



ENGEO

— Expect Excellence —

Preliminary Environmental Site Investigation

287 Tuhirangi Road

Makarau
Auckland

Submitted to:

Raymond O'Brien and Victoria Pichler

C/- Terra Group NZ Limited

PO Box 12858

Penrose

Auckland

ENGEO Limited

6 Antares Place, Rosedale, Auckland 0632
PO Box 305136, Triton Plaza, Auckland 0757
Tel +64 9 972 2205 Fax +64 3 328 9013
www.engeo.co.nz

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ENGEO Document Control:

Report Title	Preliminary Environmental Site Investigation - 287 Tuhirangi Road, Makarau, Auckland			
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18/07/2017	Final	BK	CD	EM

1 Introduction

ENGEO Ltd was requested by Terra Group NZ Limited, on behalf of Raymond O'Brien and Victoria Pichler, to undertake a Preliminary Environmental Site Investigation of the property at 287 Tuhirangi Road, Makarau (herein referred to as 'the site'; ref. P2017.000.094_01).

The site is largely undeveloped with a one-room dwelling (uninhabited) and associated shed in the centre of the site. Historically, the eastern portion of the site was used as a motocross track, evidenced by worn tracks and artificially constructed earthen ramps.

The proposed redevelopment comprises construction of an outdoor shooting range involving firearms (pistols). The development will include the construction of a clubhouse, storage area for targets and target holders, car park and toilet block.

The purpose of the assessment is to support the resource consent application for construction of the pistol range. In addition, this report provides a baseline from which future development options can be assessed.

1.1 Objectives of the Assessment

The objective of this investigation was to evaluate and identify conditions indicative of releases and threatened releases of hazardous substances at, or to the subject property, and report on the associated potential risk posed to future site users.

1.2 Approach

To satisfy the above objective, ENGEO sought to gather information regarding the following:

- Current and past property uses and occupancies;
- Current and past uses of hazardous substances;
- Waste management and disposal activities that could have caused a release or threatened release of hazardous substances;
- Current and past corrective actions and response activities to address past and on-going releases of hazardous substances at the subject property; and
- Properties adjoining or located near the subject property that have environmental conditions that could have resulted in conditions indicative of releases or threatened releases of hazardous substances to the subject property.

2 Site Description

The site is located at 287 Tuhirangi Road, Makarau (Figure 1). Site information is summarised in Table 1.

Table 1: Site Information

Item	Description
Legal Description	Lot 2 DP 365701
Property Owner	Raymond O'Brien and Victoria Pichler
Current Land Use	Largely undeveloped with a one-room dwelling (uninhabited) and associated shed in the centre of the site
Proposed Land Use	Pistol range and associated amenities
Site Area	Approximately 38 hectares
Building Construction of Existing Structure(s)	Timber cladding and a metal roof
Territorial Authority	Auckland Council

The site setting is summarised in Table 2.

Table 2: Site Setting

Item	Description
Topography	The site is largely grassed; the northern slopes are vegetated with bush and shrub. The northern portion of the site generally slopes towards the south and the western portion of the site generally slopes towards the east. Within the southern and eastern portions of the site, the land slopes towards overland flow paths and gullies. During the site walkover, the landform in the eastern portion of the site was observed to be modified from that shown on the Auckland Council GIS viewer due to construction of the motocross tracks.
Local Setting	Properties in the immediate vicinity of the site comprise rural land and lifestyle blocks.
Nearest Surface Water & Use	The site encompasses a number of overland flow paths and two gullies, which converge in the southeast portion of the site. Just upstream of the convergence, a dam has been constructed on the southern-most gully.

Item	Description
Geology	<p>The site is mapped by the Institute of Geological and Nuclear Sciences (GNS, 2001) as being underlain by the Mahurangi Limestone of the Motatau Complex, which was deposited during the Oligocene, and the Cornwallis Formation and East Coast Bays Formation of the Waitemata Group, which were deposited during the Miocene.</p> <p>The material encountered during the geotechnical investigation completed by ENGEO is broadly consistent with published mapping (ENGEO, 2017). In general, the site consisted of a recent and slump debris layer underlain by native Cornwallis Formation or Mahurangi Limestone. Reworked native material (referred to as undocumented fill material in the investigation) was identified in the central and eastern portions of the site where historical motocross tracks and the dam were observed.</p>
Hydrogeology	<p>Water seepage was observed in a number of test pits between 3.25 m and 4.5 m below ground level (bgl), during the geotechnical investigation (ENGEO, 2017), however it was not determined whether this was groundwater or perched water.</p> <p>The direction of groundwater flow beneath the site is not known. Shallow groundwater may be hydraulically connected to surface water on or near the site and therefore flow to the east (with on-site gullies) or south (toward the Makarau River approximately 1.8 km from the site).</p>
Groundwater Abstractions	<p>Three consents for construction of bores are included in the Site Contamination Enquiry response prepared by Auckland Council (AC, 2017):</p> <ul style="list-style-type: none"> • A consent for construction of a bore for stock and domestic purposes approximately 900 m northeast of the site; • A consent for construction of a bore for extraction of groundwater for supply to a medical centre approximately 890 m southeast of the site; and • A consent for construction of a bore for stock and domestic purposes approximately 890 m southeast of the site.
Discharge Consents	<p>No discharge consents have been identified for the site or surrounding properties (AC, 2017).</p>

3 Site History

ENGEO obtained and reviewed available environmental, geotechnical and geological information relevant to the site assessment, including geological maps, historical aerial photographs, the Auckland Council Property File and a Site Contamination Enquiry response prepared by Auckland Council. The findings of the assessment are summarised in this section.

3.1 Auckland Council Contaminated Site Enquiry

The response to our Site Contamination Enquiry, prepared by Auckland Council, was reviewed on 23 March 2017.

One air pollution incident for the site was recorded on 6 October 2005. The incident related to ‘nitrogen fertiliser by helicopter... affecting farm conversion to organic’. The comment included with the record indicates that Auckland Regional Council advised that this was not an issue they got involved in.

3.2 Auckland Council Property File Review

The property file for the site held by Auckland Council was reviewed on 1 March 2017. The relevant and applicable findings in relation to our environmental assessment are summarised in Table 3.

Table 3: Review of Auckland Council Property File

Date	Reference	Description
2005	Resource Consent Application – Boundary Relocation	The application is to incorporate a 690 m ² section of land at the western end of the site to allow for improved access options for the farm block. The site at this time was owned by Makarau Estate Limited.
2006	Resource Consent Application – Boundary Relocation	Auckland Council site visit form completed in relation to the boundary adjustment discussed above.
2016	Application for Certificate of Compliance	Application for outdoor recreation in a General Rural Zone, under Rule 7.9.2, Activity Table 1. The application is for “ <i>outdoor target shooting with firearms, including pistols, shotguns and rifles, involving test of proficiency (accuracy and speed). Clearly defined shooting area will be constructed in a manner compliant with all safety requirements, as referred to in the other attachments. The primary ancillary building required is a toilet and storage area for targets and target holders.</i> ” ¹
2016	Certificate of Compliance	An Auckland Council Certificate of Compliance was issued on 20 June 2016. The activity is permitted under the relevant rules of the Auckland Council District Plan (Rodney Section).

No recorded information relating to the storage of hazardous substances or potential for land contamination was observed in the property file reviewed by ENGEO.

¹ The application and subsequent Certificate of Compliance issued by Auckland Council was for construction of the first seven pistol shooting bays, which will be incorporated into the larger pistol range development for which resource consent is currently being applied for.

3.3 Historical Aerial Photograph Review

Aerial photographs dating from 1966 to 2016 have been reviewed (refer to Appendix 1), and the relevant features observed on the site and surrounding area in these photographs are summarised in Table 4.

Table 4: Aerial Photographs

Date	Description
1966	<p>The site is undeveloped and appears to be primarily grassed with sparse vegetation. The northern boundary and northeast corner of the site appear to have more mature vegetation. Two stream channels converge in the central eastern portion of the site and continue towards the east. Pale areas are identified immediately adjacent to the stream channels which could indicate bare earth, devoid of vegetation, and may be associated with soil creep, surface water erosion or livestock grazing and tracks.</p> <p>The surrounding area is mostly undeveloped, comprising areas of grazing and forest.</p>
2002	<p>More mature vegetation appears to be present on the northern and eastern slopes. There appears to be a large circular headscarp feature in the southwest portion of the site. This scarp may be pre-existing, however it is more prominent in this photograph due to topographic shadowing.</p> <p>A small building, possibly a dwelling, and a pond are present to the south of the western end of the site. A large area of bare earth is present immediately to the east of the site, possibly indicating an area of tree felling.</p> <p>No additional significant changes observed on or in the immediate vicinity of the surrounding area.</p>
2010	<p>There is now an access track running from Tuhirangi Road to the west across the majority of the site. No other significant changes observed on or in the immediate vicinity of the site.</p>
2012	<p>The earthworks / track construction associated with motocross activities in the eastern portion of the site is evident.</p> <p>No significant changes observed in the immediate vicinity of the site.</p>
2013 - 2015	<p>It appears the on-site building (one-room dwelling and shed) may be present in the 2014 and 2015 aerial photographs; however, it is difficult to discern. Some additional buildings have been constructed on the properties to the west of the site.</p> <p>No other significant changes on or in the immediate vicinity of the site are apparent.</p>

4 Current Site Conditions

A site walkover was undertaken on 8 February 2017 by an ENGEO Environmental Engineer. The information gathered is summarised in Table 5.

Photographs taken during the site visit are included in Appendix 2.

Table 5: Current Site Conditions

Site Condition	Comments
Current site description	Rural land used predominantly for cattle grazing through 2016. A disused motocross track is present in the eastern portion of the site along with a small temporary residence (one-room dwelling and shed) with solar panels and tank water.
Surface water appearance	Low volume due to dry conditions, stagnant in places (algal growth)
Current surrounding land use	Rural and lifestyle blocks
Local sensitive environments	Potentially on-site gullies and / or bush at northern edge of site
Visible signs of plant stress	None observed
Potential for on- or off-site migration of contaminants	Off-site property to the east at a higher elevation than the site, which would allow for overland flow onto site. However, no obvious source of contamination observed near eastern site boundary.
Presence of visible signs of potential contamination sources	None observed. Farm race off-site, immediately to the south of the site entrance. No evidence of a sheep dip observed at the race.
Additional comments	Earthworks associated with construction of the first seven shooting bays were underway during site visit. The earthworks contractor is Everson Contractors, operating under a Certificate of Compliance issued by Auckland Council. As part of these works, a portion of the overland flow path leading to the northern creek on-site has been piped. The excavation sidewalls of the first shooting bay (Bay 1) were approximately 3 metres high and the contractor indicated another approximately 2 metres were to be excavated. Limestone was observed to be present in the Bay 1 excavation from ~0.5 m to the base of the excavation. No wet soil was observed.

During the site walkover, soil, surface water and sediment samples were collected to assess baseline concentrations of metals associated with shooting ranges. The organic content and pH were also tested as these parameters can be used to assess the leaching potential of metals in soil.

The sample locations and laboratory reports are included in Appendix 3 for reference.

No metals were detected above the laboratory report limits in the two surface water samples collected. Metals concentrations in soil and sediment are presented below in Table 6 and Table 7, respectively, alongside adopted comparison criteria.

Table 6: Criteria Comparison to Soil Metals Concentrations

Sample Name	SS01 – 0.0	SS01 – 1.0	SS02 – 0.0	SS02 – 1.0	Human Health Criteria for Recreational Land Use ¹	Permitted Activity Criteria ²	Background Criteria for Inorganic Elements (non-volcanic) ³
Material Type	Weathered Sandstone / Siltstone	Limestone	Weathered Sandstone / Siltstone	Weathered Sandstone / Siltstone			
Sample Depth, m	0.0	1.0	0.0	1.0			
Metals / Metalloids (mg / kg)							
Antimony	<0.4	<0.4	<0.4	<0.4	20 ⁶	-	-
Arsenic	3	2	2	3	80	100	12
Cadmium ⁴	0.1	0.28	0.25	< 0.10	400	7.5	0.65
Chromium ⁵	13	8	11	11	2,700	400	55
Copper	42	44	17	17	> 10,000	325	45
Lead	9.4	4.6	8	7.9	880	250	65
Mercury	< 0.10	< 0.10	< 0.10	< 0.10	1,800	0.75	0.45
Nickel	18	109	9	8	1,200 ⁷	105	35
Tin	<1.0	<1.0	<1.0	<1.0	50 ⁶	-	4
Zinc	45	34	42	33	30,000 ⁷	400	180

Table 7: Criteria Comparison to Sediment Metals Concentrations

Sample Name	SED01	SED02	ISQG-Low (Trigger Value) ⁸	Background Criteria for Inorganic Elements (non-volcanic) ³
Material Type	Sediment	Sediment		
Sample Depth, m	0.0	0.0		
Metals / Metalloids (mg / kg)				
Antimony	<0.4	<0.4	2	-
Arsenic	3	6	20	12
Cadmium ⁴	0.70	0.12	1.5	0.65
Chromium ⁵	8	7	80	55
Copper	24	21	65	45
Lead	5.2	5.6	50	65
Mercury	< 0.10	< 0.10	0.15	0.45
Nickel	18	20	21	35
Tin	<1.0	<1.0	-	4
Zinc	52	41	200	180

Notes:

¹ Human Health Criteria from the NES (NES, 2011), except where noted. No exceedances detected.

² Environmental discharge criteria from the AUP (AC, 2016a). Exceedances are underlined.

³ Background Concentrations of Inorganic Elements in Soils from the Auckland Region (AC, 2001). Exceedances are in bold.

⁴ Assumes soil pH of 5.

⁵ Criteria for Chromium VI were conservatively selected.

⁶ Criteria sourced from the Canadian Environmental Quality Guidelines, update 2002 (CEQG, 2002).

⁷ Criteria sourced from National Environment Protection (Assessment of Site Contamination) Measure (NEPM, 2013).

⁸ Criteria sourced the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, October 2000 (ANZECC, 2000).

5 Potential HAIL Activities

Activities included on the Ministry for the Environment Hazardous Activities and Industries List (HAIL) (MfE, 2011b) trigger the requirement for a contaminated land investigation prior to redevelopment. The review of site information and observations made during the site walkover and geotechnical test pitting did not reveal any HAIL activities that have, or are more likely than not to have, occurred at the site.

There is potential for motocross activities to have resulted in fuel / oil spills; however, these are likely to have been minor and isolated incidents. Additionally, if superphosphate fertiliser was used at the site, it may have resulted in an accumulation of cadmium at the site as this metal is often co-located with sources of superphosphate fertiliser in New Zealand. A detailed site investigation was not performed; however, cadmium levels in the four soil samples analysed at the site were below the regional background level. Note that the cadmium concentration in one of the two sediment samples was slightly above the regional background level (i.e. a detection of 0.7 mg / kg and the background concentration is 0.65 mg / kg).

Nickel was detected in the limestone sample collected 1 m below ground surface from the excavation sidewall of shooting Bay 1 (SS01 – 1.0). There is no known source of nickel at this site and the sample did not show evidence of contamination (i.e. it appeared to be virgin limestone material). The sample was not directly adjacent to the on-site building and the shallower sample at the same location did not contain an elevated concentration of zinc. Therefore, this detection is considered anomalous; it is recommended that the material be resampled as part of redevelopment earthworks to confirm baseline nickel concentrations in site soil.

6 Summary and Conclusions

The site is largely undeveloped with a one-room dwelling (uninhabited) and associated shed in the centre of the site. Historically, the eastern portion of the site was used as a motocross track, evidenced by worn tracks and artificially constructed earthen ramps.

The Auckland Council Contaminated Site Enquiry response identified one air pollution incident for the site relating to the use of aerial spraying of fertilisers. The report does not state that the land is contaminated as a result, however the comment notes that this activity is ‘...affecting farm conversion to organic’. The comment included with the record indicates that Auckland Regional Council advised that this was not an issue they got involved in.

The likelihood of significant contamination due to the potential for leakage of fuel / oils associated with motocross activities and fertiliser application is considered low. In addition, no visual or olfactory indicators of contamination were identified during the walkover, environmental soil sampling or test-pitting during the geotechnical investigation. Therefore, the information assessed as part of this PSI did not identify any HAIL activities that have, or are more likely than not to have, occurred at the site.

ENGEO performed soil, surface water and sediment sampling during the site walkover on 8 February 2017 to assess baseline concentrations of metals associated with shooting ranges. The organic content and pH were also tested as these parameters can be used to assess the leaching potential of metals in soil. Metals concentrations were below background levels with the following two exceptions:

- Nickel in sample SS01 – 1.0 (soil sample collected at a depth of 1 m below ground surface from the Bay 1 excavation sidewall) – concentration of 109 mg / kg exceeded both the regional background criterion of 35 mg / kg and the permitted activity criterion of 105 mg / kg.
- Cadmium in sample SED01 (sediment sample collected from the gully in the southern portion of the site) – concentration of 0.7 mg / kg exceeded the regional background criterion of 0.65 mg / kg.

As discussed above, the nickel detection is considered anomalous; however, it is recommended that the material be resampled as part of redevelopment earthworks to confirm baseline nickel concentrations in the site soil.

As no hazardous activities have been identified on-site, no further work is necessary and the site is considered suitable for its proposed use.

No contaminated land related consents are considered to be required under regional (AUP) or national (NES) regulations. However, this finding should be confirmed with Auckland Council.

Once the shooting range activities are underway, it is likely that some metals (in particular lead) will be present in shooting bay surface soil and earth berms above permitted activity criteria. At this time, a long-term environmental discharge consent is likely to be required with ongoing monitoring.

Note: If evidence of additional contamination is encountered during the investigation works (e.g. stained or odorous soil, buried waste, asbestos containing material), additional samples and analytical tests may be required.

7 References

- Auckland Council GIS Viewer <http://maps.aucklandcouncil.govt.nz/aucklandcouncilviewer/>
- AC, 2001. Auckland Regional Council. (2001). Background Concentration of Inorganic Elements in Soils from the Auckland Region, Auckland Regional Council, Technical Publication No. 153.
- AC, 2016. Auckland Regional Council. (2016). The Proposed Auckland Unitary Plan Decisions version (notified 19 August 2016).
- AC, 2017. Auckland Council. 2017. Site Contamination Enquiry – 287 Tuhirangi Road, Kakanui.
- Edbrooke, S. W. (2001). Geology of the Auckland area. Institute of Geological & Nuclear Sciences, 1:250 000 Geological Map 3. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Limited.
- ENGEO, 2017. ENGEO Limited. (2017). Geomorphic Assessment (reference 13846.000.000_02 dated 17 March 2017).
- MfE, 2011a. Ministry for the Environment. (2011). Contaminated Land Management Guidelines No.1: Reporting on Contaminated Sites in New Zealand.
- MfE, 2011b. Ministry for the Environment. (2011). Hazardous Activities and Industries List (HAIL).
- NES, 2011. The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations (2011).
- WAMINZ, 2016. Waste Management Institute New Zealand. (2016). Technical Guidelines for Disposal to Land.

8 Limitations

- i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Raymond O'Brien and Victoria Pichler, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.
- ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.
- iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.
- iv. This Limitation should be read in conjunction with the IPENZ / ACENZ Standard Terms of Engagement.
- v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (09) 972 2205 if you require any further information.

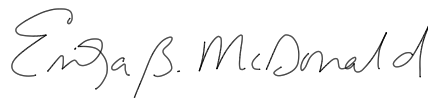
Report prepared by



Claire Davies

Environmental Consultant

Report reviewed by



Erika McDonald, MIPENZ

Associate Environmental Engineer

FIGURES

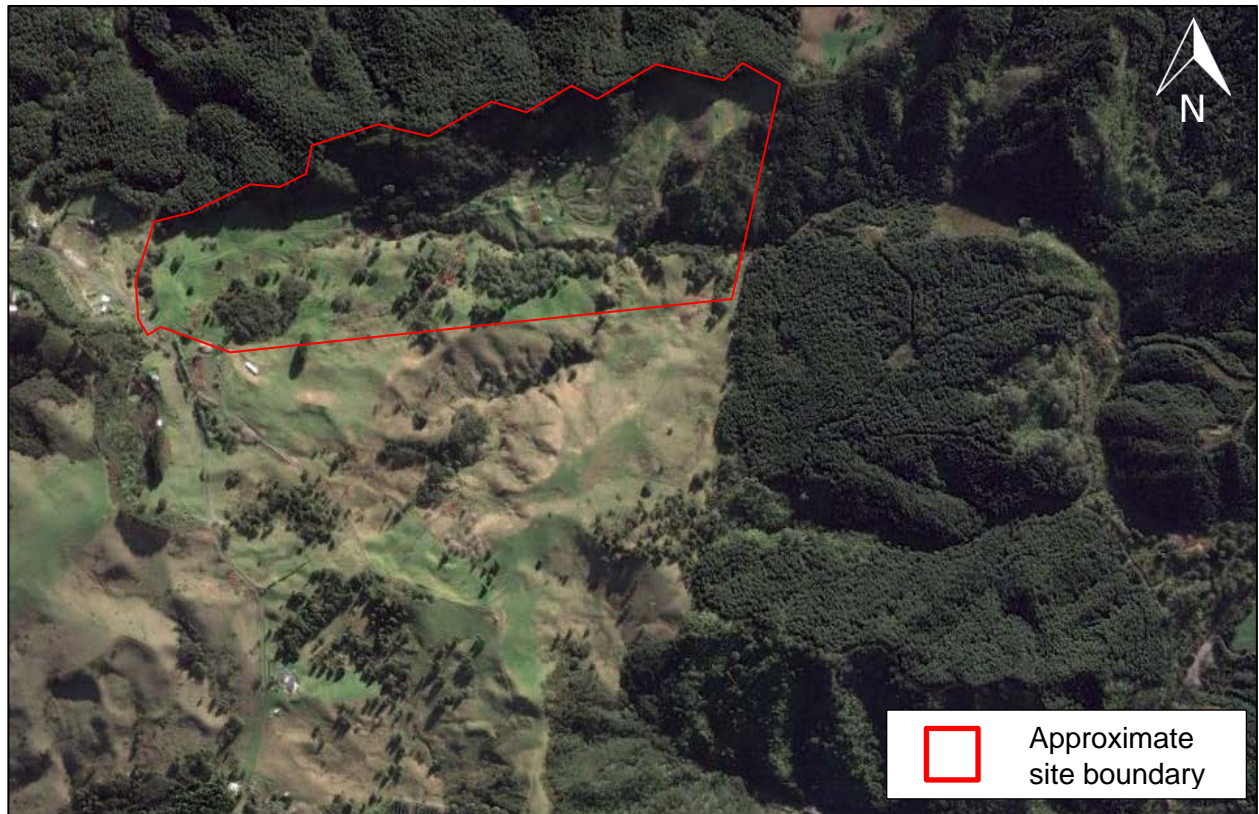
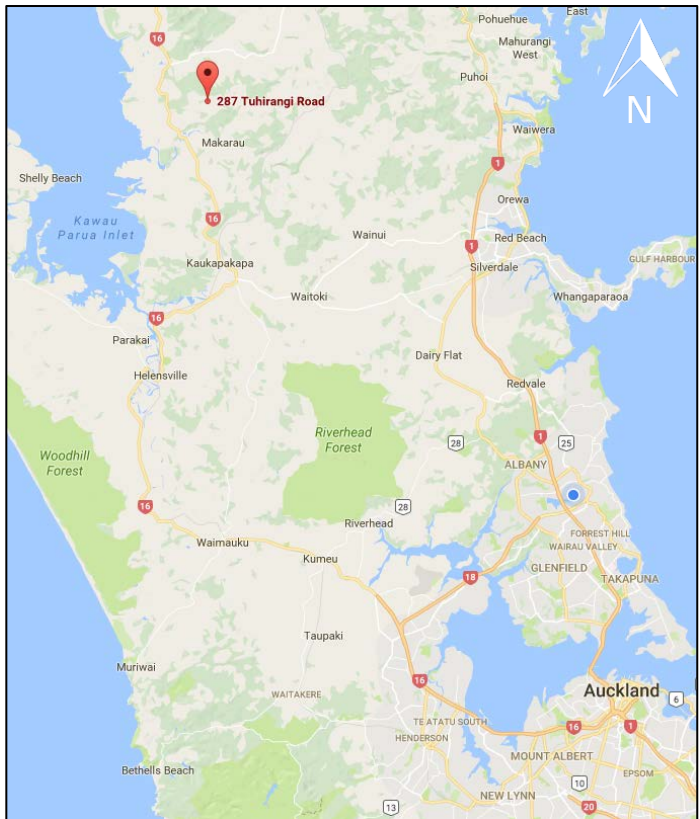


Image sourced from Auckland Council GIS Viewer



Date	Jul-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Site Location Plan
Scale (approx.)	Not to scale	ENGEO Ref.	13704.000.000

APPENDIX 1:
Historical Aerial Photographs



Image sourced from Opus International Consultants Limited



Date	Mar-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Aerial Photograph - 1966
Scale (approx.)	Not to scale	ENGEO Ref.	13704



Image sourced from Auckland Council GIS Viewer



Date	Mar-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Aerial Photograph - 2002
Scale (approx.)	Not to scale	ENGEO Ref.	13704



Image sourced from Auckland Council GIS Viewer



Date	Mar-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Aerial Photograph - 2010
Scale (approx.)	Not to scale	ENGEO Ref.	13704



Image sourced from Auckland Council GIS Viewer



Date	Mar-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Aerial Photograph - 2012
Scale (approx.)	Not to scale	ENGEO Ref.	13704



Image sourced from Auckland Council GIS Viewer



Date	Mar-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Aerial Photograph - 2013
Scale (approx.)	Not to scale	ENGEO Ref.	13704



Image sourced from Auckland Council GIS Viewer



Date	Mar-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Aerial Photograph - 2014
Scale (approx.)	Not to scale	ENGEO Ref.	13704

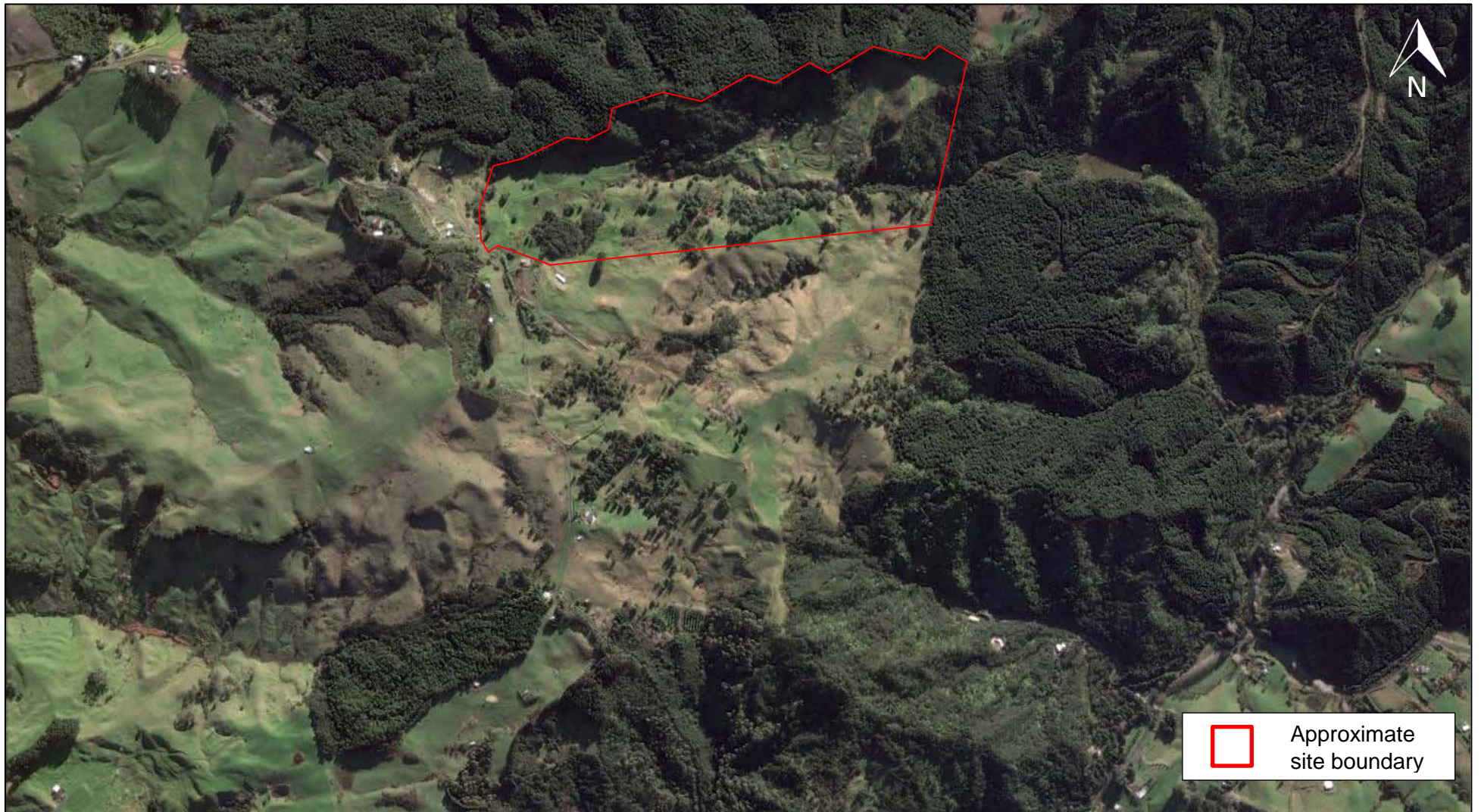


Image sourced from Auckland Council GIS Viewer



Date	Mar-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Aerial Photograph - 2015
Scale (approx.)	Not to scale	ENGEO Ref.	13704

APPENDIX 2:
Site Walkover Photographs



Photograph 1: Site entrance (with off-site farm race to the south of entrance)



Photograph 2: Farm road in western portion of site (looking northeast)



Photograph 3: Interior of one-room dwelling



Photograph 4: Exterior of one-room dwelling and associated shed



Date	Apr-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Site Walkover Photographs
Scale (approx.)	NTS	ENGEO Ref.	13704.000.000



Photograph 5: Sample location SS01 (southern face of Bay 1 excavation)



Photograph 6: Standing on future road looking northeast toward disused motocross track



Photograph 7: Partially piped overland flow path in vicinity of new road



Photograph 8: Current head of central gully (down gradient from partially piped overland flow path)



Date	Apr-17	Client	Raymond O'Brien and Victoria Pichler
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Approved by	EM	Description	Site Walkover Photographs
Scale (approx.)	NTS	ENGEO Ref.	13704.000.000



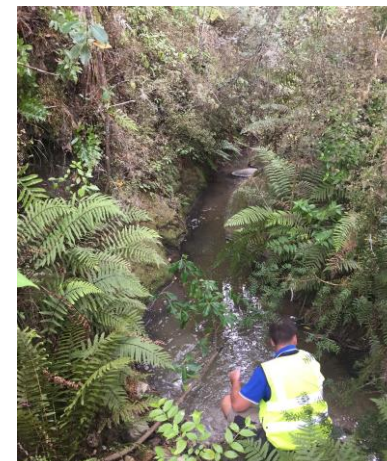
Photograph 9: Location of surface water sample SW01 and sediment sample SED01
Storage shed located on western boundary



Photograph 10: Pond behind dam



Photograph 11: Dam outlet



Photograph 12: Location of surface water sample SW02 and sediment sample SED02



Date	Apr - 17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Site Walkover Photographs
Scale (approx.)	NTS	ENGEO Ref.	13704.000.000



Photograph 13: Location of soil sample SS02



Photograph 14: Small dry retention pond and water tank behind (west) of one-room dwelling

Date	Apr-17	Client	Raymond O'Brien and Victoria Pichler
Drawn by	CD	Project	287 Tuhirangi Road, Makarau
Approved by	EM	Description	Site Walkover Photographs
Scale (approx.)	NTS	ENGEO Ref.	13704.000.000

APPENDIX 3:
Sample Locations and Laboratory Report

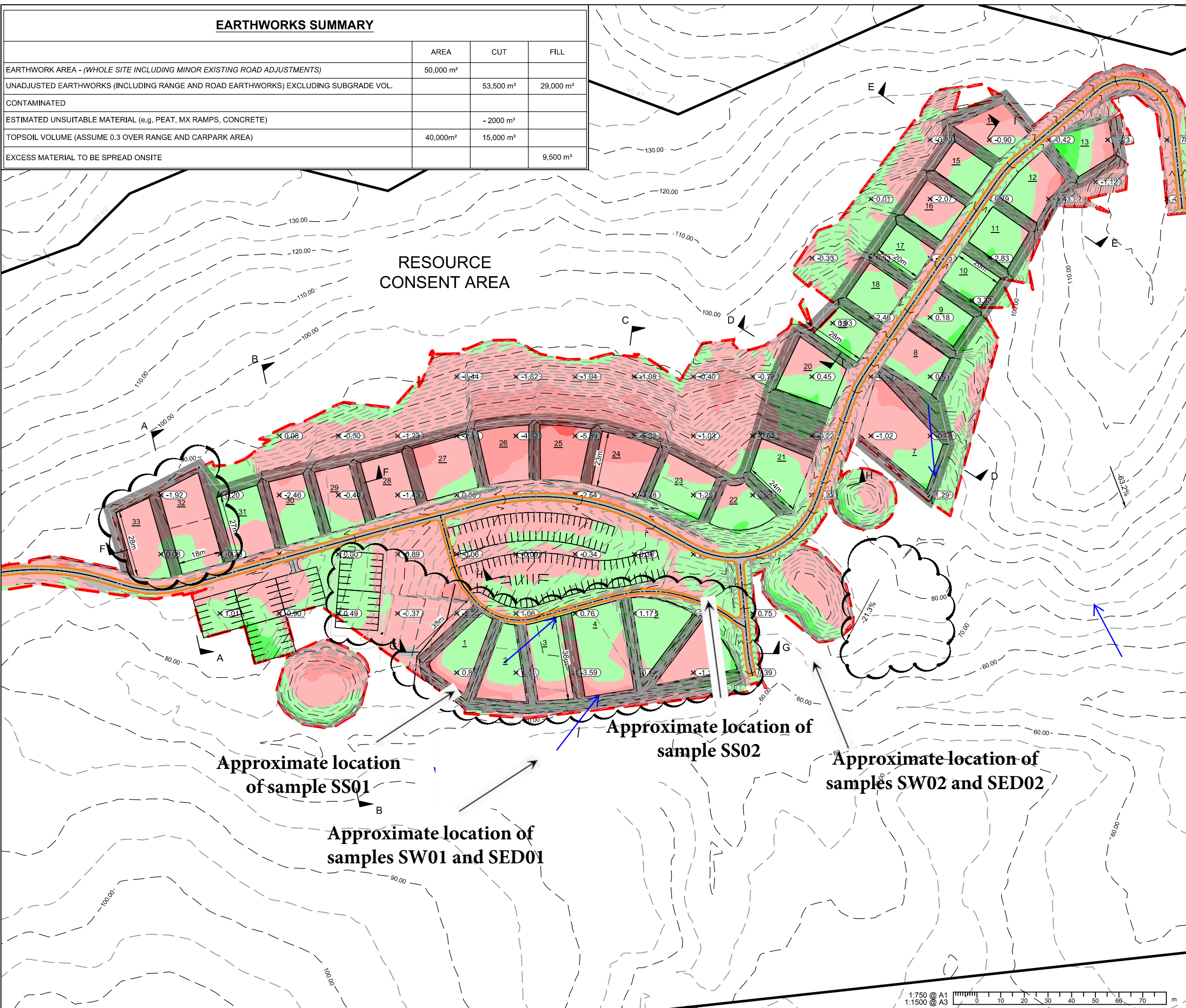
EARTHWORKS SUMMARY



	AREA	CUT	FILL
EARTHWORK AREA - (WHOLE SITE INCLUDING MINOR EXISTING ROAD ADJUSTMENTS)	50,000 m ²		
UNADJUSTED EARTHWORKS (INCLUDING RANGE AND ROAD EARTHWORKS) EXCLUDING SUBGRADE VOL.		53,500 m ³	29,000 m ³
CONTAMINATED			
ESTIMATED UNSUITABLE MATERIAL (e.g. PEAT, MX RAMPS, CONCRETE)		- 2000 m ³	
TOPSOIL VOLUME (ASSUME 0.3 OVER RANGE AND CARPARK AREA)	40,000m ²	15,000 m ³	
EXCESS MATERIAL TO BE SPREAD ONSITE			9,500 m ³

REVISION	ISSUE	DATE	DETAIL	CHKD	DRWN
A		13/07/17	FOR RESOURCE CONSENT	GC	DB

SURFACE LEVEL DATA			
NUMBER	MINIMUM LEVEL	MAXIMUM LEVEL	COLOUR
1	-12.00	-9.00	Red
2	-9.00	-6.00	Light Red
3	-6.00	-3.00	Light Green
4	-3.00	0.00	Light Blue
5	0.00	3.00	Light Yellow
6	3.00	6.00	Light Orange
7	6.00	9.00	Light Purple

 CERTIFICATE OF COMPLIANCE AREA (NOT PART OR RC APPLICATION)



STAGE		
PROJECT CONSULTANTS		
 PO BOX 12858, Penrose, New Zealand Auckland: (09) 357 3557 Northland: (09) 431 4444 Christchurch: (03) 379 5055 Email: terra@terragroup.co.nz Web: www.terragroup.co.nz		
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CLIENT		
R. O'BRIEN & V. PICHLER		
PROJECT		
NZ SHOOTING SPORTS CENTER		
LOCATION		
273 TUHIRANGI ROAD, MAKARAU, AUCKLAND		
DRAWING TITLE		
RANGE ISOPACH PLAN		
ORIENTATION	SCALE	A1: 1:750 A3: 1:1500
	DATE	13/07/2017
	SURVEYED	
	DESIGNED	G. CLARKE
	DRAWN	D. BODDIE
	CHECKED	G. CLARKE
PROJECT NUMBER	DWG NUMBER	REVISION
23406	RC-200	A

Z:\TUHIRANGI Road, Kaukapakapa (273)\Engineering\CAD Drawing\02_WORKING DWG\04_RESOURCE CONSENT\200-RC-200-ISOPACH.dwg, 200, 7/11/2017 9:49 a.m.



ANALYSIS REPORT

Client:	Engeo Limited	Lab No:	1720485	SPv2
Contact:	Erika McDonald C/- Engeo Limited PO Box 305136 Triton Plaza Auckland 0757	Date Received:	09-Feb-2017	
		Date Reported:	24-Feb-2017	(Amended)
		Quote No:	83353	
		Order No:		
		Client Reference:	13704.000.000	
		Submitted By:	Erika McDonald	

Sample Type: Soil

Sample Name:	SS01-0.0 08-Feb-2017 11:00 am	SS01-1.0 08-Feb-2017 11:00 am	SS02-0.0 08-Feb-2017 11:50 am	SS02-1.0 08-Feb-2017 11:50 am	
Lab Number:	1720485.1	1720485.2	1720485.3	1720485.4	

Individual Tests

Organic Matter*	g/100g dry wt	9.9	2.3	12.0	6.9	-
Ash*	g/100g dry wt	90	98	88	93	-
Total Recoverable Antimony	mg/kg dry wt	< 0.4	< 0.4	< 0.4	< 0.4	-
Total Recoverable Tin	mg/kg dry wt	< 1.0	< 1.0	< 1.0	< 1.0	-
pH*	pH Units	6.4	8.4	6.3	6.3	-

Heavy Metals with Mercury, Screen Level

Total Recoverable Arsenic	mg/kg dry wt	3	2	2	3	-
Total Recoverable Cadmium	mg/kg dry wt	0.10	0.28	0.25	< 0.10	-
Total Recoverable Chromium	mg/kg dry wt	13	8	11	11	-
Total Recoverable Copper	mg/kg dry wt	42	44	17	17	-
Total Recoverable Lead	mg/kg dry wt	9.4	4.6	8.0	7.9	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	< 0.10	< 0.10	-
Total Recoverable Nickel	mg/kg dry wt	18	109	9	8	-
Total Recoverable Zinc	mg/kg dry wt	45	34	42	33	-

Sample Type: Sediment

Sample Name:	SED01 08-Feb-2017 11:25 am	SED02 08-Feb-2017 11:45 am			
Lab Number:	1720485.6	1720485.8			

Individual Tests

Total Recoverable Antimony	mg/kg dry wt	< 0.4	< 0.4	-	-	-
Total Recoverable Tin	mg/kg dry wt	< 1.0	< 1.0	-	-	-
pH*	pH Units	8.2	8.4	-	-	-

Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg

Total Recoverable Arsenic	mg/kg dry wt	3	6	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.70	0.12	-	-	-
Total Recoverable Chromium	mg/kg dry wt	8	7	-	-	-
Total Recoverable Copper	mg/kg dry wt	24	21	-	-	-
Total Recoverable Lead	mg/kg dry wt	5.2	5.6	-	-	-
Total Recoverable Mercury	mg/kg dry wt	< 0.10	< 0.10	-	-	-
Total Recoverable Nickel	mg/kg dry wt	18	20	-	-	-
Total Recoverable Zinc	mg/kg dry wt	52	41	-	-	-

Sample Type: Aqueous



Sample Type: Aqueous						
Sample Name:		SW01 08-Feb-2017 11:25 am	SW02 08-Feb-2017 11:45 am			
Lab Number:		1720485.5	1720485.7			
Individual Tests						
pH	pH Units	7.3	8.1	-	-	-
Dissolved Antimony	g/m ³	< 0.004	< 0.004	-	-	-
Dissolved Mercury	g/m ³	< 0.002	< 0.002	-	-	-
Dissolved Tin	g/m ³	< 0.010	< 0.010	-	-	-
Heavy metals, dissolved, screen As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m ³	< 0.02	< 0.02	-	-	-
Dissolved Cadmium	g/m ³	< 0.0010	< 0.0010	-	-	-
Dissolved Chromium	g/m ³	< 0.010	< 0.010	-	-	-
Dissolved Copper	g/m ³	< 0.010	< 0.010	-	-	-
Dissolved Lead	g/m ³	< 0.002	< 0.002	-	-	-
Dissolved Nickel	g/m ³	< 0.010	< 0.010	-	-	-
Dissolved Zinc	g/m ³	< 0.02	< 0.02	-	-	-

Analyst's Comments

Amended Report: This report replaces an earlier report issued on 14 Feb 2017 at 3:19 pm
Reason for amendment: At the client's request, organic matter results have been added.

Appendix No.1 - Chain of Custody

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
Organic Matter*	Calculation: 100 - Ash (dry wt).	0.04 g/100g dry wt	1-4
Soil Prep Dry & Sieve for Agriculture	Air dried at 35°C and sieved, <2mm fraction.	-	1-4, 6, 8
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-4
Ash*	Ignition in muffle furnace 550°C, 6hr, gravimetric. APHA 2540 G 22 nd ed. 2012.	0.04 g/100g dry wt	1-4
Total Recoverable Antimony	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	1-4, 6, 8
Total Recoverable Tin	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	1.0 mg/kg dry wt	1-4, 6, 8
pH*	1:2 (v/v) soil : water slurry followed by potentiometric determination of pH.	0.1 pH Units	1-4, 6, 8

Sample Type: Sediment			
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%.	-	6, 8
Heavy metals, screen As,Cd,Cr,Cu,Ni,Pb,Zn,Hg	Dried sample, <2mm fraction. Nitric/Hydrochloric acid digestion, ICP-MS, screen level.	0.10 - 4 mg/kg dry wt	6, 8
Total Recoverable digestion	Nitric / hydrochloric acid digestion. US EPA 200.2.	-	6, 8

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Heavy metals, dissolved, screen As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, screen level. APHA 3125 B 22 nd ed. 2012.	0.0010 - 0.02 g/m ³	5, 7
pH	pH meter. APHA 4500-H+ B 22 nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field.	0.1 pH Units	5, 7
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22 nd ed. 2012.	-	5, 7

Sample Type: Aqueous			
Test	Method Description	Default Detection Limit	Sample No
Dissolved Antimony	Filtered sample, ICP-MS, screen level. APHA 3125 B 22 nd ed. 2012.	0.004 g/m ³	5, 7
Dissolved Mercury	Filtered sample, ICP-MS, screen level. APHA 3125 B 22 nd ed. 2012.	0.002 g/m ³	5, 7
Dissolved Tin	Filtered sample, ICP-MS, screen level. APHA 3125 B 22 nd ed. 2012.	0.010 g/m ³	5, 7

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.

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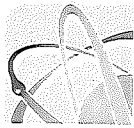
Graham Corban MSc Tech (Hons)
Client Services Manager - Environmental

172 0485

Received by: Kris Workman



3117204857



Hill Laboratories

TRIED, TESTED AND TRUSTED

Quote No 83353

Primary Contact Erika McDonald 214286

Submitted By Erika McDonald 214286

Client Name Engeo Limited 192617

Address PO Box 305136, Triton Plaza
Auckland 0757

Phone 09 972 2205 Mobile 021628 764

Email emcdonald@engeo.co.nz

Charge To Engeo Limited 160117

Client Reference 13704.000.000

Order No

Results To Reports will be emailed to Primary Contact by default.
Additional Reports will be sent as specified below.

- Email Primary Contact Email Submitter Email Client
- Email Other
- Other

ADDITIONAL INFORMATION

Empty box for additional information.

Quoted Sample Types

Soil (Soil), Surface Water (sw)

ANALYSIS REQUEST

R J Hill Laboratories Limited
1 Clyde Street Hamilton 3216
Private Bag 3205
Hamilton 3240 New Zealand

Office use only
(Job No)

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

CHAIN OF CUSTODY RECORD

Sent to Hill Laboratories Date & Time: 8/2/17, 2pm
Name: E. McDonald
 Tick if you require COC to be emailed back
Signature: E. McDonald

Received at Hill Laboratories Date & Time: 9/2/17 16:40
Name: Kris Workman
Signature: Kris Workman

Condition Room Temp Chilled Frozen Temp: 2.4
 Sample & Analysis details checked
Signature:

Priority Low Normal High
 Urgent (ASAP, extra charge applies, please contact lab first)

NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

Requested Reporting Date:

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	SS01-0.0	8/2/17 11:00am	Soil	HMS, Antimony, Tin, pH
2	SS01-1.0	"	Soil	HMS, Antimony, Tin, pH
3	SS02-0.0	8/2/17 11:50am	Soil	HMS, Antimony, Tin, pH
4	SS02-1.0	"	Soil	HMS, Antimony, Tin, pH
5	SW01	8/2/17 11:25am	Water (x2)	Dissolved [HMS, Antimony, Tin], pH
6	SEDO1	"	Sediment	HMS, Antimony, Tin, pH
7	SW02	8/2/17 11:45am	Water (x2)	Dissolved [HMS, Antimony, Tin], pH
8	SEDO2	"	Sediment	HMS, Antimony, Tin, pH
9	SS03-0.0	8/2/17	Soil	COLD HOLD
10				