	Sample 6 TFA6	Sample 7 TFA7	Sample 8 TFA8	Sample 9 TFA9
	Job No.	*M2405/1*	*M2405/2*	*M2405/3*	*M2405/4*	*M2405/5*	*M2405/6*	*M2405/7*	*M2405/8*	*M2405/9*
TEXTURE (SAND, CLAY, SILT)	** inhouse	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
MOISTURE %	** c	29	22	26	28	25	27	32	31	18
SILVER (mg/kg DW)	*a*	<1	<1	<1	<1	<1	<1	<1	<1	<1
ARSENIC (mg/kg DW)	*a*	11	12	12	11	11	11	11	18	15
LEAD (mg/kg DW)	*a*	23	30	29	30	29	25	24	87	31
CADMIUM (mg/kg DW)	*a*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
CHROMIUM (mg/kg DW)	*a*	9	9	10	9	9	7	9	9	8
COPPER (mg/kg DW)	*a*	22	20	23	27	25	25	26	38	36
MANGANESE (mg/kg DW)	*a*	979	2,282	1,995	2,460	2,369	1,309	1,263	2,643	3,662
NICKEL (mg/kg DW)	*a*	6	6	6	6	6	5	6	8	9
SELENIUM (mg/kg DW)	*a*	2	2	1	2	2	2	2	1	2
ZINC (mg/kg DW)	*a*	57	75	64	71	73	44	47	215	124
MERCURY (mg/kg DW)	*a*	0.10	0.10	0.11	0.13	0.11	0.08	0.06	0.12	0.10
IRON (% DW)	*a*	2.68	2.79	3.10	2.85	2.74	2.46	2.85	2.80	2.67
ALUMINIUM (% DW)	*a*	1.66	1.65	2.10	1.78	1.73	1.50	1.79	1.45	1.66
BERYLLIUM (mg/kg DW)	*a*	<1	<1	<1	<1	<1	<1	<1	<1	<1
BORON (mg/kg DW)	*a*	2	2	<1	1	2	<1	<1	1	2
COBALT (mg/kg DW)	*a*	10	23	21	24	20	12	10	19	27
PESTICIDE ANALYSIS SCREEN										
Hexachlorobenzene (HCB) (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor epoxide (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Alpha Endosulfan (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDE (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beta Endosulfan (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
p,p'-DDD (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan sulphate (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone (mg/kg)	*c*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Organochlorine Pesticides SUM (mg/kg)	*c*	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*
Dichlorvos (mg/kg)	*c*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dimethoate (mg/kg)	*c*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diazinon (Dimpylate) (mg/kg)	*c*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorpyrifos (Chlorpyrifos Ethyl) (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methidathion (mg/kg)	*c*	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethion (mg/kg)	*c*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Organophosphate Pesticides SUM (mg/kg)	*c*	*<1.7*	*<1.7*	*<1.7*	*<1.7*	*<1.7*	*<1.7*	*<1.7*	*<1.7*	*<1.7*

METHODS REFERENCE:

a. ^{13}Nitric/HCl digest - APHA 3125 ICPMS
b. ^{13}Nitric/HCl digest - APHA 3120 ICPOES
c. Analysis sub-contracted - SGS report no. SE224722
*** denotes these test procedure or calculation are as yet not NATA accredited but quality control data is available*

NATA
WORLD RECOGNISED ACCREDITATION
Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing

NOTES:

1. HIL A ⁄ Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare centres, preschools and primary schools.
2. HIL B ⁄ Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.
3. HIL C ⁄ Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. This does not include undeveloped public open space.
4. HIL D ⁄ Commercial/industrial, includes premises such as shops, offices, factories and industrial sites.
(REFERENCE: Health Investigation Guidelines from NEPM (National Environmental Protection, Assessment of Site Contamination, Measure), 2013; Schedule B1).
5. Environmental Soil Quality Guidelines, Page 40, ANZECC, 1992.
6. able 1 Maximum values of specific contaminant concentrations for classification without TCLP (NSW EPA 2014, Waste Classification Guidelines Part 1: Classifying Waste)
7. able 2 Maximum values for leachable concentrations and specific contaminant concentrations when used together (NSW EPA 2014, Waste Classification Guidelines Part 1: Classifying Waste)
8. Analysis conducted between sample arrival date and reporting date.
9. ** NATA accreditation does not cover the performance of this service.
10. .. Denotes not requested.
11. This report is not to be reproduced except in full.
12. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer SCU.edu.au/eal/t&cs or on request).
13. Results relate only to the samples tested.
14. This report was issued on 27/10/2021.

Additional NOTES:

DW = Dry Weight. na = no guidelines available

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

Sample 10 TFA10	Sample 11 TFA11	Sample 12 TFA12	Sample 13 TFA13	Sample 14 TFA14	Sample 15 TFA15	Sample 16 TFA16	Sample 17 TFA9 Field Duplicate	Sample 18 TFA Lab Duplicate	*RESIDENTIAL A Guideline Limit* *Individual -Column A*
M2405/10	*M2405/11*	*M2405/12*	*M2405/13*	*M2405/14*	*M2405/15*	*M2405/16*	*M2405/17*	*M2405/18*	*See note 1a*
Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	..
26	25	28	22	16	19	24	22	25	..
<1	<1	<1	<1	<1	<1	<1	<1	<1	*na*
15	11	13	17	12	26	17	13	5	*100*
37	54	23	38	32	23	74	28	13	*300*
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	*20*
9	9	11	7	7	7	8	7	10	*(<100)*
36	35	32	45	31	18	38	32	8	*6,000*
2,446	1,187	903	2,126	2,865	1,019	2,849	2,987	240	*3,800*
7	6	7	9	11	6	10	8	5	*400*
1	2	2	1	1	1	1	1	<1	*200*
138	180	66	142	93	52	230	114	29	*7,400*
0.12	0.08	0.10	0.09	0.09	0.09	0.09	0.08	0.09	*40*
2.66	2.08	3.15	2.47	2.55	2.29	2.99	2.33	1.49	*na*
1.66	1.41	1.94	1.63	1.71	1.60	1.54	1.60	1.39	*na*
<1	<1	<1	<1	<1	<1	<1	<1	<1	*60*
2	5	<1	4	3	2	1	3	<1	*4,500*
19	10	9	17	19	7	20	20	3	*100*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*10*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*6*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*6*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*6*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*240*
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	..
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*240*
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	*6*
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	*10*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*240*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*240*
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	..
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*240*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*240*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*270*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*10*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*300*
<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	*10*
<1	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*	*<1*	..
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	..
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	..
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	..
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	*160*
<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	..
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	..
<1.7	*<1.7*	*<1.7*	*<1.7*	*<1.7*	*<1.7*	*<1.7*	*<1.7*	*<1.7*	..

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

QA/QC Report for EAL Job M2405

18 samples supplied by Tim Fitzroy & Associates Pty Ltd on 14/10/2021. Lab Job No. M2405.

Samples submitted by Tim Fitzroy. Your Job: 55/2020.

61 Pine Avenue EAST BALLINA NSW 2478

Digest Date: 18/10/2021

Analysis Date: 18/10/2021

	Method	PQL	Digest Blank	LCS % Recovery AGAL 12				DUPLICATE			
		mg/kg	mg/kg	Result 1	Certified Value	Recovery (%)	Pass Limits	Result 1 - M2405/10	Result 2 - M2405/10d	RPD	Pass Limits
METALS & SALTS											
SILVER (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	1	<1	5.73	**5.63**	**101.7%**	Pass	0.00	0.00	..	Pass
ARSENIC (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	2	<2	3.87	**3.39**	**114.2%**	Pass	14.2	16.0	**12%**	Pass
LEAD (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	1	<1	29.8	**31.4**	**95.0%**	Pass	34.8	40.3	**15%**	Pass
CADMIUM (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	0.5	<0.5	0.75	**0.77**	**97.1%**	Pass	0.13	0.07	**58%**	Pass
CHROMIUM (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	2	<2	32.9	**33**	**99.7%**	Pass	8.0	9.7	**20%**	Pass
COPPER (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	1	<1	156	**150**	**103.7%**	Pass	33.6	38.6	**14%**	Pass
MANGANESE (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	1	<1	503	**500**	**100.7%**	Pass	2782	2089	**28%**	Pass
NICKEL (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	1	<1	16.2	**16.6**	**97.6%**	Pass	8.0	6.2	**25%**	Pass
SELENIUM (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	2	<2	1.53	**1.50**	**102.2%**	Pass	1.5	1.4	**9%**	Pass
ZINC (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	1	<1	177	**182**	**97.4%**	Pass	125	151	**19%**	Pass
MERCURY (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	0.1	<0.1	0.56	**0.53**	**104.8%**	Pass	0.11	0.12	**4%**	Pass
IRON (%)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	0.005	<0.005	2.41	**2.49**	**96.6%**	Pass	2.58	2.73	**6%**	Pass
ALUMINIUM (%)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	0.005	<0.005	1.07	**1.05**	**101.8%**	Pass	1.56	1.75	**12%**	Pass
BERYLLIUM (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	1	<1	0.68	**0.67**	**102.2%**	Pass	0.69	0.74	**7%**	Pass
BORON (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	5	<5	2.55	**3.46**	**73.8%**	Pass	1.44	1.61	**12%**	Pass
COBALT (mg/kg)	1:3 Nitric/HCl digest - APHA 3125 ICPMS	1	<1	8.59	**8.67**	**99.1%**	Pass	22.2	16.4	**30%**	Pass

Quality Control Global Acceptance Criteria (GAC)

Accuracy

LCS - 1 per analytical batch

LCS - general analytes 70% - 130% recovery

Precision

Laboratory duplicate - 1 every 10 samples, minimum one per analytical batch

Laboratory duplicate RPD GAC - 30%, also applicable - No Limit (<10x PQL), 0-50% (10-20x PQL), 0-20% (>20x PQL)

Notes:

This QA/QC report is specific to job number specified above

LCS: Laboratory Control Standard - Reported as percent recovery

RPD: Relative Percent Difference between two duplicate pieces of analysis

PQL: Practical Quantification Limit also referred to as Limit of Reporting LOR

.. - denotes no sufficient data available

This report was issued on 29/10/2021.

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked:.....
Graham Lancaster

E Data Usability Assessment and Quality Assurance

Data Usability Summary Assessment

All site work was completed in accordance with standard *TFA sampling protocols*, including a quality assurance/quality control (QA/QC) programme and standard operating procedures.

A data usability assessment was performed for the soil data collected by TFA, as summarised in the following tables:

- Table E.1, field QC samples summary,
- Table E.2, summary of field QA/QC, and
- Table E.3, summary of laboratory QA/QC.

Table I.1: Field quality control samples summary

	Total samples	Field duplicates	Lab duplicates	Trip Spike	Trip blank
Soil					
Heavy metals[1]	16	1	1	0	0
OCs	16	1	1	0	0
OPs	16	1	1	0	0

Notes:

1. Arsenic, lead, cadmium, chromium, copper, nickel, zinc, mercury, beryllium, boron, cobalt.
2. Silver, aluminium, arsenic, cadmium, chromium, copper, iron, manganese, nickel, lead, selenium, zinc, mercury.

Table I.2: Summary of field QA/QC

Parameter	Complies	Comments[1]
Precision		
Standard operating procedures (SOPs) appropriate and complied with	Yes	All sampling was conducted under standard TFA operating procedures.
Field duplicates	Yes	≥ 5%. RPD[2] criteria < 30% – 50%.
Inter-laboratory duplicates	Yes	≥ 5%. RPD[2] criteria < 30% – 50%.
Accuracy		
Matrix spikes samples appropriate	Yes	≥ 1/media type.
Representativeness		
Sample collection - preservation	Yes	All samples were collected directly into laboratory supplied jars with no headspace. All samples were placed immediately into eskies containing ice.
Sample collection - sample splitting	Yes	Duplicate samples were split in the field by filling each jar collectively (i.e. co-collected). These samples were not submitted for analysis however.
Field equipment calibrated	N/A	No field equipment that required calibration was used.
Decontamination procedures	Yes	Soil samples were collected using a shovel and gloved hand, which was washed with Decon 90 between locations.
Rinsate samples	N/A	Required ≥ 1/field batch, < LORs. No rinsate samples were collected.
Trip blanks	No	≥ 1/field batch (volatiles), < LORs. No volatile compounds were potential contaminants of concern.
Trip spikes	No	≥ 1/field batch (volatiles), 70 - 130%, (recovery) or ≤ 30 - 50% (RPDs). No volatile compounds were potential contaminants of concern.
Comparability		
Consistent sampling staff	Yes	field work was conducted by Tim Fitzroy of TFA and Glen Chiswell Cavvanba.
Consistent weather/field conditions	Yes	No extreme weather conditions occurred during or before/after the investigation.
Completeness		
Sample logs and field data	Yes	-
Chain of Custody	Yes	Refer to Appendix F

Notes:

1. For QC samples, specified frequency and acceptance criteria shown.
2. RPD = relative percentage difference.

Table I.3: Summary of laboratory QA/QC

Parameter	Complies	Comments[1]
Precision		
Laboratory duplicates	Yes	≥ 10%, laboratory specified. All laboratory duplicates were within the laboratory specified global acceptance criteria.

Parameter	Complies	Comments[1]
Accuracy		
Surrogate spikes	Yes	Organics by GC, 70% - 130%. All surrogates were within the laboratory specified global acceptance criteria.
Matrix spikes analysis appropriate	Yes	≥ 70% - 130%.
Laboratory control samples (LCSs)	Yes	≥ 1/lab batch, 70% - 130%.
Certified reference material (CRM)	N/A	-
Representativeness		
Sample condition	Yes	
Holding times	Yes	
Laboratory blanks	Yes	≥ 1/lab batch, < LORs.
Comparability		
NATA accredited laboratory	Yes	EAL Laboratory Services is a NATA accredited laboratory (accreditation number 14960).
NEPM methods or similar	Yes	LORs were consistent and appropriate.
Completeness		
Sample receipt	Yes	
Laboratory reports	Yes	

Notes:

1. For QC samples, acceptance criteria shown. Acceptance criteria can vary based on analyte, statistical data and laboratory specific methods. Laboratory specified relates to detected concentrations based on LORs, e.g. result < 10 x LOR = no limit, 10 – 20 x LOR = 0 - 50%, > 20 x LOR = 0 - 20%. See laboratory reports for specific details.

Summary and Discussion

The following issues were identified with the data:

- **Precision:** The data shows no significant variability.
- **Accuracy:** The accuracy of the analysis is confirmed by surrogate, matrix spike and LCS recoveries within the acceptance criteria.
- **Representativeness:** No outliers have been reported for QC samples collected to assist in the qualification of representativeness. It should be noted that no trip spikes or blanks were analysed during the works, but no volatile compounds were PCOCs.
- **Comparability:** The data is considered to be acceptable, with consistent sampling staff and NATA accredited laboratory used and all LORs below the relevant criteria.
- **Completeness:** Laboratory and field documentation is considered to be complete.

Data Usability Background

I 1.0 Introduction

Information generated from environmental investigations requires some statement in regard to the usability of the data, and therefore quality assurance (QA) and quality

control (QC) are an integral part of the analysis and interpretation of environmental data. QA/QC used in contaminated sites investigations is briefly reviewed in this section.

Quality assurance involves all of the actions, procedures, checks and decisions undertaken to ensure the representativeness and integrity of samples, and accuracy and reliability of analytical results (NEPC 1999). Quality control is the component of QA which monitors and measures the effectiveness of other procedures by the comparison of these measures to previously decided objectives.

There are various components of QA/QC which address the operation of the laboratories and the routine procedures conducted to achieve a minimum level of quality. Examples of QA components include sample control, data transfer, instrument calibration, staff training, etc. Examples of QC components include the measurement of samples to access the quality of reagents and standards, cleanliness of apparatus, accuracy and precision of methods and instruments, etc. Generally, the management of laboratory QA issues is addressed through accreditation by the National Association of Testing Authorities (NATA), or similar, and monitoring of these issues is not addressed on a project by project basis.

On a project specific basis, those involved in collecting, assessing or reviewing the relevant data should ensure the minimum level of QA is conducted. Appropriate numbers and types of QC samples should be collected and analysed, both field QC samples and laboratory QC samples. While minimum levels of QA/QC are specified in some guidelines, e.g. NSW EPA 1994, AS 4482.1-1997, NEPC 1999, the minimum level required may vary between projects, based on site and project specific aspects. This means that the minimum specified requirements may not be sufficient for a particular project. As described in the NEPM (NEPC 1999):

> *As a general rule, the level of required QC is that which adequately measures the effects of all possible influences upon sample integrity, accuracy and precision, and is capable of predicting their variation with a high degree of confidence.*

I 2.0 PARCC Parameters

Following receipt of laboratory analytical results, data validation is conducted to determine if the specified acceptance criteria have been met. This is conducted to ensure that all data, and subsequent decisions based on that data, are technically sound. Data quality is typically discussed in terms of precision, accuracy, representativeness, comparability and completeness. These are referred to as the PARCC parameters2. Field QA/QC and laboratory QC is described below within the PARCC framework.

I 2.1 Precision

I 2.1.1 Duplicates

Precision is a measure of the reproducibility of results under a given set of conditions and is assessed on the basis of agreement between a set of duplicate results obtained from duplicate analyses. The precision of a duplicate determination is measured by

comparing the difference between the two samples to the average of the two samples, expressed as a relative percentage difference (RPD).

The determination is:

RPD = (P-D)/(P+D/2) x 100

P = Primary sample
D = Duplicate sample

Three types of duplicates are commonly used:

- Field duplicates are used to measure the precision of the sampling and analytical process
- Inter-laboratory duplicates are used to check on the analytical performance of the primary laboratory
- Laboratory duplicates are used to measure the precision of the analytical process.

I 2.1.2 Field Duplicates

Field duplicates (or blind replicates) are collected from the same location and submitted to the laboratory for analyses, as a primary sample. The sample nomenclature is such that the laboratory is not aware which sample is a duplicate. The RPD is calculated to determine the degree of repeatability (precision) of results obtained from the duplicate analysis. Where results are below the practical quantification limit (PQLs) or limits of reporting (LORs), i.e. non-detects, RPDs cannot be calculated. Where one result is detected, the results are considered to conform when the detected result is less than five times the PQL/LOR.

The PQL/LOR is the lowest concentration of an analyte that can be determined with acceptable precision (repeatability) and accuracy under the test conditions. The PQL/LOR is usually calculated as five times the lower limit of detection (or method detection limit). However, adjustments in PQLs/LORs may be required due to interference from high contaminant concentrations.

As environmental samples can exhibit a high degree of heterogeneity, field duplicates often exceed the acceptance criterion, particularly if the samples are co-collected, for example, because of the potential for losing volatiles during sample splitting. It is generally accepted that before results which fail the acceptance criterion are described as due to low concentrations or sample heterogeneity, the sample should be re-analysed. This may not be necessary when the analytical results are significantly less than the landuse criteria.

2.1.3 Inter-laboratory Duplicates

Inter-laboratory duplicates (or split samples) are field duplicates which are sent to second laboratory and analysed for the same analytes and, as far as possible, by the same methods. These provide a check on the analytical performance of the primary laboratory.

2.1.4 Laboratory Duplicates

Laboratory duplicates (or check samples) are field samples which are split by the

laboratory and thereafter treated as separate samples. The RPD is calculated to determine the degree of repeatability (precision) of results obtained from the duplicate analysis.

USEPA (1994) specifies that for inorganics, if the results for laboratory duplicates fall outside of the recommended control limits for a particular analyte, all results for that analyte, in all associated samples of the same matrix, should be qualified as an estimated quantity. For organics, USEPA (1999) does not specify recommended actions for laboratory duplicates.

2.2 Accuracy

Accuracy is a measure of the agreement between an experimental determination and the true value of the parameter being measured. Inasmuch as the true sample concentrations are not known, the determination of accuracy is achieved through the analysis of known reference materials or assessed by the analysis of matrix spikes. Spiking of reference material into the actual sample matrix is the preferred technique because it provides a measure of the matrix effects on the analytical recovery.

Accuracy is measured in terms of percentage recovery as defined by:

$$\%R = ((SSR - SR) / SA) \times 100$$

%R = percentage recovery spike
SSR = spiked sample result
SR = sample result
SA = spike added

2.2.1 Matrix Spikes/Matrix Spike Duplicates

These are samples prepared in the laboratory by dividing a sample into two aliquots and then spiking each with identical concentrations of specific analytes. The matrix spike (MS) and matrix spike duplicate (MSD) are then analysed separately and the results compared to determine the accuracy and precision of the analytes.

2.2.2 Surrogate Spike

Surrogate spikes provide an indication of analytical accuracy. They are used only for analyses which use gas chromatography and are compounds which are similar to the organic analytes of interest in chemical composition, extraction and chromatography, but which are not normally found in field samples. Surrogates are generally spiked into all sample aliquots prior to preparation and analysis. If the surrogate spike recovery does not meet the prescribed acceptance criteria, the samples should be re-analysed.

2.2.3 Laboratory Control Samples

Laboratory control samples (quality control check samples) are laboratory prepared samples of an appropriate clean matrix (i.e. sand or distilled water) which are spiked with known concentrations of specific analytes. The laboratory control sample (LCS) is then analysed and the results are used to assess sample preparation and analytical accuracy, free of matrix effects. Certified reference material (CRM) is another form of

LCS, and involves the analysis of a known standard as part of the laboratory batch, e.g. British Columbia sediment samples for analysis of metals.

2.3 Representativeness

2.3.1 Rinsate blanks

Used to determine if sampling equipment has been adequately decontaminated to ensure that cross-contamination between samples has not occurred. The frequency for rinsate blanks is one per piece of equipment per day (AS 4482.1-1997), however it should be noted that cross-contamination will bias samples upwards, and the frequency should therefore be at the investigators discretion.

2.3.2 Trip Blanks

Used only when volatile organics are sampled to determine if transport in motor vehicles or similar has resulted in contamination of the samples. For trip blanks, a sufficient number should be analysed to allow the representativeness of the sampling to be determined. However, it should be noted that cross-contamination will bias samples upwards, and the frequency should therefore be at the investigators discretion.

2.3.3 Trip Spikes

Used only when volatile organics are sampled to attempt to quantify loss of volatiles during the analytical process. For trip spikes, a sufficient number of samples should be analysed to allow qualification of the likely loss of volatiles during the field sampling.

2.3.4 Laboratory Blanks

Laboratory blanks (or method blanks, or analysis blanks) are used to verify that contaminants are not introduced into the samples during sample preparation and analysis. The NEPM (NEPC 1999) specifies that laboratory blanks should be conducted at a frequency of “at least one per process batch”. The acceptance criterion for laboratory blanks is non-detect at the PQL/LOR.

2.4 Comparability

Comparability is a qualitative parameter designed to express the confidence with which one data set may be compared with another, including established criteria. Comparability is maintained by using consistent methods and ensuring that PQLs/LORs are below the relevant criteria.

2.5 Completeness

Quality control sample completeness is defined as the number of QC samples which should have been analysed, compared to the actual number analysed. If the appropriate number of QC samples are not analysed with each matrix or sample batch, then the data reviewer should use professional judgement to determine if the

associated sample data should be qualified. Completeness also refers to the complete and correct inclusion of field/sample documentation and laboratory documentation.

2.5.1 QC Sample Frequency and Criteria

Based on EPA made or approved guidelines, the following QC samples are required for all contaminated site investigations, unless otherwise specified as part of the data quality objectives (DQOs) process review. All data to be used for validation should conform as a minimum to the requirements specified, regardless of minimum sample size.

Quality Control Sample	Frequency	Results[1]
Precision		
Field duplicates	≥ 5%	≤ 30 - 50% [2]
Inter-laboratory duplicates	≥ 5%	≤ 30 - 50% [2]
Laboratory duplicates	≥ 10%	Lab specified [3]
Accuracy		
Surrogate spikes	Organics by GC	70 – 130% [4]
Matrix spikes (MSs)	≥ 1/media type	70 - 130% [5]
Laboratory control samples (LCSs)	≥ 1/lab batch	70 - 130% [6]
Certified refence material (CRM)	LCS for metals	Lab specified [7]
Representativeness		
Rinsate samples	≥ 1/field batch	< LOR
Trip blanks	≥ 1/field batch (volatiles)	< LOR
Trip spikes	≥ 1/field batch (volatiles)	70 - 130%, ≤ 30 - 50% [8]
Laboratory blanks	≥ 1/lab batch	< LOR

Notes

1. Where results are laboratory specified, the laboratory analytical reports should be consulted for specific information.
2. Relative percentage differences (RPDs) for field duplicates from AS 4482.1 (1997).
3. RPDs for laboratory duplicates specified by the laboratory. Based on the magnitude of the results compared to the level of reporting (LOR), e.g. ALS: result < 10 x LOR = no limit, 10 – 20 x LOR = 0-50%, > 20 x LOR = 0-20%. LabMark: < 5 x LOR = 0-100%, 5 – 10 x LOR = 0-75%, > 10 x LOR = 0-50% or 0-30% for metals.
4. Surrogate recoveries specified by laboratory based on global acceptance criteria or dynamic recovery limits based on statistical evaluation of actual laboratory data.
5. MS recoveries specified by laboratory based on global acceptance criteria.
6. LCS recoveries specified by laboratory based on global acceptance criteria or dynamic recovery limits based on statistical evaluation of actual laboratory data.
7. CRM recoveries specified by laboratory based on global acceptance criteria.
8. Trip spike results are specified as either recoveries or RPDs.

3.0 References

Australian New Zealand Environment and Conservation Council (1996) Guidelines for the laboratory analysis of contaminated soils. ANZECC, Canberra, ACT.

Australian Standard AS 4482.1 (2005) Guide to the sampling and investigation of potentially contaminated soil, Part 1: Non-volatile and Semi-volatile compounds. Standards Australia, Homebush, NSW.

National Environment Protection Council (NEPC) (1999) National Environmental Protection (Assessment of Site Contamination) Measure, Schedule B(2) Guideline on Data
Collection, Sample Design and Reporting. National Environment Protection Council Service Corporation. Adelaide, SA.

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NSW Environment Protection Authority (1994) Contaminated Sites: Guidelines for Assessing Service Station Sites. NSW EPA, Chatswood, NSW.

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