

Remediation Action Plan

197 Limekilns Road, Kelso NSW



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Executive summary

Background

A due diligence contamination investigation undertaken by SESL Australia Pty Ltd and reported in May 2015 (report number C4503.Q4409.B34749c) identified lead and dieldrin impacted soil in one location. A detailed contamination investigation undertaken by Envirowest Consulting Pty Ltd determined the extent of impacted material to be approximately 5m by 5m to a depth of 0.3m. Remediation of the contaminated areas was recommended. A remediation action plan (RAP) is required to develop an effective plan to remediate the impacted area to enable residential land-use.

Objective

Preparation of a remediation action plan to describe remediation works to enable the site to be suitable for residential land-use.

Summary

The site is located in a developing area in the north east outskirts of Bathurst and located within a former orchard.

Elevated levels of lead and dieldrin in soil were previously identified by SESL Australia Pty Ltd in an area north west of the packing shed. The extent of the lead and dieldrin impacted soil is approximately 5m by 5m to a depth of 0.3m.

The recommended remediation method is excavation and transportation off-site for disposal at landfill.

The remediation works will be validated through a sampling and analysis program. The base and walls of the excavation pit created to remediate the lead and dieldrin impacted soil will be sampled and analysed for lead and OCP (dieldrin). Residential land-use thresholds as outlined in NEPC (1999) will be adopted.

Remediation works will be supervised by an Environmental Scientist and comply with EPA guidelines including *Guidelines for Reporting on Contaminated Sites* (OEH 2011) *Remediation of Contaminated Land State Environmental Planning Policy* (SEPP55).

Implementation of the described strategies will ensure the successful remediation of the site for future residential land-use.

Contents

Executive summary.....	3
1. Introduction.....	5
2. Site identification	5
3. Site condition and surrounding environment	5
4. Previous investigations.....	7
5. Areas requiring remediation	9
6. Remediation options.....	10
7. Remediation plan	11
8. Remediation works issues.....	13
9. Remediation work validation.....	16
10. Other issues	17
11. References.....	19

Figures

Figure 1. Site locality

Figure 2. Site plan and area to be remediated

Appendices

Appendix 1. Data quality indicators

Appendix 2. Soil sampling protocols

1. Introduction

A due diligence contamination investigation undertaken by SESL Australia Pty Ltd and reported in May 2015 (report number C4503.Q4409.B34749c) identified lead and dieldrin impacted soil in one location. A detailed contamination investigation undertaken by Envirowest Consulting Pty Ltd determined the extent of impacted material to be approximately 5m by 5m to a depth of 0.3m. Remediation of the contaminated areas was recommended. A remediation action plan (RAP) is required to develop an effective plan to remediate the impacted area to enable residential land-use.

2. Objectives

Envirowest Consulting Pty Ltd has been commissioned by Bathurst Regional Council to prepare a RAP for the remediation of lead and dieldrin impacted material at 197 Limekilns Road, Kelso NSW and:

- Set remediation goals based on land-use threshold
- Propose a cost effective and workable remediation method
- Establish a validation procedure for the site
- Ensure remediation works comply with:
 - Guidelines for Consultants Reporting on Contaminated Sites* (OEH 2011)
 - Guidelines for NSW Site Auditor Scheme* (DEC 2006)
 - The Contaminated Land Management Act* (1997)
 - Remediation of Contaminated Land State Environmental Planning Policy* (SEPP55)
 - National Environment Protection (Assessment of Site Contamination) Measure 1999* NEPC (2013)
 - Bathurst Regional Council contaminated land policy*

3. Site identification

Address	197 Limekilns Road Kelso NSW
Client	Bathurst Regional Council
Deposited plans	Lot 5 DP847225
Size	Total lot – approximately 35ha Lead and dieldrin impacted material – approximately 25m ²

4. Site history

4.1 Zoning

The site is zoned R1 – General Residential and RE1 – Public Recreation under the Bathurst Local Environmental Plan (2014).

4.2 Land-use

The site is currently vacant with residential development beginning in the western section of the site. The investigation areas are part of later stage residential development. The site was previously used as an apple orchard with a packing shed and dwelling.

4.3 Summary of council records

A section 149 Certificate undertaken in 2015 identified Bathurst Regional Council has not received notice under the *Contaminated Land Management Act 1997*

- that the land is significantly contaminated
- subject to a voluntary management order
- subject to an ongoing maintenance order
- subject to a site audit statement.
- The land is not subject to mine subsidence under section 15 of the *Mine Subsidence Compensation Act 1961*
- The land is not bushfire prone land
- The site is subject to flood related development controls

Bathurst Regional Council did not have any other records on the site regarding contamination.

4.4 Sources of information for historical review and site description

- Site inspection 20 July 2017 by Envirowest Consulting Pty Ltd
- NSW EPA records of public notices under the CLM Act 1997
- Soil and geological maps
- Historical photographs 1964, 1974, 1984 and 1996
- NSW Planning and Environment planning viewer
- SESL Australia Pty Ltd (2015) *Due Diligence Assessment* (report number C4503.Q4409.B34749)
- Envirowest Consulting Pty Ltd (2016) *Detailed Contamination Investigation* (report number R8593c)

4.5 Review of site history

4.5.1 Aerial photographs

Year	Visual observations on Site
1964	The site has a similar layout to present. The site contains orchard trees and forms part of a larger site to the west. The site contains the packing shed and a dwelling north of the packing shed in the location of the current dwelling.
1974	Four additional sheds have been added to the property which were still present on the site in 2015. The dwelling is visible in this aerial photograph. The entire site still contains orchard trees.
1984	An additional farm dam has been constructed in this aerial photograph. The entire site is still covered in orchard trees.
1996	The water storage easement in the north of the site has been constructed. Many orchard trees have been removed from the site, predominately along the western side of the site.
2003	Orchard trees continue to be removed. The buildings all appear to remain. Residential development is evident west of the site.

4.5.2 Historical land uses

Title search Lot 5 DP847225

Year	Owners	Expected Landuse
1912 to 1922	Claude Harold Crago	Unknown
1922 to 1942	Harold Keith Chapman, Orchardist and Perpetual Trustee Company Ltd	Primary Production /Apple orchard
1942 to 1961	James Adrian Reed, Fruit and Vegetable Agent	Primary Production /Apple orchard
1961 to 1997	Sunbright Pty Ltd	Primary Production /Apple orchard
1997 to 2015	P J Paull Pty Ltd	Primary Production /Apple orchard
2015 to date	Bathurst Regional Council	Residential development

4.7 Buildings and infrastructure

No buildings or infrastructure were identified within the investigation area. Two sheds/structures are located south east of the investigation area.

4.9 Potential contaminants

Lead and dieldrin (OCP) have been identified as the contaminants of concern within this investigation area.

4.10 Relevant complaint history

None known.

4.11 Regulatory information

The site is not listed on the NSW EPA register of contaminated sites.

4.13 Neighbouring land-use

North – Rural-residential

South – Rural-residential

East – Rural-residential

West – Residential

Historical and present neighbouring land-uses are not expected to impact on the site.

4.14 Integrity assessment

The information obtained is accurate as the review records have allowed. The information available is considered sufficient for the purpose of the assessment and believed to be correct by the investigator.

5. Site condition and surrounding environment

5.1 Surface cover

Surface cover on-site included pasture grasses and broadleaved weeds. No bare areas were identified within the investigation area.

5.2 Topography

The site is on a mid-slope with a very gently inclined slope of 1 to 3%. The site slopes from north to south.

5.3 Soils and geology

The site is within the Bathurst Soil Landscape (Kovac *et al.* 1990). The soil landscape includes non-calcic brown soils with yellow solodic soils on the lower slopes and in drainage lines. Sands and mottled yellow solodic soils also occur.

The site is underlain by Bathurst Granite. Parent rock includes medium to coarse-grained and massive granodiorites and adamellites. Parent materials comprise *in situ* and alluvial-colluvial materials from previously mentioned parent rock (Kovac *et al.* 1990).

5.4 Hydrology

5.4.1 Surface water

The soil is expected to have a moderate permeability. Surface water flows into on-site dams which flow south through a network of dams and drainage lines into Raglan Creek approximately 1.2km south of the site.

5.4.2 Groundwater

One groundwater bore is located on the property approximately 140m west of the site. The bore is licensed for irrigation and was constructed to a depth of 18.2 metres. The bore has a water bearing zone from 10.6m and standing water levels from 5.7m. No other bores are located within 500m of the investigation areas.

6. Previous investigations

6.1 Due Diligence Assessment, Lot 5 DP847225 Limekilns Road, Kelso (SESL Australia Pty Ltd C4503.Q4409.B34749), June 2015

A due diligence assessment was undertaken for Bathurst Regional Council prior to acquisition for residential development. A site history review, site walk over and inspection, sampling, soil analysis and preparation of report were undertaken.

The site was determined to be open agricultural land which contains a residential dwelling, farm dams and agricultural sheds. The analysis of soil samples indicated the results were below the adopted Health Investigation Levels and Health Screening Levels for residential land-use with the exception of the asbestos containing materials in the vicinity of some structures and the fill mound adjacent to the former processing shed and elevated OCP (dieldrin) (9.9mg/kg) and lead (310mg/kg) in sample location S7.

SESL Australia concluded that these elevations were not uncommon for sites with similar history, and minor remediation of the affected areas will be required prior to development of the proposed residential and recreational area.

6.2 Clearance Certificate, 197 Limekilns Road, Kelso (Envirowest Consulting Pty Ltd R8538cc), July 2017

A clearance certificate was issued to EODO Pty Ltd following removal of non-friable asbestos containing irrigation pipes and tape stand. The removal work was under the supervision of Central Demolition and Asbestos Pty Ltd on 19, 20, 26, 27, 29, and 30 June 2017.

6.3 Clearance Certificate and Air Monitoring, 197 Limekilns Road, Kelso (Envirowest Consulting Pty Ltd R8538cc1 and R8538m), August 2017

A clearance certificate was issued to EODO Pty Ltd following removal of a fire pit with asbestos cement fragments from east of the former fruit store shed. The removal work was under the supervision of Central Demolition and Asbestos Pty Ltd in August 2017. Air monitoring was undertaken during the removal work. Ash potentially containing asbestos remains to the north and south of the former fruit store shed.

6.4 Detailed contamination investigation, 197 Limekilns Road, Kelso NSW (Envirowest Consulting Pty Ltd), September 2017

A detailed contamination investigation was undertaken of three areas previously identified by SESL Australia Pty Ltd as containing elevated levels of lead and dieldrin or asbestos. SESL Australia previously identified asbestos cement fragments within investigation areas 1 and 2 and lead and dieldrin impacted material within investigation area 3.

Test pits were constructed within investigation areas 1 and 2 to identify the presence of asbestos cement fragments. Two asbestos cement fragments were identified on the surface of investigation area 1 and were removed. No additional fragments of asbestos were identified within this area or within investigation area 2. It was recommended for investigation area 1 and 2 to be managed under an unexpected find protocol during the site works.

Soil samples were collected from investigation area 3 and test pits constructed to determine the lateral and vertical extent of impact material. The levels of lead and OCP's including dieldrin in the additional soil samples collected were below the adopted thresholds for residential land-use. One sample (S7) previously collected by SESL Australia contained levels of lead and dieldrin (OCP) above the adopted threshold for residential land-use.

Remediation and validation of lead and dieldrin impacted material was recommended to enable the site to be suitable for proposed residential land-use.

7. Area requiring remediation

Lead and dieldrin impacted soil was identified in the location of S7 (Figure 2) by SESL Australia Pty Ltd. The extent of the lead and dieldrin impacted soil has been determined to be approximately 5m by 5m to a depth of 0.3m.

8. Conceptual site model

8.1 Sources of contamination

The previous agricultural land-use including orcharding on the site is the source of contamination.

8.2 Contaminants of concern

The contaminants of concern identified from previous investigations include:

- Lead
- Dieldrin (OCP)

8.3 Potential receptors

The proposed land-use of the site is residential. The site is also located within 2.7km of Macquarie River which is a moderately disturbed ecosystem.

Human receptors include

- On-site works during site works
- Residences
- Intrusive maintenance workers

Ecological receptors include

- Vegetation on the site and adjacent the site
- Aquatic ecosystems of Macquarie River

8.4 Exposure pathways

Pathways for exposure to contaminants are:

- Dermal contact following soil disturbance
- Ingestion after soil disturbance
- Inhalation of dust after soil disturbance
- Surface water and sediment runoff into nearby waterways
- Leaching of contaminants into the groundwater
- Direct contact of flora and fauna with the soil

8.5 Source receptor linkages

Potential source pathway receptor linkages are identified to enable evaluation of any adverse impact on human health or ecology.

The site is currently vacant with works for the residential subdivision occurring in the eastern section of the site. Human receptors to the investigation area are possible. Residential users of the site may have a risk of exposure if the contaminants are present and the soil is disturbed. Intrusive maintenance workers may also have an increased risk of exposure to contaminants during soil disturbance.

Potential exposure pathways to surface water is also expected to be limited as the site will contain residential buildings with paved surface, lawn or gardens and significant sediment mobilisation is unlikely.

Mobilisation of contaminants in groundwater is unlikely due to depth of groundwater and confinement within granite.

9. Remediation options

The NSW DEC (2006) hierarchical order for soil remediation and management is:

1. On-site treatment of the soil so the contaminant is either destroyed or the associated hazard is reduced to an acceptable risk
2. Off-site treatment of excavated soil so the contaminant is either destroyed or the associated hazard is reduced to an acceptable risk, after which the soil is returned to the site
3. Removal of the soil to an approved site or facility followed where necessary with replacement with clean fill
4. Consolidation and isolation of the soil on-site by containment with a barrier

The appropriateness of the remediation option depends on technical feasibility, local factors and cost.

9.1 On-site treatment

On-site treatment is not an option as lead does not breakdown.

Advantages: Soil remains on the site

Disadvantages: Not technically feasible

9.2 Excavation, off-site treatment and returned to the site

This would involve:

- Excavation of the material
- Transportation to a licensed facility for treatment
- Validation of the excavated material and excavated areas
- Return soil to the site

Advantages: Nil

Disadvantages: Not a viable alternative as remediation not technically feasible.

9.3 Excavation and off-site disposal

The lead and dieldrin contaminated material would be excavated and transported to a landfill.

This would involve:

- Excavation of the material
- Transportation to a suitably licensed facility
- Validation of the excavated areas
- Replacement with clean fill

Advantages: No on-going site liability or restrictions on land-use.

Disadvantages: Required use of scarce landfill space. Cost can be significant if large volume of material requires excavation and transport.

9.4 On-site containment

This would involve:

- Installation of a barrier over the impacted soil layer
- Placing of soil cap to a depth of 600mm
- Restrictions placed on excavation into the impacted soil

Advantages: Construction costs are relatively low.

Disadvantages: Not technically practical due to the small volume and shallow depth at which the contaminated soil is present.

9.5 Preferred management option

Excavation and off-site disposal is considered the preferred option for remediation of the lead and dieldrin impacted soil. The impacted area has been determined to be approximately 5m by 5m to a depth of 0.3m.

The impacted areas will be excavated and the material transported off-site for disposal. The excavations will be extended beyond the impacted areas to ensure all contaminated material has been removed. The excavation areas will be graded to conform with the surrounding landscape. This is expected to be the most timely, technically practical and cost effective method of remediation.

The footprint of the former lead and dieldrin impacted area will be inspected and soil samples collected from the base and walls of the excavated area to ensure the lead impacted soil has been removed.

10. Remediation plan

10.1 Remediation goal

To establish site conditions that will be an acceptable risk to human health or the environment from contaminated soil at the site. The proposed land-use is residential.

10.2 Remediation criteria

10.2.1 Soil

The proposed land-use of the site is a residential subdivision which is expected to include residential lots, streets and parklands. The residential lots will include a dwelling with hard surfaces as well as garden and lawn areas. The most applicable land-use category for the proposal is considered residential with access to soil (HIL A). The HIL A thresholds assume a residential land-use with garden and accessible soil including home grown produce contributing less than 10% of fruit and vegetable intake and no poultry.

The laboratory results will be assessed against the proposed land-use of residential with access to soil (HIL A). The health-based and ecological investigation levels of contaminants in the soil for residential sites, for the substances for which criteria are available, are listed in Table 1, as recommended in the NEPC (1999).

The NEPC (1999) provides ecological investigation levels (EIL) for a range of contaminants. EILs vary with land-use and apply to contaminants up to 2m depth below the surface. The EILs for residential land-use are listed in Table 2.

Table 1. Soil assessment criteria (mg/kg)

Analyte	Residential land-use with access to soil threshold <i>HIL A</i> (NEPC 1999)	Ecological investigation levels – (Urban residential/public open space) (NEPC 1999)
Lead	300	1,100
OCP – aldrin and dieldrin	6	-

10.2.2 Waste material classification

Any waste that is disposed of off-site will be classified against the NSW EPA (2014) guidelines. The waste will be classified into general or restricted waste.

The level of contaminants and TCLP (leachable concentrations) levels are described in Table 2.

Table 2. Waste classification (EPA 2014)

Analyte	General solid		Restricted solid	
	Leachable concentration (mg/L)	Specific contaminant concentration (mg/kg)	Leachable concentration (mg/L)	Specific contaminant concentration (mg/kg)
Lead	5	1,500	20	6,000
OCP – Dieldrin (Scheduled chemical)	NA	<50	NA	<50

NA – Not applicable

10.2.3 Imported fill

The excavation pits are shallow and backfilling is not expected to be required. Any imported fill used to backfill the excavation pits will be classified as ENM in accordance with the excavated natural material order 2014 (Table 3).

Table 3. ENM assessment criteria (mg/kg)

Analyte	Units	Maximum average concentration for characterisation	Absolute maximum concentration
Mercury	mg/kg	0.5	1
Cadmium	mg/kg	0.5	1
Lead	mg/kg	50	100
Arsenic	mg/kg	20	40
Chromium (total)	mg/kg	75	150
Copper	mg/kg	100	200
Nickel	mg/kg	30	60
Zinc	mg/kg	150	300
Electrical conductivity	ds/m	1.5	3
pH	mg/kg	5 to 9	4.5 to 10
PAH	mg/kg	20	40
Benzo(a)pyrene	mg/kg	0.5	1
TPH(C6-C36)	mg/kg	NA	0.5
Total chlorinated hydrocarbons	mg/kg	NA	65
Rubber, plastic, bitumen, paper, cloth, paint and wood	mg/kg	NA	25

10.3 Remediation method

The lead and dieldrin impacted material will be excavated and transported to an approved landfill.

The depth of the excavation is expected to be 0.3m and will be determined by visual appearance of the soil and laboratory analysis results.

The excavation and off-site disposal will include:

- Excavation of contaminated material under supervision of an Environmental Scientist
- Stockpiling of excavated materials
- Sampling of excavated materials for off-site disposal classification
- Loading and transportation to appropriately licensed landfill
- Validation of excavated areas (base and walls), additional excavation may be required
- Preparation of validation report

10.4 Services, excavation and earth moving

Excavation, stockpiling, transport and disposal methods must ensure that potentially affected soil is not spread onto non-excavation areas. Care will be taken to separate differently classified materials from each other and from the surrounding soil. The impacted material will be removed with an excavator or backhoe and stockpiled. The excavated material will be assessed and classified for off-site disposal according to NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste*. Following waste classification the impacted material will be loaded onto trucks for disposal to an appropriately licensed landfill.

10.5 Validation of excavation areas

Requirements for validation of excavated areas are discussed in Section 12.

10.6 Supervision

Remediation works will be supervised by an Environmental Scientist or other suitably qualified person and comply with EPA guidelines including *Guidelines for Reporting on Contaminated Sites* (OEH 2009) and *Remediation of Contaminated Land State Environmental Planning Policy* (SEPP55).

11. Remediation works issues

11.1 Approvals

The works are a Type 2 remediation. Bathurst Regional Council requires 30 days notice prior to works.

Applications for approval to dispose of waste will follow the guidelines set out in NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste*. Approval from the landfill will be required before transportation.

11.2 Access

In order to ensure there is no unauthorised access to the excavation site, appropriate barricading may be established as required. The site will be managed and controlled by the works manager to ensure appropriate control, security and exclusion of all persons not authorised to be on-site during the remediation works.

Vehicle access to the site shall be stabilised to prevent the tracking of soils onto non-excavation areas, the roads and footpaths. Care will be taken to ensure soil, earth or similar materials are retained within the excavation site. Soil, earth, mud or similar materials must be removed from non-excavation surfaces by shovelling or a means other than washing, at the end of the day or as required.

11.3 Dust control

Dust emission shall be confined within the site boundary. The following dust control procedures may be employed to comply with those requirements:

- Securely covering all loads entering or exiting the site
- Use of water sprays across the site to suppress dust, as appropriate
- Covering of stockpiles may be considered
- Excavation surfaces will be kept moist
- Work to stop during high winds to minimize problems with dust generation

11.4 Sediment and water management

The NSW Department of Housing Blue Book *Managing Urban Stormwater – Soil and Conservation* August 2004 outlines the general requirement for the preparation of a soil and water management plan. All remediation works shall be conducted in accordance with a soil and water management plan prepared by the contractor using this Remediation Management Plan. A copy of the plan shall be kept on-site and made available to Council officers on request. All erosion and sediment measure must be maintained in a functional condition throughout the remediation works.

11.5 Stockpile management

The excavated material will be temporarily stockpiled prior to removal off-site. The following will be implemented for all stockpiles:

- Care will be taken to separate differently classified materials from each other and from the surrounding soils,
- Contaminated material stockpiles shall be placed on PVC plastic, in a secure bund consisting of hay bales/sand bags and if required covered,
- All stockpiles of soil or other material shall be placed within an erosion containment boundary away from drainage lines, gutters or stormwater pits or inlets,
- All stockpiles of soil or other materials likely to generate dust or odours shall be covered, and
- Inspections will be undertaken to ensure liner not breached. If the liner has been breached, samples will be taken from the soil beneath the liner and analysed for hydrocarbons.

11.6 Excavation pump-out

Based on our knowledge of the site subsurface conditions, pump-out will not be required. In the unlikely event that a pump-out is required the following will be carried out:

- Any excavation pump-out water must be analysed for suspended solid concentrations, pH, and any contaminants of concern identified during the site investigation prior to discharge to the stormwater system or other disposal method as appropriate. The analytical results must comply with relevant Council/EPA and ANZECC standards for water quality, and
- Other options for the disposal of excavation pump-out water include disposal to sewer with prior approval from Oberon Council or off-site disposal by a liquid waste transporter for treatment/disposal to an appropriate waste treatment/processing facility.
- Contaminated groundwater will need to be collected by a liquid waste contractor.

11.7 Landscaping/rehabilitation

The excavation areas are expected to be shallow and the pits will be graded to conform with the current landscape. Landscaping and rehabilitation will not be required.

11.8 Bunding

Appropriate bunding will be undertaken of stockpiled impacted material.

11.9 Timing

The remediation works will be scheduled to allow excavation and grading one area requiring remediation prior to beginning works on the next area. The removal of the contaminated material is expected to be completed over a period of less than 1 week.

11.10 Noise control

The site activities should not generate any noise other than that normally associated with a building site. Hours of operation will be 8am to 5pm, Monday to Friday.

All remediation work shall comply with the Environment Protection Authority's *Environmental Noise Manual and the Protection of the Environment Operations Act (1997)*.

11.11 Odour control

Based on the current knowledge of the site it is our expectations that odour control measure will not be required.

11.12 Public and work health and safety (P&WH&S)

11.12.1 Prior remediation

Interim site management to protect human health and environment prior to remediation may include fencing of the site to prevent unauthorized access. Soil bunding will be constructed around the site to prevent surface water flow over the site and act as a silt fence for wind erosion. Warning signs will be erected.

11.12.2 During remediation

Standard P&WH&S procedures for earthworks projects should be implemented on the site together with emergency and evacuation procedures.

A site specific P&WH&S plan is to be developed by the contractor prior to starting the works. This plan may include but not be limited to the following:

- Briefing of all staff on P&WH&S concern, contractors' and individuals' responsibilities and personal protective procedures
- Site access exclusively for briefed and authorized staff. A log book shall be kept.
- Soil and Water, Dust and Waste Management plans
- Dust suppression particularly during the excavation and handling of materials
- Staff personal protection handling affected soils
- Crib and washing facilities
- Provision of site security at all times, and
- Emergency and evacuation procedures. The nearest hospital is Bathurst Base Hospital, Howick Street, Bathurst NSW. Relevant telephone numbers are:

▪ Bathurst Base Hospital	6330 5311
▪ Fire Brigade, Police, Ambulance	000
▪ Poisons Information Centre	131126
▪ SafeWork NSW	131050

The following WH&S plan outlines requirements to be implemented during the site remediation to ensure works are conducted in a safe and health conscious manner. The following protective equipment should be used:

- Highly visible safety vests
- Safety boots with steel toe and shank
- Safety glasses with side shields
- Hardhat
- Gloves when handling the soil

Smoking, eating or drinking on the site is prohibited whilst remediation works are active. Exposed areas including hands and face are to be washed thoroughly upon completion of work and prior to eating and drinking. Heat stress is an important consideration that must be taken into account in hot weather.

11.13 Vibration

Site development involves excavating soil. It is not expected that any *in situ* rock will be excavated for the remediation proposed. The contractor should ensure that excessive vibration does not occur in the existing surrounding buildings.

11.14 Site, signage and contact numbers

The following are contact numbers that will be needed for the various parties involved:

- Environmental Supervisor: To be determined
- Contractor: To be determined

Signage displaying the contact details of the remediation contractor (and site facilitator) shall be displayed on the site adjacent to the site access. These signs shall be displayed throughout the duration of the remediation works.

11.15 Transport

All haulage routes for trucks transporting soil, materials, equipment or machinery to and from the site shall be selected to meet the following objectives:

- Comply with all road traffic rules
- Minimize noise, vibrations and odour to adjacent premises
- Securely cover all loads to prevent any dust or odour during transportation
- Exit the site in a forward direction and
- Will not track soil, mud or sediment onto the road.

11.16 Decontamination

Footwear of workers should be rinsed prior to leaving the site. Plant and equipment removed from the site must be inspected and brushed down before leaving the site.

11.17 Hazardous materials

In the event that hazardous and/or intractable wastes are encountered during the remediation work, they shall be treated and disposed of in accordance with the requirements of the NSW EPA and SafeWork NSW, together with the relevant regulations.

A suitable management plan for their proper disposal to a licensed landfill would be developed by and approved by the principal. The plan would include additional testing to quantify the material and classify it to ensure proper off-site disposal to a licensed landfill. Material will not be removed from the site until this approval is given.

11.18 Imported fill

The excavation pits are shallow and backfilling is not expected to be required. If backfilling is required, the fill material will be validated prior to importing in accordance with OEH requirements to ensure it is compatible with the proposed site use. Requirements for imported fill are discussed in detail in Section 12.

11.19 Site security

The contractor will be responsible to ensure any temporary barricading/fencing if required, is securely erected to prevent unauthorized access to the site. All SafeWork NSW requirements will be followed regarding signs and safety measures when working near excavations.

12. Remediation work validation

12.1 Validation

Validation sampling of the lead and dieldrin impacted soil excavation pit will be undertaken by sampling of walls and base to confirm sufficient soil has been excavated.

12.2 Validation imported fill

If backfilling of the excavation pit is required, validation of all imported fill is required including:

- An ENM certificate issued by a suitably qualified professional including a description of the source of the material, typical analysis results, and a statement that the material is suitable for the proposed use.
- Systematic and documented inspection of loads of fill entering the site will be undertaken. Loads of material suspected to not be ENM or that are not consistent with the material at the source site will be rejected.
- Validation will be achieved by sampling and analysis for metals, total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides (OCP), benzene, toluene, ethylbenzene, xylenes, naphthalene (BTEXN) and asbestos. Additional laboratory analysis of samples will be undertaken if any additional potential contaminants of concern are identified at the source site. Results will be compared against ENM order (2014) assessment criteria.
- The frequency of samples will be a minimum of 3 samples per source site for less than 500 tonnes. Sampling frequency and analysis will be increased if site condition or analytical results suggest a potential risk of contamination. The results of analysis will reflect background concentrations for the material. The sample density and results will be adequate to characterize the imported fill as ENM suitable for the proposed land-use.
- The depth of the impacted soil is expected to be between 0.1 to 0.2m. If any additional excavations undertaken reach a depth greater than 0.6m then all fill to a depth greater than 0.6m will be compacted with a vibratory roller and density testing undertaken. The required compaction density for residential developments is 95%.

12.3 Validation reporting

Following the completion of the excavation and validation of the remediated location, a validation report will be prepared in accordance with NSW EPA *Guidelines for Consultants Reporting on Contaminated Sites (2011)* and *Guidelines for the NSW Site Auditor Scheme (2006)*. The validation report will:

- provide a brief summary of previous assessment work carried out
- outline remediation works undertaken on-site
- summarise field observations
- describe validation sampling and analysis
- discuss analytical results
- confirm waste has been disposed of appropriately through the presentation of waste disposal dockets
- confirm that any imported fill has been validated as required and are accompanied with ENM certificates
- confirm that the RAP objectives have been achieved, and
- detail any on-going management requirements.

13. Other issues

13.1 Community consultation

Nearby residents shall be consulted and notified in accordance with Council policies.

13.2 Contingency plans

In order to obviate potential effect on the surrounding environment and community the contractor will implement the following contingency plan.

Table 4. Contingency plan

Issue	Contingency Response
Excessive odour	Cover with plastic sheeting until a solution is developed by an environment consultant.
Excessive dust	Increase the use of moisture sprays to suppress dust and/or cover with plastic sheeting.
Excessive noise	Reduce noise until noise is monitored by an acoustics consultant. Adopt recommendations made.
Excessive vibrations	Cease activities causing vibrations and engage a vibrations consultant to monitor. Implement any vibration control measure recommended.
Discovery of unknown underground storage tanks (UST)	The Environmental Supervisor and Client Representative shall be notified and work within the vicinity will cease. A RAP and Sampling and Analysis Quality Plan (SAQP) will be prepared for the USTs. Upon approval of the RAP and SAQP, the offending UST's shall be removed and disposed at a licensed landfill. Samples shall be taken from the area where the UST once was located and soil analysis undertaken. Upon the results of the soil samples appropriate works shall proceed; either further excavation and remediation or continuation of the development works proposed.
Discovery of further contamination	Remediation works shall take place accordingly. All unsuitable material shall be removed and disposed off-site to a licensed landfill. If contamination is more extensive than initially determined, other remediation methods may be considered and the RAP revised. Discussions with the Orange City Council may be required in regards to appropriate course of action.
Spillage/leakage of oil, hydraulic fluid or fuels from excavator/backhoe and trucks	An environmental management plan shall be prepared by the contractor detailing procedures and emergency responses to be undertaken in the event of spillages. Procedures to be followed may include: Major spill: Stop spill and contain. Place sandbags downslope, cover area in sand, excavate impacted soil and dispose in appropriate approved facility Minor spill: Stop spill and contain. Cover area in sand, excavate impacted sand and soils and dispose in EPA approved facility

13.3 Progress reporting

Progress reporting will occur at set milestones in the remediation process. The milestone will be:

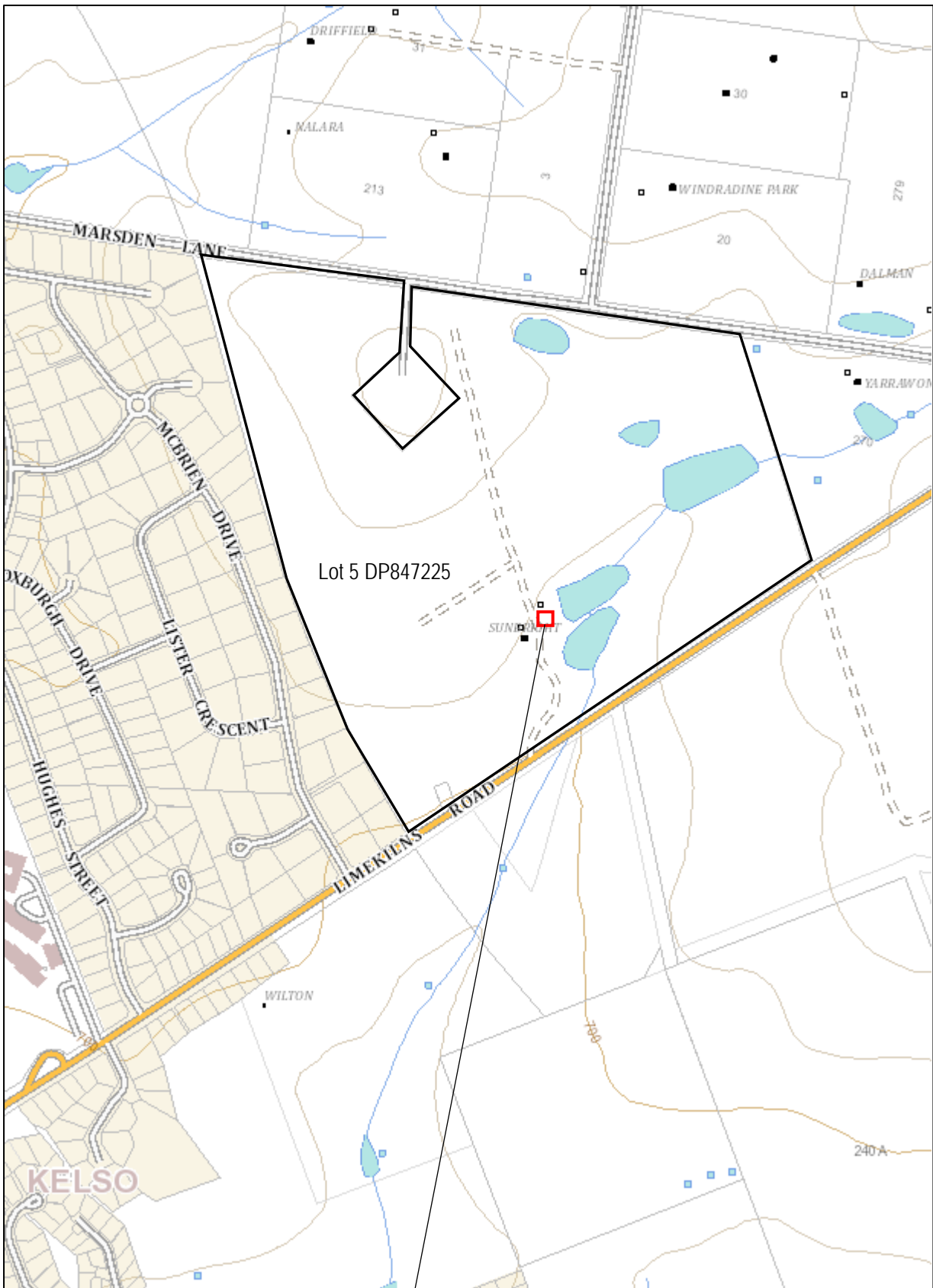
- Completion of the validation

13.4 Regulatory compliance

All works are to comply with the relevant regulations ensuring that the remediation works do not adversely impact on the environment and public amenity.

14. References

- ANZECC (2000) *Australian Water Quality Guidelines for Fresh and Marine Waters* (Australian and New Zealand Environmental and Conservation Council, Canberra)
- DEC (2006) *Contaminated Sites: Guidelines for the NSW Site Auditors Scheme* (Department of Environment and Conservation NSW: Chatswood)
- NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste* (Department of Environment and Climate Change, Sydney)
- EPA (1995) *Contaminated sites: Sampling Design Guidelines* (NSW Environment Protection Authority: Chatswood)
- Kovac, M and Lawrie, JW (1990) *Soil Landscapes of the Bathurst 1:250,000 Sheet* (Soil Conservation Service of NSW, Sydney)
- NEPC (1999) (Revised 2013) *National Environment Protection (Assessment of Site Contamination) Measure 1999* (National Environment Protection Council Service Corporation, Adelaide)
- OEH (2011) *Guidelines for Consultants Reporting on Contaminated Sites* (NSW Office of Environment and Heritage, Sydney)



Investigation area

Figure 1: Locality map

Lot 5 DP847225, 197 Limekilns Road, Bathurst NSW



Envirowest Consulting Pty Ltd

Job: R8593rap

Drawn by: AP




Date: 11/09/2017



SESL Australia
Lead 310mg/kg
Dieldrin 9.9mg/kg



Legend

-  Area requiring remediation
-  Elevated sample location
-  Slope

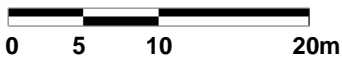

Approximate Scale 1: 500


Figure 2. Site plan and area to be remediated		
Lot 5 DP847225, 197 Limekilns Road, Bathurst NSW		
	Envirowest Consulting Pty Ltd	
Job: R8593c	Drawn by: AP	Date: 4/07/2017

Appendix 1. Data quality indicators

Quality control and assurance is undertaken to ensure the representativeness and integrity of field and laboratory procedures to ensure accuracy and reliability results.

1. Completeness

A measure of the amount of usable data for a data collection activity (total to be greater than 90%)

1.1 Field

Consideration	Requirement
Locations to be sampled	Described in the sampling plan
Depth to be sampled	Described in the sampling plan, each layer or explained
SOP appropriate and compiled	Described in the sampling plan
Experiences sampler	Sampler or supervisor
Documentation correct	Sampling log and chain of custody completed

1.2 Laboratory

Consideration	Requirement
Samples analysed	Number according to sampling and quality plan
Analytes	Number according to sampling and quality plan
Methods	EPA or other recognised methods with suitable PQL
Sample documentation	Complete including chain of custody and sample description
Sample holding times	Metals 6 months, OCP, PAH, TPH, PCB 14 days

2. Comparability

The confidence that data may be considered to be equivalent for each sampling and analytical event

2.1 Field

Consideration	Requirement
SOP	Same sampling procedures to be used
Experienced sampler	Sampler or supervisor
Climatic conditions	Described as may influence results
Samples collected	Sample medium, size and preparation

2.2 Laboratory

Consideration	Requirement
Analytical methods	Same methods
PQL	Same
Same laboratory	Justify if different
Same units	Justify if different

3. Representativeness

The confidence (expressed qualitatively) that data are representative of each media present on the site

3.1 Field

Consideration	Requirement
Appropriate media sampled	Sampled according to sampling and quality
All media identified	Sampling media identified in the sampling and quality plan

3.2 Laboratory

Consideration	Requirement
Samples analysed	Blanks

4. Precision

A quantitative measure of the variability (or reproduced of the data)

4.1 Field

Consideration	Requirement
Field duplicates	Frequency of 5%, results to be within +/-40% or discussion required indicate the appropriateness of SOP

4.2 Laboratory

Consideration	Requirement
Laboratory and inter lab duplicates	Frequency of 5%, results to be within +/-40% or discussion required
Field duplicates	Frequency of 5%, results to be within +/-40% or discussion required
Laboratory prepared volatile trip spikes	One per sampling batch, results to be within +/-40% or discussion required

5. Accuracy

A quantitative measure of the closeness of the reported data to the true value

5.1 Field

Consideration	Requirement
SOP	Complied

5.2 Laboratory

Consideration	Requirement
Field blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Rinsate blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Method blanks	Frequency of 5%, <5 times the PQL, PQL may be adjusted
Matrix spikes	Frequency of 5%, results to be within +/-40% or discussion required
Matrix duplicates	Frequency of 5%, results to be within +/-40% or discussion required
Surrogate spikes	Frequency of 5%, results to be within +/-40% or discussion required
Laboratory control samples	Frequency of 5%, results to be within +/-40% or discussion required
Laboratory prepared spikes	Frequency of 5%, results to be within +/-40% or discussion required

Appendix 2. Soil sampling protocols

1. Sampling

The samples will be collected from the auger tip, mattock, hand auger or excavator bucket immediately on withdrawal.

The time between retrieval of the sample and sealing of the sample container will be kept to a minimum.

The material will be collected using single use disposal gloves or a stainless steel spade which represented material which has not been exposed to the atmosphere prior to sampling.

All sampling jars will be filled as close to the top as possible to minimise the available airspace within the jar.

2. Handling, containment and transport

Daily sampling activities will be recorded including sampling locations, numbers, observations, measurements, sampler, date and time and weather condition.

The sampling jars will be new sterile glass jars fitted with plastic lid and airtight Teflon seals, supplied by the laboratories for the purpose of collecting soil samples for analysis. Sample containers will be marked indelibly with the sample ID code to waterproof labels affixed to the body of the container.

All samples will be removed from direct sunlight as soon as possible after sampling and placed in insulated containers. Samples will be stored in a refrigerator at 4°C prior to transportation to the laboratory in insulated containers with ice bricks in accordance with AS4482.1.

Handling and transportation to the laboratory will be accompanied with a chain of custody form to demonstrate the specimens are properly received, documents, processed and stored.

Maximum holding time for extraction (AS4482.1) are:

Analyte	Maximum holding time
Metals	6 months
Mercury	28 days
Sulfate	7 days
Organic carbon	7 days
OCP, OPP, PCB	14 days
TRH, BTEX, PAH, phenols	14 days

3. Decontamination of sampling equipment

Sampling tools will be decontaminated between sampling locations by

- Removing soil adhering to the sampling equipment by scraping, brushing or wiping
- Washing with a phosphate-free detergent
- Rinsing thoroughly with clean water
- Repeating if necessary
- Collect rinsate per sampling time and preserve according to AS 2031.1
- Dry equipment with disposable towels or air