

Proposed Public Open Space, Kerrier Way, Camborne

Report details		Written by: Reviewed by:	Kieran Smith Giles Maund	
Date:	11.08.2023	Location:	165379.7, 40275.6	
Client:	Meiloci Ltd (FAO Graham Sansom)	Our Ref:	GEO1740158135	

Client Ref: Kerrier Way



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Executive Summary

On instruction of MeiLoci a Summary Report documenting previous site investigations has been carried out for the proposed public open space, Kerrier Way, Camborne.

This Summary Report aims to review all previous works undertaken on site and identify mining related ground instability that impacts the current value of the property. The report will identify evidence of potential ground stability or mining issues and is not a structural survey where other causes of structural defects in a property are considered.

Multiple site investigations have been carried out across the subject site by means of trenching, site stripping and drilling. Ten historical mining features have been observed within the boundary of the site.

Nine of the features (1-8 & 34) are described as backfilled exploratory pits and trench workings are reported to have been excavated to a natural undisturbed horizon within the natural ground and backfilled with engineered fill to secure the features. No further action is required for these features.

An unrecorded tunnel-like (T1) working at located near the northern boundary of the site was identified during a previous drilling investigation. The full extent of this tunnel-like feature is unknown and it currently is considered to pose an ongoing risk of settlement or subsidence in the north of the site.

Further action is therefore recommended to mitigate the potential ongoing mining-related ground stability risk of the tunnel-like feature in the north of the site. Further investigation should be undertaken at the property to delineate the full extents of the observed working. Following any further site investigation an appropriate remediation scheme may be required to mitigate the potential ongoing settlement and/or subsidence risk.

With regards the contaminated land aspect of the subject site, Groundsure considers that further action as regards to Arsenic and Beryllium concentration is necessary. Given the relatively low likelihood that further testing will provide a favourable result, the site should be considered contaminated with Arsenic and Berylium and a suitable remediation strategy should be implemented.

As with any development, the standard Health and Safety guidance should be referred to during the course of the development (Protection of workers and the general public during the development of Contaminated Land).

While it is not considered likely, should any new buildings be part of the redevelopment of the site, a foundation inspection should be carried out by a suitably qualified person.

Assessment	Result	Recommendations*	
Features 1-8 & 34	Passed	Features 1-8 & 34 - No further action	
Tunnel feature T1	Further Action	Feature T1 - Site investigation and if necessary appropriate securing works	
Contaminated Land	Further Action	Y: Implement appropriate Remediation Strategy	

 Table 1: Investigation summary table. *Please refer to conclusion and recommendation section for full details

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1 Introduction

On instruction of MeiLoci a Summary Report documenting previous site investigations has been carried out for the proposed public open space, Kerrier Way, Camborne.

Presented within this report is a summary of the currently identified mining related features.

Please note that this report provides a summary of the investigation carried out up to the date of issue as such this summary report will be superseded following further works conducted onsite.

1.1 Site description

The Site is approximately 0.78 ha in size and is centred approximately on Ordnance Survey National Grid reference Easting 165379.7, Northing 40275.6. The Site is located within the village of Reskadinnick, approximately 3.6 miles west of Pool.

The site comprises of an irregular parcel of land, divided by an asphalt road named Kerrier Way (check this). The site is currently undeveloped and overgrown with various grasses and weeds.

We understand the following relates to the proposed development of the site:

Public Open Space - soft landscaping, hard surface paths and seating

1.2 Scope of works

This report covers the possible presence, or otherwise, of any mining or quarry related features that could result in surface or sub-surface instability that may affect the land identified within previous site investigation reports.

This report provides a compilation and interpretation of the mining archive information within our own organisation. An opinion is provided as to the considered mining risk to the subject property.

The mining risk to the land with regards to its current use is considered and also provided is advice for future development.

2 Previous works

Groundsure Ltd are aware of numerous previous works having been carried out at the Site. The recent reports which are relevant to mining risk are summarised below:

2.1 Site Strip Inspection Report - February 2009

We understand that a Site Strip Inspection Report (ref: NM.PR.KG.4547.SSIR.Features 1 - 8) was conducted by Cornwall Mining Services Ltd on 4th August 2009.

This report covers the inspections for the site strips carried out during September 2008 covering an area approximately 70 metres by 85 metres located in the northwest corner of the site.

This site strip inspection report was carried out on a larger parcel of land which includes the northwestern extent of the subject property. That report has been reviewed and any features of note are summarised below.

Eight features were identified within the site strip and are described below. Please refer to the attached summary plan for the locations of the known features:

"Feature 1 (Plate 1)

Feature 1 was intersected close to the north eastern corner of the site. Excavations revealed a probable early backfilled exploratory pit, which had a base at approximately 2.9 metres below the stripped surface, at an elevation of 107.3 metres. The maximum dimensions of the feature were 11.9 metres by 3.2 metres. The feature was excavated within moderately strong, slightly weathered, tabular/laminar, orange/buff/black, structured shale with a low clay matrix. This feature was infilled with a lean mix concrete (Plate 2).

Feature 2 (Plate 3)

Feature 2 was intersected close to the western boundary of the site. Excavations revealed a backfilled exploratory pit, which had a base at approximately 1.1 metres below the stripped surface, at an elevation of 109.35 metres. The dimensions of the exploratory pit were approximately 5.5 metres by 1.5 metres. The sides and the base of the exploratory pit were within a natural, firm, buff, gravelly clay with altered fragments of shale.

Feature 3 (Plate 4)

Feature 3 was intersected close to the northern boundary of the site. Excavations revealed a backfilled exploratory pit, which had a base at approximately 0.7 metres below the stripped surface, at an elevation of 110.06 metres. The dimensions of the exploratory pit were approximately 2.5 metres by 2.1 metres. The sides and the base of the exploratory pit were within a natural, firm, buff, gravelly clay with altered fragments of Shale.

Feature 4 (Plate 5)

Feature 4 was intersected close to the northern boundary of the site. Excavations revealed a backfilled exploratory pit, which had a base at approximately 1.6 metres below the stripped surface, at an elevation of 108.85 metres. The dimensions of the exploratory pit were

approximately 4.0 metres by 2.1 metres. The sides and the base of the exploratory pit were within a natural, firm, buff, gravelly clay with altered fragments of shale.

Feature 5 (Plate 6)

Feature 5 was intersected close to the northern part of the site. Excavations revealed a backfilled exploratory pit, which had a base at approximately 0.6 metres below the stripped surface, at an elevation of 109.33 metres. The dimensions of the exploratory pit were approximately 2.2 metres by 2.2 metres. The sides and the base of the exploratory pit were within a natural, firm, buff, gravelly clay with fragments of altered shale.

Feature 6 (Plates 7 & 8)

Feature 6 was intersected towards the western part of the site, trending in a NE/SW Direction. Excavations revealed a shallow backfilled trench feature over a mineralised vein which had a maximum base at 2.0 metres below the stripped surface, at the lowest elevation of 108.72 metres. The vein itself measured 44.8 metres in length and had a maximum width of 2.0 metres. The vein was mainly black in colour with some red patches. The sides were within moderately strong, buff shale. The vein may be associated with the outcrop of the recorded lode.

Feature 7

Feature 7 was intersected within the north western part of the site. Excavations revealed a backfilled exploratory pit, which had a base at approximately 1.05 metres below the strippedsurface, at an elevation of 109.57 metres. The dimensions of the exploratory pit were 1.9 metres by 2.3 metres. The sides and the base of the exploratory pit were within a natural, firm, buff, gravelly clay with fragments of altered shale.

Feature 8

Feature 8 was intersected within the north western part of the site. Excavations revealed a backfilled exploratory pit, which had a base at approximately 2.1 metres below the stripped surface, at an elevation of 110.4 metres. The dimensions of the exploratory pit were 3.3 metres by 3.7 metres. The sides and the base of the exploratory pits were within a natural, firm, buff, gravelly clay with fragments of altered shale.

The discovered features have been backfilled with engineered fill."

The report stated that all features identified within the investigation had been excavated to a natural base and were back filled with engineered ground. It was concluded that this area of the site strip was considered to be acceptably free from mining related settlement or subsidence risk and suitable for development.

2.2 Feature Report - August 2009

We understand that a Feature Report (ref: NI.PR.KG.4547.Feature 34) was conducted by Cornwall Mining Services Ltd on 4th August 2009.

This report summarises the securing works undertaken on Feature 34. The report describes the feature 34, as a probable early exploratory pit, with a maximum base at approximately 1.6m below the stripped surface. Surface dimensions of the pit were approximately 3.7m by 6.4m.

This feature was excavated to natural base and infilled with engineered fill, in accordance with Pell Frishmann's.

This report concluded that the area of the exploratory pit is acceptably free from mining related settlement or subsidence risk and is therefore suitable for development as regards the mining related aspect.

2.3 Commercial Mining Report - October 2016

We understand that a Commercial Mining Report (ref: 97000) was conducted by Mining Searches UK on 20th October 2016.

The report stated:

"The site lies within an area which has witnessed historical mining activity for the extraction of metalliferous minerals.

The site lies within the Camborne Consols mining sett, later incorporated into Dolcoath Mine and finally included within the South Crofty mining lease.

The nearest recorded mine shaft lies approximately 15 metres to the east of the site. This mine shaft has been secured under the supervision of Mining Searches UK."

Multiple lodes where recorded across the site:

"Three mineralised veins following a WSW-ENE alignment pass through the site at surface outcrop.

Five mineralised veins following a WSW-ENE alignment pass through the site at an undefined elevation of plot.

Five mineralised veins following a NNW-SSE alignment pass through the site at an undefined elevation of plot."

Two poorly recorded adits are also recorded to pass beneath the site following WSW-ENE and NNW-SSE alignments. Both adits are considered to lie at significant depth and are not considered to affect the site surface.

The report concluded:

"Mining Searches UK consider the area of the site previously investigated to be acceptably free from metalliferous mining related settlement and subsidence risk.

Mining Searches UK consider the risk to the site outside that previously investigated from past metalliferous mining activity to be moderate.

There is a moderate possibility of unrecorded mining features within the site."

The report recommended that site investigation be undertaken on site by a suitably qualified, experienced and competent person of metalliferous mining in the South West of England.

2.4 Site Investigation Report - January 2017

We understand that a Site Investigation Report (ref: RH/BP/99077.SIR) was conducted by Mining Searches UK on 24th January 2017.

This report covers the western side of the subject site with 3 trenches excavated across the subject site to provide general cover across the surface lodes. Madeground within the trenches varied between 0.9 and 3.2 metres with no depth variations considered to be related to any mining features.

This report concluded:

"The trenching encountered no backfilled mining features or evidence ground water within the excavated trenches. Evidence of mineralisation was encountered within the south-eastern end of trench 3 however there was no evidence of mining related activity associated with this feature.

The trenched areas are considered acceptably free from mining related settlement or subsidence risk and are considered suitable for development as regards the mining related aspects.

With regards to the proposed development, we consider the risk of finding mining features during construction to be low to moderate given that the previous site strip encountered small pits and shallow lode workings. There remains the possibility that features exist outside of the area covered by the trenches. A full site strip of the site could not be undertaken at this stage due to the presence of underground services.

In addition, the foundation excavations of the proposed buildings would still need to be inspected by a suitably qualified mining engineer or geologist. We would be pleased to assist in this regard."

2.5 Ground investigation - April 2017

We understand that a Site Investigation Report (ref: PE171377) was conducted by Geotechnics in April 2017.

The investigation consisted of a series of window sampling and dynamic probe boreholes in order to establish the geotechnical characteristics of the ground conditions, and to allow soil samples to be collected for contaminated land testing. The report indicated the following:

"Madeground within the eastern part of the site, which was subject to Mining Searches UK site strip investigation, was found to have thickness of made ground varying between 1.4 and 1.9 metres. This made ground was considered to be consistent with the engineered fill which was layered and compacted across the eastern part of the site during the 2009 land reclamation works. Made ground within the northern part of the site which was also part of the 2009 land reclamation works was found to have a thickness of between 1.4 and 1.5 metres.

Made ground within the north western part of the site north of Kerrier Way was found to be in region of 4.5 metres. It was considered likely that this was related to infilled storm drains.

Made ground within the site to the south of Kerrier Way and to the west of the land reclamation works was found to be in the region of 1.35 to 2.3 metres.

SPT 'N' value ranged between 4 and 50 with the average equating to 20 indicating a relative density of medium dense. A low 'N' value of 4 and 8 was encountered in WS101 and WS102 respectively.

Based on the above, Pell Frischmann recommended a combination of trench fill for areas of shallow made ground and pile foundations in areas where deeper made ground was encountered."

2.6 Phase 1 & 2 Site Investigation Report - October 2017

We understand that a Phase 1 and 2 Site Investigation Report (ref: RE70076G001A) was conducted by Pell Frischmann in October 2017. This report covers contaminated land studies, ground investigation and geotechnical appraisal.

With regards to the contaminated land aspect of the report identified the following potential contaminative land uses onsite:

"Any residual, undetected contamination associated with the former engineering works. Potential contaminants could include metals, metalloids, asbestos, PAH and petroleum hydrocarbons

Historically, a rail line has transected the western half of the Site. Potential contaminants include metals, metalloids, PAH, and petroleum hydrocarbons.

Background contamination associated with the regraded Made Ground/Fill across the Site. Potential contaminants include asbestos, arsenic, heavy metals."

The Contaminated Land aspect of the report identified a potential pollutant linkage to be present onsite in terms of asbestos, heavy metals, metalloids, hydrocarbons and radon.

Further ground investigation was undertaken on the 23rd February 2017 and 29th March 2017 and comprised a total of 15 dynamic sampler holes with 10 used for geochemical and geotechnical samples. The geochemical testing undertaken on the 10 samples identified elevated concentrations of arsenic (Upper confidence limit of 950 mg/kg) and beryllium (Upper confidence limit of 2.2 mg/kg). Further testing of 8 samples for asbestos screening, found no asbestos to be detected within any of the samples.

With regards the geotechnical aspect of the report highlight land reclamation works and mining feature securing work undertaken in the eastern area of the site. The report recommended a pre construction trenching trail be undertaken to gain confidence in the foundation construction approach and to indicate whether or not a general reduction in ground level across the areas of the proposed dwellings is a worthwhile strategy.

The with regards to the geo environment (contaminated land) aspect of the report it was recommended that:

"A minimum 600mm cover layer of clean topsoil and subsoil (with an anti-dig barrier) should be used in all garden and soft-scape areas of the residential development (excluding planters);

There should be rigorous construction phase implementation of appropriate health and safety measures by all contractors involved in excavations and groundworks;

Consideration should be specifically given to processes arising from removal of contaminated soils, including the excavation, transport and off-site disposal of contaminated soils."

The with regards to the geotechnical aspect of the report it was recommended that:

"The Site has both quite spatially variable founding constraints and the requirement to address the mining-related risks;

Cost benefit assessment will determine a preferred approach. Our recommendation at this stage is to presume a combination of strip, trench fill and pile foundations, in association with some local strip to natural ground where Made Ground is relatively shallow;

Suspended ground floors will be required;

Full radon protection measures are required."

The report recommended further works of additional preparation of a remedial strategy for contaminated land, ground investigation and further discussion to identify the most cost-effective foundation design.

2.7 Drilling Investigation Report - April 2019

We understand that a Site Investigation Report (ref: RH/BP/138263.DIR) was conducted by Mining Searches UK on 18th April 2019. This drilling investigation consisted of 61 boreholes drilled across the site.

The drilling investigation provided general coverage across the site and covered the area of a previously identified storm drain to ensure no deeper connections were present extending the base of the storm drain tank. The chamber was stated to be timber lined, with concrete dust intersected at a depth of between 4.7 metres and 5.3 metres and was considered to be the base of the tank.

The drilling investigation intersected a feature consistent with a tunnel along the southern elevation of the proposed plots 3-4. For the purpose of this report the tunnel-like feature is referred to as T1. The roof of the feature was stated to be between 1.5 metres and 1.8 metres below the surface with a base varying between 2.2 metres and 2.7 metres. This feature was identified within 4 locations approximately 6.2 metres apart and was backfilled with soft madeground. This feature was considered likely to continue to the east and west.

This report concluded that:

"The investigation revealed the presence of varied levels of made ground across the site ranging between 0.7 and 3.4 metres in depth.

Made ground to the east of the land reclamation western boundary is considered to be related to layered and compacted engineered fill which was put down following the site strip investigations and mining remediation works.

Made ground to the west of the boundary varied between 0.7 and 2.2 metres with some locally deeper zones of made ground up to 3.4 metres. These are considered to be related to minor backfilled excavations such as exploratory pits.

Made ground to 3.0 metres depth in the vicinity of the recorded surface mineralised vein indicated by borehole BH 37 may indicate the presence of a surface lode working. The trenching carried out in the previous investigation and the proximity of nearby boreholes with significantly lower levels of made ground indicate this may be a localised feature.

SPT N values ranged between 9 (loose) and >50 (very dense) in the underlying structured bedrock. The SPT's conducted during the site investigation correlate well with those conducted during the Pell Frischmann site investigation. The low SPT 'N' values are considered likely to be related to the clay horizons which were frequently encountered during the investigation.

A backfilled feature considered consistent with a tunnel was identified in the northern part of the site. This feature poses a settlement risk to plots 3 and 4 and will need to be appropriately remediated."

The report considered the eastern and northern areas of the site suitable for trench fill foundations and recommended localised deeper areas where deeper areas of madeground are encountered.

Further recommendations stated that plots 1-2 should have piled foundations with the pile logs reviewed by Mining Searches UK. For the plots located within the area of the identified tunnel likely feature it was recommended that the made ground be stripped off over the footprint of the dwelling plus a 3 metre buffer to expose the identified tunnel. The tunnel was recommended to be excavated fully and exposed to the east and west to determine its full extent to allow the feature to be suitably secured.

All other foundations across the subject site there stated to require a foundation inspection prior to concrete being poured.

3 Discussion

A review of all known previous works at the subject site has been carried out by Groundsure Ltd. Multiple site investigations have been carried out, by means of trenching site stripping and drilling. In total 10 features of note have been observed within the subject site.

Eight features were identified within the Site Strip Inspection Report (ref: NM.PR.KG.4547.SSIR.Features 1 - 8) and were identified as backfilled exploratory pits and trench workings and described as Features 1 - 8. Features 2-8 identified within the site strip are stated to have been excavated to bases within the natural ground and back filled with natural ground. Feature 1 is confirmed to have infilled with a lean mix concrete and covered with engineered ground. Feature 34 a probable early exploratory pit was excavated to natural base and infilled with engineered fill, in accordance with Pell Frishmann's during the Site Strip Inspection Report (Ref: NI.PR.KG.4547.Feature 34).

Site investigation carried out by Mining Searches UK in the form of a trenching investigation (due to a full site strip not being possible onsite due to buried services), followed a commercial mining search. Three trenches were excavated within the area to the west of the road. This investigation did not intersect any mining features and reported the madeground depth within the trenches to vary between 0.9 and 3.2 metres with none of the depth variations observed considered to be related to any mining features. The conclusion of this report did not rule out the possibility of features existing outside of the excavated trenches and recommended foundation inspection be undertaken on the proposed building plots. This recommendation is deemed not applicable for the current planned site use as a public open green space - however if any structures are to be included in the development these recommendations still apply.

Further site investigation carried out by Geotechnics in April 2017 focused on collecting geotechnical data for foundation designs. The investigation identified varying depths of madeground between 1.4 metres and 2.3 metres consistent with the level over madeground identified within the previous site investigations. The report also noted the presence of madeground to a depth of 4.5 metres which is deemed consistent with the infilled storm drain which was covered during the later drilling conducted by Mining Searches UK (Ref: RH/BP/138263.DIR). The report referenced the presence of engineered ground likely to be consistent with the securing exploratory pits and trenches identified and secured by Cornwall Mining Services Ltd (Ref: 4547.FRS). This report recommended a combination of trench fill for areas of shallow made ground and pile foundations in areas where deeper made ground was encountered. These recommendations are deemed not applicable for the current planned site use as a public open green space - however if any structures are to be included in the development these recommendations still apply.

A drilling investigation was carried out at the subject site in April 2019 by means of drilling 61 boreholes.

With regards to mining risk this investigation identified madeground varying between 1.4 metres and 2.3 metres consistent with the level over madeground identified within the previous site investigations. The drilling investigation identified a backfilled feature (T1) within the northern area of the site, considered to be consistent with a tunnel with base depth varying between 2.2 metres and 2.7 metres. The full extent of this feature is unknown and it is considered to continue to the east and west. Based on the findings of this report there was considered to be an ongoing risk of settlement or subsidence from the tunnel-like feature identified within the north of the site.

The remainder of the site was considered to be acceptably free from metalliferous mining related settlement and subsidence risk based on the coverage achieved over multiple site investigations.

A Phase 1 and 2 Site Investigation Report (ref: RE70076G001A) by Pell Frischmann in October 2017 identified the potential pollutant linkage of asbestos, heavy metals, metalloids, hydrocarbons and radon. Geochemical testing of 10 samples taken across the site identified elevated concentrations of arsenic (Upper confidence limit of 950 mg/kg) and beryllium (Upper confidence limit of 2.2 mg/kg). Based on the findings of the report it was recommended that a minimum 600mm layer of clean topsoil and subsoil should be used in all garden and soft-scape areas of the development.

Further recommendations stated consideration should be given to the processes of removing contaminated soil. Based on the planned uses of the site it is deemed that the recommendations from this report remain applicable to the subject site, however the site is unlikely to need radon protections due to the planned use as a public open space.

4 Recommendations

On review of the previous works carried out on site we considered there to be an ongoing stability risk in the northern extent of the site, where an unrecorded tunnel was located during the most recent phase of site investigation (Ref: RH/BP/138263.DIR).

The full extent of the tunnel-like feature has not been investigated and it is considered to extend to the east and west. At this stage it is considered that the tunnel-like feature poses an ongoing risk of potential settlement or subsidence.

It is recommended that the tunnel-like feature (T1) should be subject to further investigation to confirm the extent of the tunnel to the east and west of the location confirmed from the previous drilling investigation. Depending on the results of the further investigation, the tunnel-like feature may require securing works in line with modern standards. An appropriate remediation scheme should be implemented to mitigate the potential ongoing settlement and/or subsidence risk.

On review of the previous works carried out on site 9 features were identified within the subject site labelled (Features 1-8 and 34). Feature 1 was described as an exploratory pit and is confirmed to have been infilled and secured with a lean mix concrete. All remaining features were described as backfilled exploratory pits and trench-like workings all excavated to confirmed natural undisturbed ground horizons and were backfilled within engineered fill. With regards features 1-8 and 34, no further action is required.

With regards to the contaminated land reports carried out for the site, Groundsure considers that further action as regards to Arsenic and Beryllium concentration is necessary. Given the relatively low likelihood that further testing will provide a favourable result, the site should be considered contaminated with Arsenic and Beryllium and a suitable remediation strategy should be implemented.

As with any development, the standard Health and Safety guidance should be referred to during the course of the development (Protection of workers and the general public during the development of Contaminated Land).

While it is not considered likely, should any new buildings be part of the redevelopment of the site, a foundation inspection should be carried out by a suitably qualified person.

5 Limitations

This assessment has been based on a review of historical site data both from in house and external sources, and therefore our opinions given may be conjectured or based upon inferences given the information available to us.

Groundsure Ltd accepts no liability to any party not named on the report. The report may not be copied or distributed without Groundsure Ltd consent. The report applies to the named property only and shall not be used for interpreting the condition of any other property.

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We draw your attention to the Groundsure Ltd terms and conditions, which are amended from time to time, and can be found here:

https://www.groundsure.com/groundsure-standard-terms-and-conditions-april-2023/

Attachments:

• Overview Plan



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		Brighton Office:	Groundsure Ltd, Sovereign House C	hurch Street, Brighton, BN1 1UJ
		Cornwall Office: email	Groundsure Ltd, Wilson Way, Redru geology@groundsure.com	th, TR15 3RN Phone: 01209 218861
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• Feature sheets



PLATE 1: Showing feature 1, early exploratory pit with a base.



PLATE 2: Feature 1 secured.



PLATE 3: Showing feature 2, an early exploratory pit.





PLATE 4: Showing feature 3, an early exploratory pit.



PLATE 5: Showing feature 4, an early exploratory pit.



PLATE 6: Showing feature 5, an early exploratory pit.



 Proposed Residential Development, Compair Holmans, Dolcoath, Camborne, Cornwall.

 Client - For Midas Homes

 Plates 4 - 6 (Feature No. 3, 4 and 5)

 SIZE

 A4

 Report No. 4547

 SCALE
 NTS

 Taken by NM



PLATE 7: Showing surface/ lode working still intact, can see black vein, in centre of trench.



PLATE 8: Sinuous lode outcrop.

	Mining Servi	Proposed Residential Development, Compair Holmans, Dolcoath, Camborne,		
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	0°.	it - For Midas Homes		
		Plat	es 7 - 8 (Feature No. 6 Surface working intact)	
		SIZE A4	Report No. 4547	REV
		SCA	LE NTS Taken by NM	