

***Soil Contamination Risk  
Stage 4 – Validation Report***

***Homestead Area - Wilfield***

***Weedons Ross Road, West Melton***

*November 2016*



***Malloch Environmental Ltd***

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*Stormwater Solutions • Soil Contamination Investigations • Environmental Planning*

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- C. Table of Validation Results
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## 1 Executive Summary

The subject site is located near the intersection of West Coast and Weedons Ross Roads, West Melton. A proposal to subdivide the land for residential use will change the use of the land and disturb soils. A Preliminary Site Investigation and XRF Screening Report (PSI) was prepared by Malloch Environmental Ltd in June 2014. That investigation identified two risk areas, around the former homestead buildings and the sheep yard area with a foot rot trough present. The remainder of the site was considered to be suitable for residential development without any further investigation.

A subsequent Detailed Site Investigation Report in November 2014, also by Malloch Environmental Ltd, found that the rural/residential 25% produce soil guideline value (SGV) for lead was exceeded in the former homestead area and that the recreational SGV for arsenic was exceeded in the sheep yard area. Results showed that organochloride pesticides are present in the soils in the sheep yard area, however levels are below the recreational SGV adopted for this area. Remediation of these areas was proposed and described fully in the Remediation Action Plan Report, dated December 2014.

Over the last two years the site has been progressively developed and the contaminated areas have been remediated at times to suit the construction programme. This current report details the remediation measures carried out in the former homestead area only. The sheep yard area has already been remediated and a separate validation report, dated April 2016, has been completed. A copy of the Remediation Plan for the Homestead Area is included in **Appendix A**.

The remediation proposal for the lead affected homestead area involved excavating and mixing the affected soils with clean soils to dilute the contaminants to below the rural residential SGVs. A motor scraper was used to remove the contaminated soils and mix them with adjacent clean soils. Following remediation, validation sampling was undertaken with 13 samples submitted to the laboratory to be tested for arsenic and lead. All results indicate that the remediation was successful and the remediation goal was met. The former homestead area is considered suitable for rural residential use with no further actions required.

## 2 Objectives of the Report

The objective of the report is to detail the remedial actions undertaken in the homestead area which will ensure the site is suitable for the future rural residential use. It also describes the validation sampling undertaken and results received.

It has been completed in accordance with the Ministry for the Environment's (MfE) "Contaminated Land Management Guidelines No 1: Reporting on Contaminated Sites in New Zealand".

## 3 Scope of Work Undertaken

This report includes all requirements for a Stage 4 Validation report and includes:

- A summary of the site and the results of the previous reports
- Details of the remedial works undertaken
- Details of the validation sampling undertaken and results analysis
- Preparation of report in accordance with MfE guidelines

## 4 Site Identification

The site is located on the south-eastern corner of the intersection of West Coast and Weedons Ross Roads in West Melton, as shown on the plans in **Figure 1** below. The entire subdivision site is legally described as Rural Sections 37783 and 37879 and Lot 2 DP 391578 and is well defined by existing fences, hedges and trees and has a total area of approximately 92 hectares.

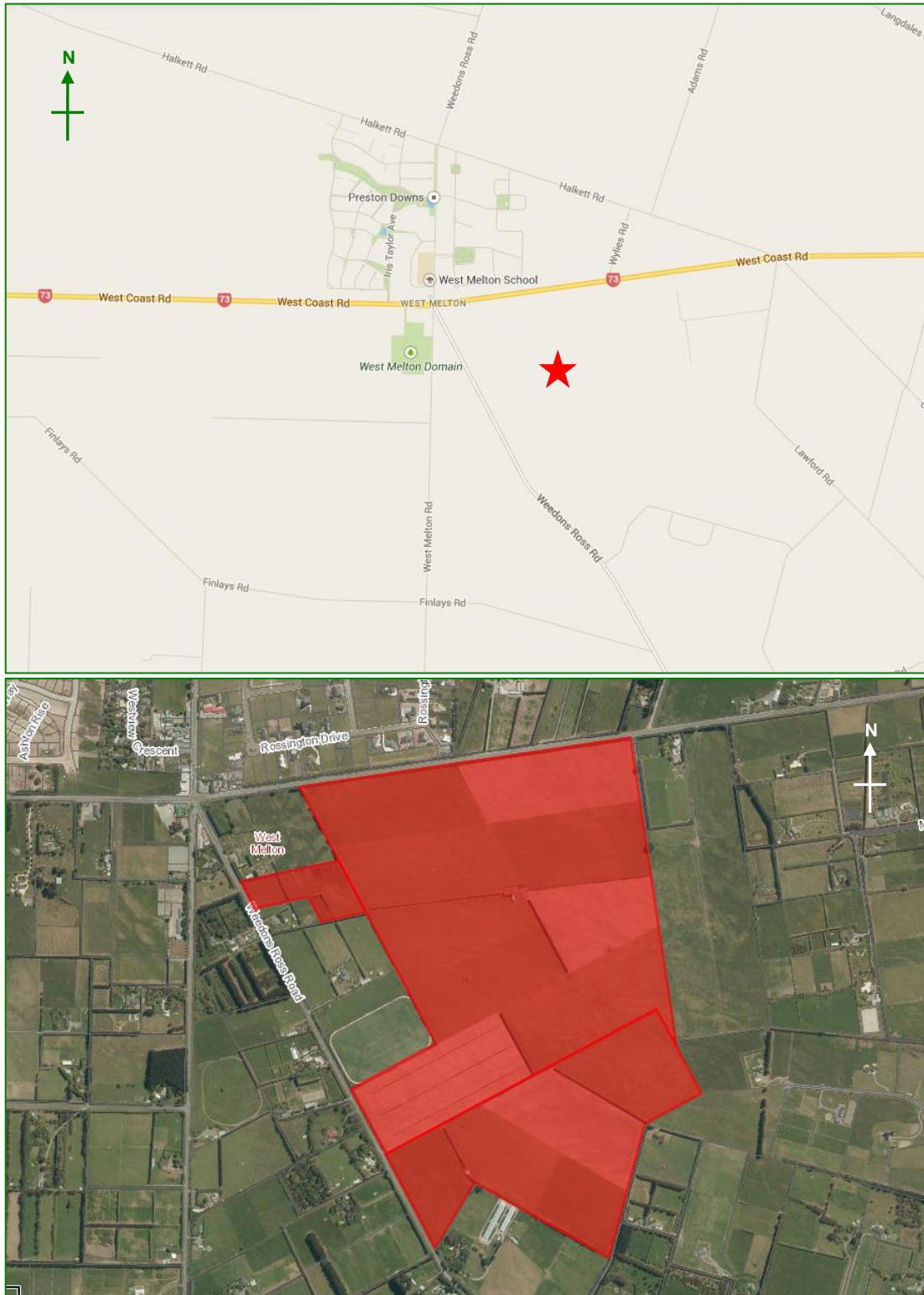


Figure 1 – Subdivision Location Plan

The area that this validation report covers is the former homestead area near the south-western corner of the site, as shown on the plan in **Figure 2** below:

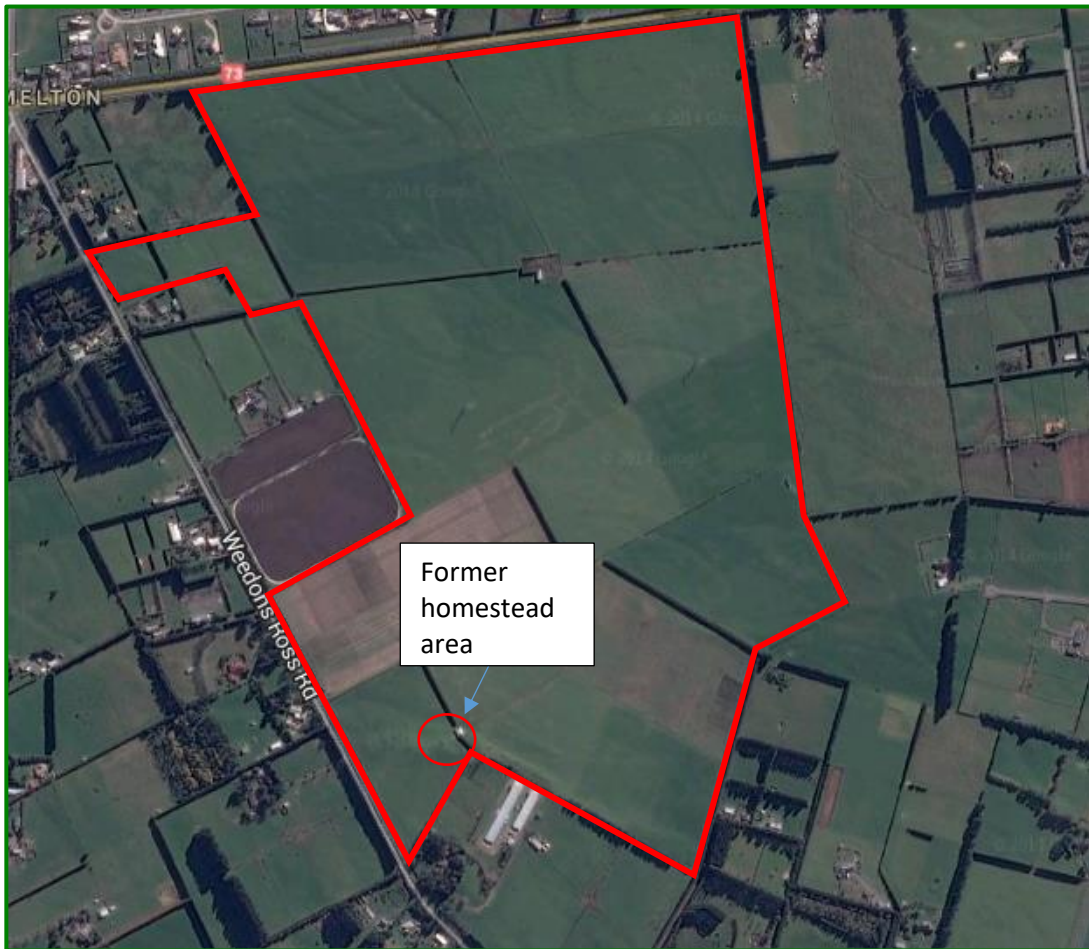


Figure 2 – Homestead Area Location

## 5 Summary of Site Description, History and Surrounding Environment

The subdivision site has a generally flat contour consisting of former pasture and cropping land and had only two farm shed buildings on it prior to subdivision development works. Hedges and trees lie around most of the perimeter of the site and there were a number of shelter belts within the site. An open drain runs along the northern boundary of the site, along West Coast Road. High voltage overhead power lines and power pylons run through the middle of the site. There are a number of rural lifestyle blocks adjacent to the site including the Melton Park estate to the east. The residential township of West Melton is to the northwest of the site. The PSI investigations confirmed that the site had been used for mainly sheep farming and pasture related crops for the known history of the site.

The former homestead area is in the south-western corner of the site, on an elevated area. There was a barn adjacent to where the original homestead was sited, but has been removed since the DSI was completed.

## **6 Geology and Hydrology**

The site is underlain by Eyre shallow sandy loam soils. The site is over the semi confined or unconfined aquifer system and ground water levels in nearby bores indicate water levels are in the order of 20-24m deep. The direction of ground water flow is generally in a south-eastern direction.

The closest wells downstream of the site are M35/7747 and M35/18112, both used for domestic water supply and drawing water from 36 to 54m deep. Both bore logs indicate that a layer of clay bound gravels provides a lower permeability layer above the gravel aquifer.

The nearest surface water body is an open water race which runs down the western boundary of the subject site.

## **7 Basis for Guideline Values**

### **7.1 Activity Description**

The homestead area is within land proposed to be used as a large rural residential section. The likely activities on this site include:

- Building of a residential dwelling, which is a change of use of the land
- Potential produce growing
- Disturbance of the soil related to the above activities

### **7.2 Zoning**

The subject site is currently zoned L2.

### **7.3 Soil Guideline Values**

Human health soil contaminant standards for a group of 12 priority contaminants were derived under a set of five land-use scenarios, and are legally binding under The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Health) Regulations 2011 (NES). These standards have been applied where applicable. For contaminants, other than the 12 priority contaminants, the hierarchy as set out in the Ministry for the Environment Contaminated Land Management Guidelines (CLMG) No 2 has been followed. For soil, guideline values are predominantly risk based, in that they are typically derived using designated exposure scenarios that relate to different land uses. For each exposure scenario, selected pathways of exposure are used to derive guideline values. These pathways typically include soil ingestion, inhalation and dermal adsorption. The guideline values for the appropriate land use scenario relate to the most critical pathway.

The applicable soil guideline values (SGV) are 'rural residential 25%', and 'commercial/industrial/outdoor workers' as a proxy value to protect the health of construction workers.

## 8 Summary of DSI Results

The results of the DSI found that the rural/residential 25% produce soil guideline value (SGV) for lead of 160mg/kg, was exceeded in four sample locations. Further testing of deeper samples at SS5 showed that lead levels reduced to below SGV by 450mm. Lead levels at the four locations varied from 178mg/kg to 320mg/kg.

No organochloride pesticides were detected in the one sample tested from the homestead area. Results for heavy metals were compared with background concentrations. This shows that cadmium and zinc levels are elevated above expected background concentrations, with one zinc result above the ecological value.

## 9 Summary of Remediation Action Plan

### 9.1 Remedial Options and Discussion

The remediation option chosen for the homestead area was mixing of the soils. Mixing the soils with clean soils to dilute was considered to be the most viable option for the lead contaminated soils at the former homestead. This was because the contaminant levels are not very high, do not extend very deep and there is adequate area and available clean soil for this option to be successful.

### 9.2 Proposed Remedial Actions

The following order of works was proposed:

- At the start of remediation, use the XRF to further define the lead affected area at the former homestead in order to minimise the volume for mixing.
- Strip the affected soils to a depth of approximately 300mm to 400mm using a motor scraper with an elevating paddle, in a pattern of stripes. The scraper will traverse along the contaminated area and then extend out beyond into clean soils for a distance of at least double the contaminated area.
- Soils will be laid down in a linear stockpile in 50mm layers.
- Once validation by XRF confirms the goal contaminant level for lead of 160mg/kg has been met, samples will be taken for lab analysis.
- When lab results have confirmed that all the contaminated material has been removed, the stockpile of mixed soils will be returned to the excavated area, once again using a motor scraper with an elevating paddle to mix the soils again.
- Validation sampling and lab testing of the mixed soils will then be carried out.

The expected volume of contaminated soils was estimated to be around 100m<sup>3</sup>.

### 9.3 Remediation Goal

The remediation goal is to ensure that the final mixed soil does not have lab tested levels of lead greater than the 'Residential 25% produce' SGV of 160mg/kg

## 10 Remediation Actions Undertaken

The entire remediation actions, including replacement of the mixed soils into the excavated area, were completed before Malloch Environmental Ltd was advised, so the proposed validation of

the excavated surface was not completed. However, it was evident from the depth of loose mixed soils that a depth of at least 300mm had been involved in the mixing process. The soils had been stripped off an area extending beyond the contaminated extent and at least double the distance of the contaminated area. The soil was excavated in layers, in a series of strips using a motor scraper with an elevating paddle which mixes the soils. The soils were laid out into a longitudinal stockpile. The soils were then replaced in layers in a similar manner.

The validation sample plan included in **Appendix A** shows the extent of the contaminated area, and the extent of the mixed area and stockpile.

## **11 Validation Sampling**

On the 19<sup>th</sup> October, 2016 a total of ten validation samples were taken from the area of excavation around the contaminated area. The soils were loose and appeared to be well mixed. Samples were taken from a range of depths. An additional three samples were taken from the surface in the area used for stockpiling the mixed soils during remediation. All samples were tested for arsenic and lead at Hill Laboratory.

A table of lab results is included in **Appendix C**, with the full laboratory report in **Appendix D**.

## **12 Field Quality Assurance and Quality Control**

The Contaminated Land Management Guidelines No 5, Ministry for the Environment was followed for all aspects of the investigation. Field quality control procedures included ensuring decontamination procedures were followed. Samples were taken using a stainless steel trowel or fresh disposable nitrile gloves. All equipment was decontaminated between samples using Decon 90 and rinsed with tap water.

Samples were collected in laboratory supplied containers and immediately placed in chilled bins. Following sampling, the samples were delivered to Hill Laboratory under chain-of-custody documentation.

## **13 Laboratory Quality Assurance and Quality Control**

All samples were submitted to Hill Laboratories in Christchurch for analysis. Hill Laboratories hold IANZ accreditation. As part of holding accreditation the laboratory follows appropriate testing and quality control procedures. No quality control issues were identified.

## **14 Results Summary and Discussion**

All thirteen samples taken in the contaminated area, and the area where the soil was stockpiled, returned results below the rural residential SGVs. Results for arsenic were all below expected background levels. Results for lead were consistently around 40-90mg/kg indicating the mixing of soils had been relatively consistent. The highest result of 131 mg/kg was from the base of the stockpiled area. Although the base of the excavation was not tested prior to the mixed soils being replaced, it is considered that due to the relatively low level of contamination found at depth during the DSI, the evident depth of mixing, and the good results for the mixed soils, that no further actions or investigations are necessary.

## **15 Site Characterisation and Conclusion**

The remediation actions in the former homestead area were considered to be successful with all validation samples of the mixed soils returning results below the rural residential 25%



produce SGVs for arsenic and lead. The area is now deemed to be suitable for rural residential use, with no further actions or investigations required.

## 16 Limitations

Malloch Environmental Limited has performed services for this project in accordance with current professional standards for environmental site assessments, and in terms of the client's financial and technical brief for the work. Any reliance on this report by other parties shall be at such party's own risk. It does not purport to completely describe all the site characteristics and properties. Where data is supplied by the client or any third party, it has been assumed that the information is correct, unless otherwise stated. Malloch Environmental Limited accepts no responsibility for errors or omissions in the information provided. Should further information become available regarding the conditions at the site, Malloch Environmental Limited reserves the right to review the report in the context of the additional information.

Opinions and judgments expressed in this report are based on an understanding and interpretation of regulatory standards at the time of writing and should not be construed as legal opinions. As regulatory standards are constantly changing, conclusions and recommendations considered to be acceptable at the time of writing, may in the future become subject to different regulatory standards which cause them to become unacceptable. This may require further assessment and/or remediation of the site to be suitable for the existing or proposed land use activities. There is no investigation that is thorough enough to preclude the presence of materials at the site that presently or in the future may be considered hazardous.

Report co-written by:



Chris Peacock  
Environmental Engineer

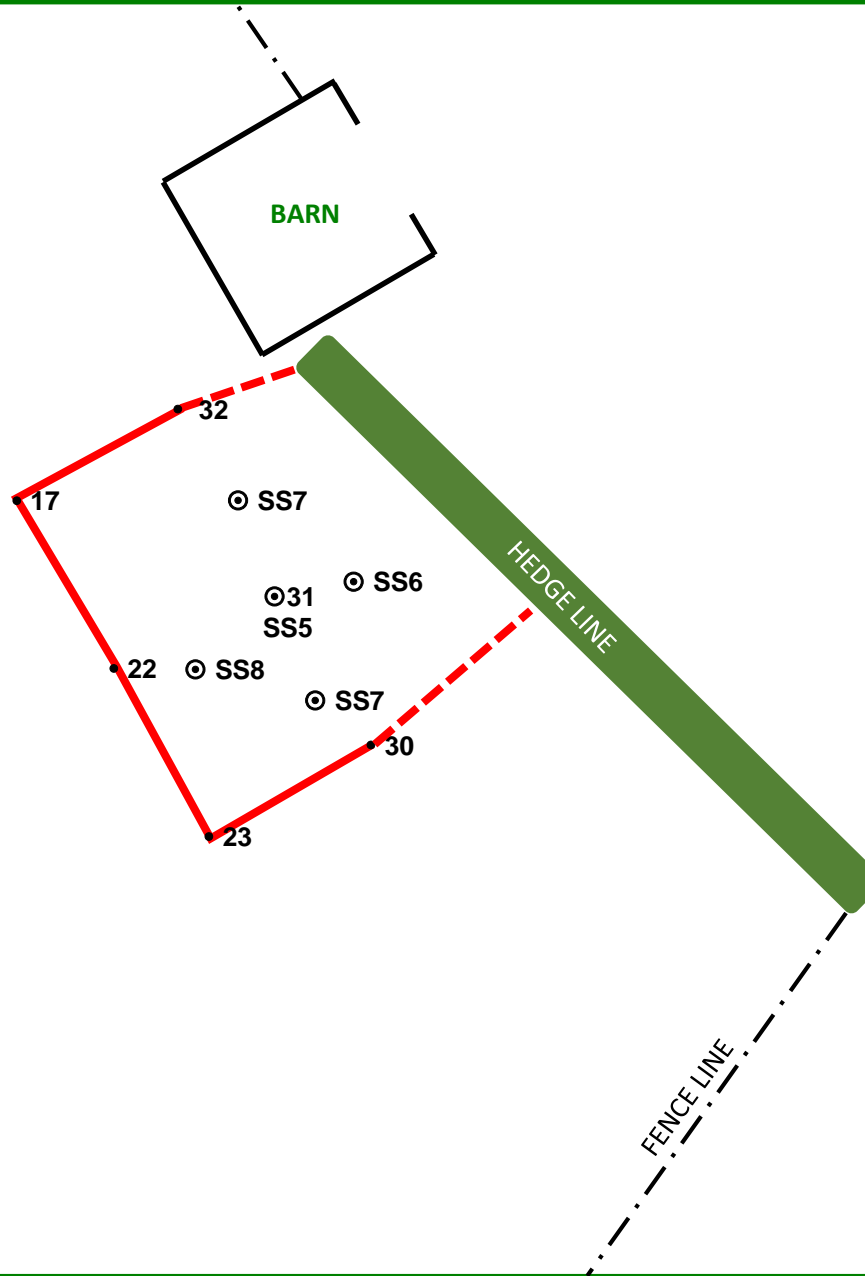
Report co-written and certified by a suitably qualified and experienced practitioner as prescribed under the NESCS (soil):



Nicola Peacock, CEnvP  
Principal Environmental Engineer



## ***Appendix A – Homestead Area Remediation Plan***



**LEGEND**

- 1 Soil sample location
- ⊙ 1 Soil sample location that exceeds Rural/Residential 25% Produce SGV
- Extent of remediation area
- - - - Remediation extent to be delineated during remediation by XRF

**Notes:**

1. This plan has been prepared for soil contamination risk assessment purposes only. No liability is accepted if the plan is used for any other purposes.
2. Any measurements taken from this plan which are not dimensioned on the electronic copy are at the risk of the user.
3. Soil sample locations are approximate only.

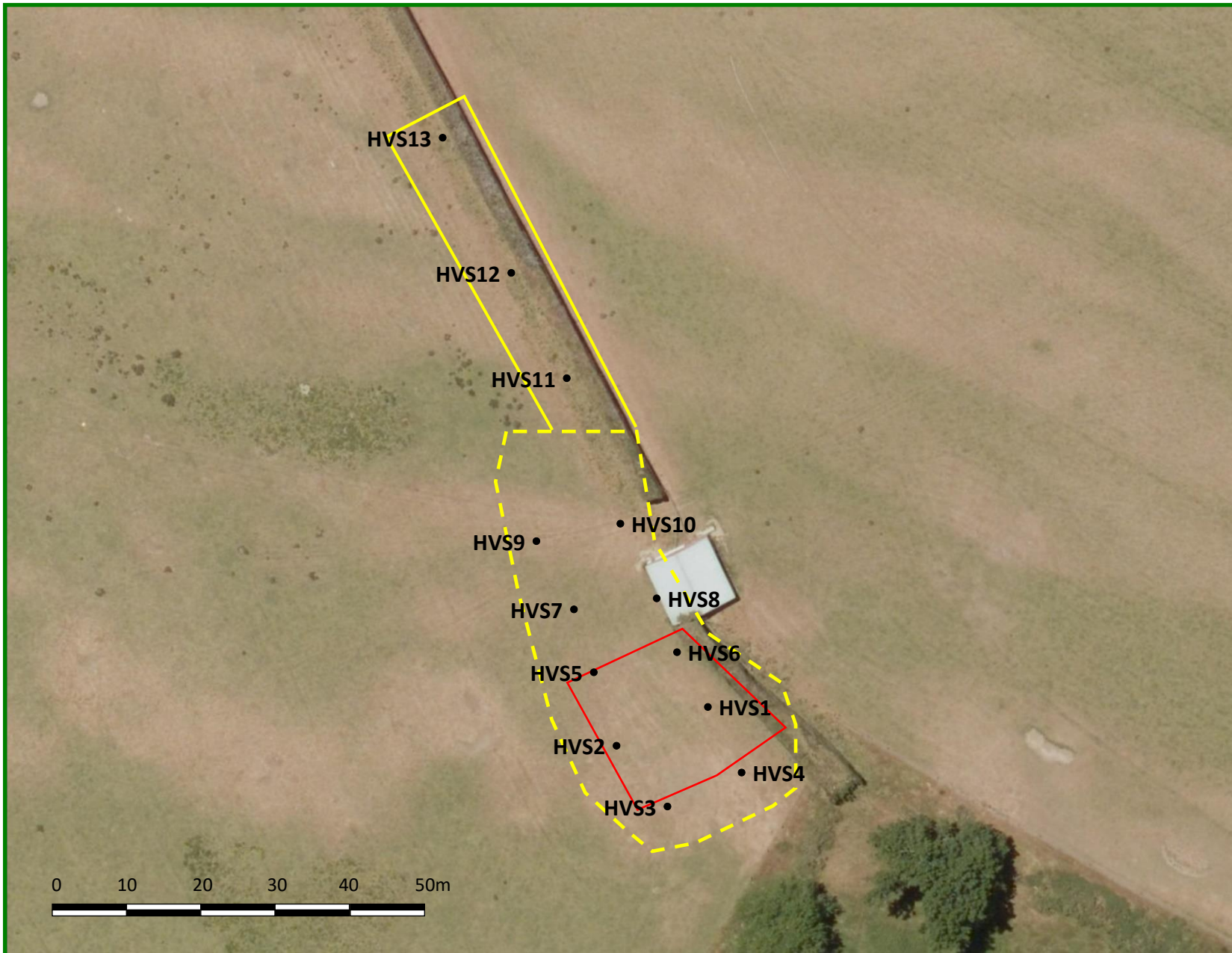


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Wilfield Homestead Remediation Plan  
 Cnr West Coast & Weedons Ross Rds, West Melton

Scale: NTS  
 Date: 31 October 2014  
 Drawing No: 01015 / 5

## ***Appendix B – Validation Sample Location Plan***



**LEGEND**

- **HVS3** Soil sample location XRF tested
- Area of stockpile
- - - Area of excavated and mixed soil
- Original contaminated area

**Notes:**

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**Validation Sample Location Plan**  
 Wilfield – Homestead Area

*Scale: NTS*

*Date: 19 October 2016*

*Drawing No: 01015/9*

## ***Appendix C – Table of Validation Results***

**Table of Laboratory Results - Wilfield Homestead Area**

Date of testing: 19th October, 2016

Analyte	Sample Name:	HVS1	HVS2	HVS3	HVS4	HVS5	HVS6	HVS7	HVS8	HVS9	HVS10	HVS11	HVS12	HVS13	Soil Guideline values					
															Rural Residential 25%	Commercial/ Outdoor Worker	Reference	Ecological receptors	Reference	Background <sub>1</sub>
Soil Results	Lab Number:	1667104.1	1667104.2	1667104.3	1667104.4	1667104.5	1667104.6	1667104.7	1667104.8	1667104.9	1667104.10	1667104.11	1667104.12	1667104.13						
	Depth:	0 - 50mm	0 - 50mm	50-100mm	150-200mm	0 - 50mm	0 - 50mm	100-150mm	250-300mm	100mm	0 - 50mm	0 - 50mm	0 - 50mm	0 - 50mm						
<b>Heavy Metals</b>																				
Total Recoverable Arsenic	mg/kg dry wt	3	3	3	3	3	3	3	3	3	3	3	3	4	17	70	NES	17	CCME	3.5
Total Recoverable Lead	mg/kg dry wt	58	89	74	45	84	92	83	69	88	76	74	131	40	160	3,300	NES	300	CCME	39.0

Indicates result exceeds rural residential soil guideline value

Indicates result exceeds ecological guideline value

Indicates result exceeds background value for soil type

NES - National Environmental Standard for Assessing and Managing Contaminants in Soils, MfE

NEPM - National Environmental Protection Measures 2013, Formerly NEPC, Australia

EAUK - Soil guideline values for nickel - Environment Agency UK 2009

CCME - Canadian Environmental Quality Guidelines, CCME (updated 2012)

<sub>1</sub> Concentrations for "Regional Yellow Brown Sand" from Background concentrations of selected Level 2 trace elements in Canterbury soils, Tonkin and Taylor, July 2007

## ***Appendix D - Laboratory Reports***





## ANALYSIS REPORT

<b>Client:</b>	Malloch Environmental Limited	<b>Lab No:</b>	1667104	SPV1
<b>Contact:</b>	Nicola Peacock C/- Malloch Environmental Limited 801 East Maddisons Road Rolleston 7614	<b>Date Received:</b>	19-Oct-2016	
		<b>Date Reported:</b>	26-Oct-2016	
		<b>Quote No:</b>	72157	
		<b>Order No:</b>		
		<b>Client Reference:</b>	Wilfield	
		<b>Submitted By:</b>	Chris Peacock	

### Sample Type: Soil

Sample Name:	HVS1	HVS2	HVS3	HVS4	HVS5
	19-Oct-2016 1:01 pm	19-Oct-2016 1:03 pm	19-Oct-2016 1:06 pm	19-Oct-2016 1:07 pm	19-Oct-2016 1:10 pm
<b>Lab Number:</b>	1667104.1	1667104.2	1667104.3	1667104.4	1667104.5
Total Recoverable Arsenic mg/kg dry wt	3	3	3	3	3
Total Recoverable Lead mg/kg dry wt	58	89	74	45	84

Sample Name:	HVS6	HVS7	HVS8	HVS9	HVS10
	19-Oct-2016 1:13 pm	19-Oct-2016 1:18 pm	19-Oct-2016 1:19 pm	19-Oct-2016 1:22 pm	19-Oct-2016 1:27 pm
<b>Lab Number:</b>	1667104.6	1667104.7	1667104.8	1667104.9	1667104.10
Total Recoverable Arsenic mg/kg dry wt	3	3	3	3	3
Total Recoverable Lead mg/kg dry wt	92	83	69	88	76

Sample Name:	HVS11	HVS12	HVS13		
	19-Oct-2016 1:29 pm	19-Oct-2016 1:33 pm	19-Oct-2016 1:35 pm		
<b>Lab Number:</b>	1667104.11	1667104.12	1667104.13		
Total Recoverable Arsenic mg/kg dry wt	3	3	4	-	-
Total Recoverable Lead mg/kg dry wt	74	131	40	-	-

## SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

### Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1-13
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	1-13
Total Recoverable Arsenic	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	2 mg/kg dry wt	1-13
Total Recoverable Lead	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.4 mg/kg dry wt	1-13



These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.

A handwritten signature in blue ink, appearing to read 'Graham Corban', is positioned above the printed name.

Graham Corban MSc Tech (Hons)  
Client Services Manager - Environmental