



**REPORT C8341 Rev B
FEBRUARY 2022**

PRELIMINARY APPRAISAL (DESK STUDY)

**of land off
GOAT MILL ROAD, MERTHYR TYDFIL**

**prepared for
J&A YOUNG (LEICESTER) LTD**

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SITE NAME: Land off Goat Mill Road,
Merthyr Tydfil

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Ltd

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PRELIMINARY APPRAISAL (DESK STUDY)**of land off****GOAT MILL ROAD, MERTHYR TYDFIL****prepared for****J&A YOUNG (LEICESTER) LTD****CONTENTS****EXECUTIVE SUMMARY**

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Drawing No.	Title	Scale
JAY1001/04/01 Rev 0 (Sirius Planning)	Site Location Plan	1:2,500 / 1:50,000 @ A3
JAY1001/04/06 Rev 0 (Sirius Planning)	Site Layout	1:2,500 @ A3
JAY1001/04/04 Rev 0 (Sirius Planning)	Development Platform Formation Isopachytes	1:2,500 @ A3
C8341/02	Site Features Plan	1:4,000 @ A3
C8341/03	Historical Mining Features Plan	1:4,000 @ A3
C8341/04 Rev A	Preliminary Conceptual Site Model	Not to Scale (A3)

APPENDIX B ENVIROCHECK REPORT

APPENDIX C COAL AUTHORITY INFORMATION

APPENDIX D RISK ASSESSMENT METHODOLOGY

EXECUTIVE SUMMARY

Introduction	Sirius Geotechnical Ltd was commissioned by Sirius Planning Ltd, acting on behalf of J&A Young (Leicester) Ltd (Jayplas), to undertake a preliminary appraisal (desk study) of land off Goat Mill Road, Merthyr Tydfil (the 'site'). It is understood that consideration is being given to development of the site for industrial use, comprising a plastics recycling and processing facility.
Site Description	The site surfacing comprises mainly open sparsely grassed gravel, with a wooded margin along the western and eastern edges of the site. The eastern flank of the site forms the shoulder of an embankment carrying the A4060 dual carriageway.
National Grid Reference	306200, 207000.
Site Area	Approximately 14.6 hectares.
Site History	The site and surrounding area were affected by coal and ironstone mining during the Nineteenth Century and first half of the Twentieth Century, with several mine entries, spoil heaps, mineral railways and reservoirs present. A large ironworks slag heap (The Great White Tip) was also present on the northern half of the site. Opencast coal mining was undertaken on the majority of the site in 1996; this removed The Great White Tip and probably the majority of former mining features. The opencast was backfilled upon completion, with the site restored to its current condition, and a road embankment constructed in the eastern part of the site.
Coal and Ironstone Mining	Within the footprint of opencast coal mining, historical underground mine workings and the remnants of Coal Authority (CA) recorded mine shafts may still remain within depths below the base of the opencast at which future collapses could affect stability at the surface. There is a CA recorded mine adit that is potentially located outside of the area subject to later opencast mining, and therefore may remain, in an area of proposed plastic bale storage. There are also potentially shallow mine workings within several ironstone and coal seams in the western and northern parts of the site, i.e., outside the former opencast. Dependent on the depth, thickness and position in relation to the proposed development, historical underground mine workings and mine entries may require stabilisation / treatment to allow subsequent construction. It is possible that there are additional unrecorded mine entries within the site. Any identified mine entries with potential to affect the proposed development should be investigated and stabilised, e.g., by filling, grouting and capping.
Preliminary Foundation and Ground Floor Slab Assessment	At this stage, it is considered unlikely that shallow spread foundations (i.e. strip / trench fill / pads) would be suitable for use without ground improvement / earthworks, as it is likely that deep made ground, as well as sudden variations in depth due to buried opencast highwalls, are present below the proposed locations of buildings. Alternative foundation solutions may be required if deep made ground is proven. This may include the use of shallow spread foundations (rafts, pads and / or strips) constructed on fill material subjected to ground improvement, or piled foundations, taken through fill material into rockhead (possibly below the level of any abandoned mine workings within the influencing depth of piles). The floor slab design will be subject to proven ground conditions, development levels and required loading and settlement tolerances, and may vary from building to building. However, at this stage it would be prudent to assume that suspended floor slabs, or ground-bearing floor slabs following ground improvement works, may be required.
External Works	The existing made ground may be unsuitable for support for settlement-sensitive pavements in its current condition, without specific mitigation measures.

	It is therefore recommended that intrusive site investigation is undertaken in order to determine ground conditions for the purposes of identifying whether ground improvement is required in this respect, and if so, which techniques may be suitable. The construction details of external works potentially affected by coal mine entries (included treated mine entries) should be agreed in advance with the CA.
Contamination	The preliminary conceptual site model indicates that pollutant linkages are possible to various receptors. Potential contamination by heavy metals, petroleum hydrocarbons, PAHs and asbestos may pose risks to human health (construction workers and site end-users) and controlled waters (surface water courses within the site). The nature of the risks should be investigated further, informed by the results of intrusive site investigation and laboratory analysis.
Ground Gas Risk	The site is likely to be underlain by deep made ground in parts, as well as being potentially underlain by shallow abandoned coal and ironstone mine workings, with mine entries also possibly present. These could act as a source / pathway of hazardous ground gases, e.g., methane and carbon dioxide. A ground gas risk assessment is required to determine the risk of migration of ground gases to the surface, and whether gas protection measures are required in this respect. No radon protective measures are required at the site.
Invasive Plant Species	A Japanese knotweed survey undertaken by others has identified that there are stands of Japanese knotweed in the central and western parts of the site. A mitigation strategy is contained within the survey report.
Recommended Further Works	• Trial pitting to investigate near-surface soil, rock and groundwater conditions and to allow recovery of soil samples for chemical and geotechnical testing. • Targeted trial trenching to expose the western edge of the former opencast mine. • Rotary probehole drilling to determine depth, thickness and condition of coal and ironstone seams and mine workings. • Targeted investigation of the recorded mine entries that may remain below the proposed developed areas following opencast mining, using trial trenching and rotary probehole drilling. • Cable percussion and window sampler boreholes, with standard penetration tests (SPTs) to be undertaken in order to provide geotechnical data. • If ground conditions revealed by the above are suitable, static cone penetration testing (CPT), in order to derive continuous geotechnical parameter profiles to assist in assessment of settlement and foundation design. • Geotechnical and contamination testing at UKAS accredited testing laboratories to adequately characterise made ground, shallow soils, surface water and groundwater. • A programme of ground gas monitoring visits should be undertaken, to allow a quantitative ground gas risk assessment to be produced for the site. • Reporting. Intrusive ground investigation works should be carried out by a suitably qualified geoenvironmental consultant. Intrusive site investigation of coal seams, mine workings and mine entries would require permission from the Coal Authority. Statutory utilities information should be procured, to identify the position of buried services within the site.

The executive summary given above is an overview of the key findings and conclusions of the report. There may be other information contained within the body of the report which puts into context the findings of the executive summary. No reliance should be placed on the executive summary in isolation.

1. INTRODUCTION

Sirius Geotechnical Ltd was commissioned by Sirius Planning Ltd, acting on behalf of J&A Young (Leicester) Ltd (Jayplas), to undertake a preliminary appraisal (desk study) of land off Goat Mill Road, Merthyr Tydfil (the 'site').

This desk study has been compiled to accompany a planning application, determine potential ground constraints and facilitate scoping of suitable intrusive site investigation works.

It is understood that consideration is being given to development of the site for industrial use, comprising a plastics recycling and processing facility, broadly as shown on Sirius Planning Drawing No. JAY1001/04/06 Rev 0, dated 25/02/2022, a copy of which is included in Appendix A.

The proposed site layout includes two large portal frame buildings amongst hard-paved areas upon which bailed plastic waste is to be stored. A surface water lagoon is also proposed in the south of the site. Wooded areas immediately east of Goat Mill Road are to remain undeveloped.

A Proposed Development Platform Isopachytes drawing (Sirius Planning Drawing No. JAY1001/04/04 Rev 0, dated 25/02/2022, a copy of which is included in Appendix A), shows that cut and fill earthworks are required to achieve the required finished development levels, with up to c. 1.8m of cut in the eastern and central parts of the site, and up to c. 1.0m of fill in the north-western and south-western parts of the site.

If the proposed site layout and development levels change significantly from those referenced above, this assessment will require revision.

The objectives of this appraisal were to:

- Establish the historical development of the site and surrounding area from a review of available historical Ordnance Survey (OS) maps and other information.
- Establish the environmental setting of the site.
- Determine whether historical activities could give rise to significant ground contamination.
- Evaluate whether past mining or other extractive industries could have an influence on the site and produce a preliminary Coal Mining Risk Assessment (CMRA).

- Determine the outline risk to the development from hazardous ground gas sources, including radon.
- Provide, where possible, provisional recommendations for foundations, and measures to deal with potential contamination; and
- Provide recommendations for intrusive works required to confirm the ground conditions below the site and the contamination status of the shallow soils, and from this, foundation solutions and measures to deal with any contamination.

This investigation includes an assessment of information provided by Landmark Information Group (Envirocheck report), Natural Resources Wales (NRW), the British Geological Survey (BGS) and the Coal Authority (CA).

A site inspection (walkover survey) was undertaken by a Sirius geoenvironmental engineer on 20th February 2020.

This report presents and interprets the factual information reviewed during this appraisal and presents a Preliminary Conceptual Site Model (PCSM), from which ground-related hazards and risks have been assessed.

Where the report refers to the potential presence of invasive plants or asbestos containing materials (ACMs), such observations are for information only and should be verified by an appropriate specialist.

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2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview

Location	The site is located off Goat Mill Road, approximately 1km north-east of Merthyr Tydfil town centre. A site location plan illustrating the planning application boundary, Sirius Planning Drawing No. JAY1001/04/01 Rev 0, is included within Appendix A.
NGR	306200, 207000.
Topography and Features	Limited existing levels contours on the proposed site layout plans indicate that the site slopes gently down from east to west, from c. 281 - 279m Above Ordnance Datum (AOD), with an overall gradient of c. 1 in 90. The site surfacing comprises mainly open sparsely grassed gravel, with a wooded margin along the western boundary of the site. There is a surface watercourse that forms the northern site boundary, with a small concrete bridge spanning this giving access to the site. There is a second small concrete bridge spanning a watercourse within the south of the site. Across the site, there is evidence of previous site investigation, comprising several upright monitoring well covers and backfilled trial pits, which revealed disturbed coarse made ground including cobbles and boulders of slag and rock. There is a small compound in the extreme south-eastern corner of the site, surrounded by steel palisade fencing, which houses equipment that is possibly used for noise monitoring.
Services and Underground Structures	No evidence of underground services or structures was noted within the site.
Site Area	Approximately 14.6 hectares.
Current Land Use	The site is currently vacant and disused, apart from informal use by dog walkers, etc.
Adjacent Land Uses	The site is bound to the north by an un-named access road and a watercourse, beyond which lies similar disused land. The site is bound to the east by a wooded embankment carrying the A4060 dual carriageway, beyond which lies an opencast coal mine. The site is bound to the south by Mount View, beyond which lies residential properties, and to the west by the A4102 Goat Mill Road, beyond which lies residential, commercial and light industrial premises.

3. ENVIRONMENTAL SETTING

3.1. Introduction

Published environmental, geological and historical data relating to the site has been reviewed. A summary of relevant information is provided below and a copy of the Envirocheck report and historical OS maps is included in Appendix B.

3.2. Historical Development

Table 3.1 presents a summary of the site history from 1875 to 2020, as illustrated on historical OS maps. Only information pertinent to the proposed development is described. All distances are approximate. It should be noted that the site boundary shown on the OS maps in Appendix B is based on a previous site boundary that included the embankment to the east, and which is now outside the current site boundary.

Table 3.1 Historical Development

Map Dates	On-Site Features	Off-Site Features (only features within 500m that may affect the site are listed)
1875-1885	The northern part of the site is part of the wider Dowlais Great Tip (a spoil heap associated with the Steel Works to the north). Pwyll-yr-Hwyaidd (translated from Welsh as 'Duck Pond') is present in the north of the site, with an Old Shaft (Ironstone) just to the south. A Reservoir occupies the southern tip of the site, with a spoil heap also present in the south, as well as unlabelled buildings and railway lines and an Old Level (Coal and Ironstone). There are two Air Shafts, as well as Ton-y-ffald Level (Coal) and several circular ponds, in the central part of the site. The Level is connected to the wider rail network. There is an Old Level (Coal) in the west of the site. There is a cutting carrying a railway along the western site boundary, with a railway building in the north of the site.	The surrounding area is heavily affected by mining, with numerous Air Shafts, spoil heaps, railways, Tramways and Engine Sheds. There is an Old Level (Ironstone) adjacent to the western site boundary. Dowlais Great Tip extends beyond the northern site boundary. Dowlais Iron Works comes within 100m of the north of the site. Pen-y-daren Iron Works is 200m west of the site.

Map Dates	On-Site Features	Off-Site Features (only features within 500m that may affect the site are listed)
1900-1905	A railway (Dowlais Steel Works Branch) crosses the southern half of the site. There is a Reservoir at the western site boundary. The two Air Shafts in the central part of the site are now labelled as Old Air Shafts. The Duck Pond has been filled in with spoil. Most of the buildings within the site are no longer shown. Ton-y-ffald Level is no longer shown.	There is a Brick Works 300m north-east of the site. Pen-y-daren Iron Works is no longer shown.
1919-1922	There are additional areas of spoil tipping in the north-western part of the site.	No significant changes noted.
1938	No significant changes noted.	No significant changes noted.
1951-1957	Dowlais Great Tip has expanded to occupy most of the northern half of the site. However, there are no longer rail lines onto the Tip from the north. The railway along the western site boundary is no longer present. The Reservoir in the southern tip of the site is now shown as marshy land. There are a number of Ruin buildings in the north-western part of the site.	Dowlais Iron Works is no longer present; there are several industrial premises, including a Hosiery Factory, Agricultural Engineering Works and a Plastic Factory in its place. There is a Works, including several large circular tanks, 50m north of the site. The Brick Works is noted as Disused.
1958-1965	One of the two Old Air Shafts is no longer shown. The number of Ponds within the site has increased.	The A4060 road has been built c. 100m east of the site.
1969-1979	The railway crossing the site is Dismantled, although the cutting remains. There is a Tank and a Weighbridge in the western part of the site. An Electricity Transmission Line crosses the southern half of the site, from west to east. There are Stables in the southern part of the site.	Goat Mill Road runs along the route of the former railway along the western site boundary. There is a Clothing Factory, Chemical Works and Packing Case Works on the opposite side of Goat Mill Road.

Map Dates	On-Site Features	Off-Site Features (only features within 500m that may affect the site are listed)
1983-1989	There is a Scrap Yard in the south-western part of the site. The marshy land in the south of the site has expanded northward.	Houses have been built 40m south of the site.
1992-1999	There are three rectangular lagoons / reservoirs in the north-western corner of the site, as well as a pond on the northern site boundary. There is a Garage close to the western site boundary.	Houses have been built 50m west of the site.
2020	There are wooded areas along the western margins of the site. The lagoons / reservoirs in the north-west of the site are no longer present; there is a surface water drain along the site boundary in this area.	The A4060 road now runs c. 150m to the east of the site.

3.3. Published Geological Information

A summary of available published geological information is provided in Table 3.2.

Table 3.2 Geological Summary

Sources of Information	BGS 1:50,000 scale Sheet 231, Merthyr Tydfil (Solid Edition and Drift Edition), 1979. Geological Survey of Great Britain. 1:10,560 scale geological map sheet SO 00 NE, dated 1972. BGS Geoindex website. BGS geological memoir – Geology of the South Wales Coalfield, Part V, the Country around Merthyr Tydfil, Third Edition, 1988. Envirocheck Report (Reference 233970729_1_1), dated 11th February 2020, presented within Appendix B. CA Interactive Map Viewer. CA Consultants Mining Report (Reference 51002253821001), dated 10th February 2020, presented within Appendix C.
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	CA Mine Abandonment Plans, copies presented within Appendix C.
Made Ground	Published geological mapping shows, ' <i>Made Ground, mainly spoil from coal and ironstone workings</i> ' covering much of the site. However, this is considered to be out of date, as it is known that a former ironworks slag heap was removed from the site and that the site is now underlain by made ground including opencast mine backfill.
Superficial Geology	The 1:10,560 and 1:50,000 scale geological mapping (produced prior to opencast mining) indicates that Boulder Clay is present in the central part of the site.
Solid Geology	The Geology of Britain Viewer shows the site to be underlain by solid strata comprising the South Wales Lower Coal Measures Formation (SWLCMF) (Carboniferous age), described as, ' <i>Mudstone, siltstone and sandstone</i> '.
Coal Seams	Although there are geological cross-sections on the BGS geological maps, and coal seams are shown to outcrop across the site on the CA Consultants Mining Report, there is much more detailed and site-specific information relating to coal and ironstone seams within the Robert West report (see Section 4) and mine abandonment plans, which are described below.
Faults	No faults are shown to affect the site on geological mapping. A previous ground conditions report for the site (see Section 4) states that the Penydaren fault runs through the site; this is not shown to affect the site on any geological mapping, but this was drawn prior to opencast mining on the site. However, the Penydaren Fault is shown to affect the site on an old mine abandonment plan (CA catalogue no. SWR2510). The approximate trace of the Penydaren fault, as shown on the abandonment plan, is shown on Drawing No. C8341/03, in Appendix A.
BGS Boreholes	There is one BGS borehole record, close to the eastern site boundary (BGS Ref. SO00NE72). The log is of, '<i>Strata Between the Lower 4ft Coal and Farewell Rock at Dowlais</i>'. The date and exact location of the borehole is not given. Although the scan quality is poor, it can be determined that the following ironstone seams are present below the Lower Four Feet Coal at the following depths: • Spotted Ironstone: 10' (c. 3m); • Yellow Ironstone: 30' (c. 9.1m);

	• Red Ironstone: c. 38' (11.6m); • Blue Ironstone: 50' (c. 15.2m); • Lumpy Ironstone: 90' (c. 27.4m); • Rosser Veins: 100 – 125' (c. 30.5 – 38.1m).
Consultants Coal Mining Report	The CA Consultants Mining Report for the site includes the following salient points: • There are records of underground mining in one seam (Rosser Ironstone) to the east of the site, at a depth of 108m. The extraction thickness was 0.78m and the last year of working was 1900. The seam dipped 4.8° to the south. • There are probable unrecorded shallow (i.e., less than 30m deep) mine workings below the site. • There are three records of spine roadways at shallow depth (i.e., less than 30m deep) within the site. • There are records of 25 No. mine entries within, or within 100m of, the site (see below for further details). • The site is located within the Great White Tip opencast area, which extends to the north-east, east and a small distance to the south of, the site boundary.
Mine Entries	The 1:10,560 scale geological map shows an area that includes the central part of the site, labelled as, '<i>Many Bell Pits</i>'. However, it should be noted that these would have been subsequently removed where later opencast mining took place. Within the CA Consultants Coal Mining Report, there are records of 25 No. mine entries within, or within 100m of, the site. Each of these has been assessed in terms of their relevance to the proposed development, and placed in one of three categories, of decreasing risk to the development: 1) Within the area of proposed area of development (6 No.). 2) Within the site boundary, but outside the area of proposed development, or in the case of adits, near to the site boundary and directed towards the site (4 No.). 3) Outside the site boundary, and in the case of adits, not directed towards the site (15 No.).

	The recorded mine entries within categories 1) and 2) above are summarised in Table 3.3, below; the recorded mine entries within category 3) are not considered to have potential to affect the proposed development and are not considered further.
Mine Abandonment Plans	The CA was requested to provide a list of mine abandonment plans relating to the site. The list provided included opencast mining plans for various seams, and a composite opencast mining plan, which was obtained (Catalogue No. 17930/1) and a plan covering ‘multiple ironstone seams’ (Catalogue No. SWR2510/1), which was also obtained. <u>Catalogue No. SWR2510/1</u> This is a plan titled ‘<i>Plan of Penydarran Minery</i>’, dated 1860. There are few surface features shown with which to orientate the plan against modern features precisely, but the general site area can be inferred from the position of some mine entries. The plan shows the Penydarran Fault crossing the southern part of the site, in an approximately north-south direction, with the rise to the east of 17 yards, i.e., the western side of the fault is downthrown c. 15.5m. The plan shows that the ‘<i>Pingaw and Coal</i>’ outcrops close to the northern site boundary, and that strata dip to the south in the area. The plan shows a number of underground mine roadways, including ‘<i>Level on Garw</i>’ and ‘<i>Level on Blue</i>’ in the southern end of the site. There is also a lesser density of underground roadways / levels in the central and northern part of the site, including two drainage levels. The only visible mine entry that is within the site is a mine shaft, corresponding to CA ref. 306207-032. There are no depths or levels given on the plan for the recorded workings. <u>Catalogue No. 17930/1</u> This is an abandonment plan for the Great White Tip opencast coal mine, produced by Celtic Energy Ltd, dated July 1996. The plan states that coaling was completed in March 1996. The boundary of the site corresponds to the Opencast Mine Licence Area for the Great White Tip opencast shown on the CA Consultants Mining Report; however, the extent of actual opencast mining is much smaller. The extent of opencast mining covers the majority of the site boundary, with the exceptions on the extreme southern and south-western

	margin, and a significant part of the western and north-western parts of the site. The approximate extent of the recorded opencast mining in relation to modern day topography is shown on Drawing No. C8341/03, in Appendix A. There is a vertical section detailing the coal seams extracted, taken at a point c. 100m east of the site boundary. The coal seams listed, in descending order (youngest first), with their thicknesses and base levels of seams are summarised below: • Rhaslas Lower Leaf (0.84m thick; base at 296.5m AOD); • Bute (0.82m thick; base at 294.6m AOD); • Three Coals Rider (0.44m thick; base at 286.1m AOD); • Three Coals Upper (0.83m thick; base at 284.3m AOD); • Three Coals Lower (0.34m thick; base at 283.9m AOD); • Little Rider (0.49m thick; base at 278.9m AOD); • Little Vein Upper Leaf (0.72m thick; base at 263.0m AOD); • Little Vein Lower Leaf (0.79m thick; base at 262.0m AOD); • Little Vein Lower Leaf 2 (0.35m thick; base at 261.5m AOD); • Lower Four Feet Upper Leaf (0.75m thick; base at 260.7m AOD); • Lower Four Feet Middle Leaf (0.94m thick; base at 259.7m AOD); • Lower Four Feet Lower Leaf (1.41m thick; base at 257.3m AOD). The total thickness extracted at the location of the section above was 65m, comprising 24.9m of overburden (note that this included the former slag heap), 8.72m of coal, and 31.35m of intervening coal measures.
Quarries	There are two BGS Recorded Mineral Sites listed within the Envirocheck report within the site that relate to opencast workings; in addition to the Great White Tip opencast for coal, described above, there is a record for Dowlais Iron Workings, operated by Dowlais Iron Co. Ltd, where ironstone was extracted from the SWLCMF.

Table 3.3 summarises those CA-recorded mine entries that are considered to have potential to affect the site. The assessment is based on information contained within the CA Consultants Coal Mining

Report and Interactive Map Viewer. All adits within Table 3.3 run in an easterly or south-easterly direction.

Table 3.3 Summary of Coal Authority Recorded Mine Entries that may affect the Site

CA Mine Entry Ref.	Mine Entry Type	Name	Location	CA Consultants Coal Mining Report Treatment Comments
306206-005	Adit - Coal	-	Within proposed development area – bale storage area	None recorded
306206-006	Adit - Coal	Ton -y- Fald Level	Within proposed development area – footprint of Building 2	May have been partially or wholly excavated by opencast mining
306206-008	Shaft – Coal	Pwll-y-Hwydd Colliery - Air Shaft	Within proposed development area – bale storage area	
306206-009	Shaft – Coal	Air Shaft		
306206-067	Shaft – Coal	Air Shaft		
306206-083	Adit – Ironstone	-		
306206-004	Adit – Ironstone	-	To west of, but heading towards southern end of site (proposed lagoon)	
306206-030	Adit – Limestone	Clay Pit Level		
306207-019	Adit – Coal	-	To west of, but heading towards, proposed development	None recorded
306206-078	Adit – Coal	Dip Level Horseway to No. 4 Pit		

3.4. Hydrology and Hydrogeology

A summary of available information pertaining to hydrology and hydrogeology is presented in Tables 3.4 to 3.6.

Table 3.4 Surface Water Features

	Presence/location	Comments
Unclassified Watercourses (within 500m)	Mapping within the Envirocheck report show that there is an unnamed surface water course along the northern site boundary, flowing to the west.	These appear to convey surface water from the opencast mine to the east, below the A4060 road.
	There are also drainage ditches along the base of the embankment to the A4060 road, which discharge into the surface water course to the north of the site, and a smaller watercourse, running to the west, within the site.	
Licensed Surface Water Abstractions (within 1km)	There are no recorded surface water abstractions within 1km of the site.	
Flood Risk Status	According to the NRW website ¹ , the site is not in an Area of Risk of Flooding from Rivers & Sea.	Relatively small areas in the northern and western parts of the site are shown to be at risk of surface water flooding.

1

https://maps.cyfoethnaturiolcymru.gov.uk/Html5Viewer/Index.html?configBase=https://maps.cyfoethnaturiolcymru.gov.uk/Geocortex/Essentials/REST/sites/Flood_Risk/viewers/Flood_Risk/virtualdirectory/Resources/Config/Default&layerTheme=0

Table 3.5 Groundwater Occurrence and Abstraction

	Presence/location
Licensed Groundwater Abstractions (within 1km)	There are no recorded groundwater abstractions within 1km of the site.
Source Protection Zones (within 500m)	No source protection zones present.
Groundwater Flooding	The Envirocheck report indicates that the western margin of the site has, ' <i>Potential for Groundwater Flooding of Property Situated Below Ground Level</i> ', and that the rest of the site has, ' <i>Potential for Groundwater Flooding to Occur at Surface</i> '.

Table 3.6 Groundwater Vulnerability Status

	Environment Agency (EA) Classification
Superficial Deposits Aquifer Designation	Under the aquifer classification system developed by the EA, the superficial deposits are classified as a Secondary Undifferentiated Aquifer. Secondary Undifferentiated Aquifers are described by the EA as, '<i>assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type</i>'.
Solid Strata Aquifer Designation	The solid strata underlying the site are classified as a Secondary A Aquifer. Secondary A Aquifers are defined by the EA as, ' <i>permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers</i> '.

3.5. Landfilling and Waste Management

Table 3.7 Waste Management Activities

	Presence / Location / Comments
Historical Landfills (within 500m)	There is a Historical Landfill Site recorded on the site itself, encroaching on to the northern end of the site, but being mostly located north of the site. This is recorded as BSC (British Steel Corporation) Dowlais Tips, with the waste input dates being 1978 – 1998 and the specified waste types being, <i>‘Deposited Waste included Inert, Industrial and Commercial Waste, and Liquid Sludge’</i>. There are two other Historical Landfills, located 445m south-east, and 484m south of the site. The closest of the two has a recorded first waste input date of 1972, but no last input date and the same specified waste types as those noted above for the on-site Historical Landfill Site. The furthest of the two has recorded input dates of 1980 – 1985, with the specified waste types being, <i>‘Deposited Waste included Inert, Industrial, Commercial, Household and Special Waste’</i>.
Local Authority Recorded Landfills (within 500m)	There is a Local Authority Recorded Landfill pertaining to the site itself, named as B.S.C. Dowlais Tips. The landfill covers the northern half of the site, and also extends beyond the northern and eastern site boundaries. The date of closure is given as 1979. No other details are given. There are two other large Local Authority Recorded Landfills, located 38m south-east (Cwmbargoed Lower; no further details given) and 303m east (Cwmbargoed Main; closure date of 1989, but no further details given).
Registered Landfill Sites (within 500m)	There is an entry relating to the site itself, for BSC Dowlais Tips. The authorised wastes are listed as Controlled Wastes, Cupola Waste, Foundry Sand and Sludge Wastes. The prohibited wastes are Toxic / Poisonous Wastes. The status is listed as, <i>‘Licence lapsed / cancelled / defunct / not applicable / surrendered / Cancelled’</i>, as of 1978.

	Presence / Location / Comments
Other Licensed Waste Management Facilities (within 500m)	There is a civic amenity / waste transfer station located 484m to the north-west of the site.
Walkover Evidence of Fly-Tipping on Site?	No.
Ground Gas Risk Assessment Required?	Yes, due to the presence of deep made ground and potential shallow mine workings.

3.6. Radon Risk

The Envirocheck Report states that the site is in a Lower Probability Radon Area and that, '*no radon protection measures are necessary in the construction of new dwellings...*'.

3.7. Other

Other potentially contaminative activities or environmental constraints identified within the Envirocheck report are listed below. The entries relate to activities within approximately 250m of the site, with the exception of active Control of Major Accident Hazard (COMAH) and Notification of Installations Handling Hazardous Substances (NIHHS) facilities, where the assessment is extended to a distance of 500m.

- There are four records of Discharge Consents (now expired) relating to the site, for Celtic Energy to discharge Trade Effluent to a Culvert and thence to the River Taff, dated between 1992 and 1996, from the Great White Tip Site Coal Extraction.
- There is a Local Authority Pollution Prevention and Control record (now revoked) pertaining to the site, for Celtic Energy to undertake Coal, Coke and Coal Product Processes, dated 1993.

4. REVIEW OF PREVIOUS REPORTING

The following report pertaining to the site have been forwarded to Sirius for review as part of this Preliminary Appraisal:

- Robert West Consulting Ltd. 1997. *East Merthyr Reclamation Scheme Phase II – Assessment of Ground Conditions Report.*

The report is briefly summarised below. The original document should be referred to for the full details therein. It should be noted that the original report contained 18 No. Drawings that are considered to be directly relevant to this Appraisal, but are not included within the electronic copy forwarded to Sirius. Robert West Consulting Ltd was requested to provide copies of the Drawings, but the response was that the project could not be found within its archives, and that project data is only stored for 12 years.

4.1. Introduction

The report covers an area of 14 hectares. There is no accurate site boundary plan within the copy reviewed by Sirius, but there is a marked-up oblique aerial photograph that indicates that the area covered is similar to the site area covered in this Preliminary Appraisal, although the report states that the embankment to the new A4060 route forms the eastern site boundary.

The report was produced for Merthyr Tydfil County Borough Council and comprises an assessment of ground conditions, based on a desk study of existing information produced by others, following completion of opencast coal mining and restoration.

No information regarding soil, groundwater or ground gas contamination is reviewed within the report.

Although no specific development of the site was proposed at the time of writing, the assessment is made in relation to a theoretical likely end use, of a large industrial development consisting generally lightly loaded steel framed buildings with large floor areas.

4.2. Historical Ironstone Mining

The Dowlais ironworks was built to the north of the site in 1759, and smelted iron ore sourced from nearby opencast extractions. Large scale local ironstone mining started in 1748 and was finished by 1877; however, small-scale ironstone mining may have been carried out prior to these dates.

4.3. Historical Coal Mining

Coal mining in the area postdates that of ironstone, with records of coal mining dating from the 19th Century until the 1950s, although unrecorded coal mining probably occurred prior to this.

Most of the recorded coal mining in the area was underground, by pillar and stall methods, although there is also evidence of small opencast workings.

After the Second World War, large-scale opencast coal mining was undertaken along the outcrop of the Lower and Middle Coal Measures.

The site was subject to extensive opencast coal mining and restoration between 1993 and 1996.

4.4. Ground Conditions Prior to Opencast Mining

The site was underlain by a combined thickness of made ground and boulder clay of up to 28m. Much of the eastern part of the site was covered in heaps of waste from iron smelting, comprising extremely variable material including large blocks of fused slag and reinforced concrete. However, the greatest volume of waste material comprised ash and slag from the blast furnaces of Dowlais Iron Works. Relatively small volumes of colliery spoil were also encountered.

Natural drift deposits comprised silty, sandy grey / brown clay, with gravel, cobbles and boulders.

The solid strata present prior to opencast mining are described in detail within the report, and are summarised on a generalised cross-section. There were eleven coal seams prior to opencast mining, which were (from shallowest to deepest), the Rhaslas (Middle and Lower), Bute, Three Coals Rider, Three Coals, Little Seam Rider, Little Seam (Upper and Lower), Lower Four Feet (Upper, Middle and Lower).

Below the above-listed coal seams, were workings in five seams of ironstone, which were (from shallowest to deepest), the Spotted, Yellow, Red, Blue and Lumpy Ironstone seams.

The Garw Coal is present below the Lumpy Ironstone.

Historical underground pillar and stall workings were identified in all coal seams encountered by opencast mining. The workings were all fully closed by roof collapse, with fractured zones extending up to 3m above the workings. The collapsed materials were found to be fairly compact, with no voids. However, main roadways and levels within both coal and ironstone seams were found to be stone-lined arches, up to 2m high and to be in good condition. A plan showing mine shafts, adits

and areas of suspected pillar and stall workings collapse encountered during opencast mining was included with the original report, but not in the electronic copy supplied to Sirius.

4.5. Ground Conditions Following Opencast Mining

Rock, Coal and Ironstone Seams

The opencast mining in the Great White Tip Opencast Mine removed all coal seams above, and including, the Lower Four Feet seam, leaving only the Garw Coal seam (which was worked below the site), and the pre-existing workings in the underlying five ironstone seams in situ.

The Garw seam, and workings within it, may remain in situ at shallow depth in the western margin, northern and southern tips of the site.

During the opencast reclamation works, Robert West Consulting recommended that any ironstone workings that were to remain within 10m of final restoration levels be exposed and collapsed, to remove voids. Any levels within 5m of the final restoration surface were also to be treated in this manner. Any coal seams to the east of the Penydaren fault were to be exposed and treated. In the event, only one level, the Waun Bant, was encountered within the depths specified, and this was collapsed (the location of this is not described in the report text).

Workings within the Spotted, Yellow and Red Ironstones were identified in trial trenches up to 11m deep and found to be tightly packed with mine waste, with little to no voids present. However, an area of ironstone workings was excavated and filled in accordance with an engineering specification.

All areas of intact bedrock exposed within 2m of the finished surface were broken out and recompacted to an engineering specification.

A small area to the south-west of the Penydaren Fault may remain intact, with possible shallow mine workings in coal and ironstone seams younger than the Lower Four Feet seam, in the south of the site.

Historical Mine Entries Identified During Opencast Mining

No historical mine shafts or adits were identified during opencast mining, with the exception of Waun Bant Level. Similarly, no such features were identified within 5m of finished ground levels by trial trenching. The report considers that the recorded locations of these were therefore inaccurate, or were not identified due to being previously backfilled.

Opencast Backfill

The opencast was backfilled in 500mm deep compacted layers, tested using a nuclear density gauge. The backfill ranges in thickness from 0m along the western limit of coal extraction (which does not coincide with the western site boundary), to 15m along the eastern limit of the development area. However, there are also variations along the length of the opencast, being 10-20m deep at the northern and southern ends of the site, and as little as 5m deep in the central area. The backfill material generally comprises reworked mudstones and siltstones, with localised areas of recompacted ironstone, ash and slag, up to 5m deep, in areas where modern, large-scale opencast mining exposed historical small-scale ironstone opencast extractions.

Settlement Monitoring

A total of 86 No. monitoring pins were installed in March 1997 on a general 100m grid, with a 25m grid used in areas where backfilling of trial trenches and shallow historical opencast mining was undertaken. Monitoring was undertaken on a weekly basis, between March and April 1997.

The report also mentions settlement monitoring undertaken by others along the then-proposed A4060 embankment, over a 12-month period.

It is stated that the recorded settlements are generally within the limits of surveying accuracy and that for engineering purposes the settlement is effectively zero, and that settlement of the compacted backfill will be very low and will not have a detrimental effect upon settlement of structures.

4.6. Geotechnical Risk Assessment

The following geotechnical risks to a possible future development are considered:

- Shallow abandoned coal mine workings;
- Shallow abandoned ironstone workings;
- Shallow abandoned adits, shafts and roadways;
- Depth and consistency of backfilled excavations.

Shallow Abandoned Coal Mine Workings

The report states that the only coal seam remaining following opencast mining is the Garw seam, and that there are workings in this seam below the site. As the seam (and workings within it) was

not exposed during opencast mining, it is not known for certain whether historical underground workings within the Garw seam have already collapsed and closed up. It is therefore considered that there is a high risk from shallow mine workings in this seam at the western margin of the site, where the seam may be present within 20m of the ground surface and with less than 15m of rock cover. As the seams dip to the south-east, the risk is considered 'lower', further down-dip.

It is also stated that opencast mining was not undertaken within the area of the Penydarren Fault, and therefore, there may be shallow underground workings in the Garw seam and shallower overlying coal and ironstone seams and it is recommended that further investigation of this area is undertaken, although the drawing(s) showing this area are not included within the copy of the report provided to Sirius.

Shallow Abandoned Ironstone Workings

Historical workings in the Spotted, Yellow and Red Ironstone seams are present at shallow depth below the site. Although trial trenching identified that workings within 5-10m of finished ground level were backfilled, with no voids remaining, it is possible that workings deeper than this, and workings outside the opencast extraction are voided and hence be a risk of future collapse.

Shallow Abandoned Adits, Shafts and Roadways

With the exception of Waun Bant Level, no mine entries or levels / roadways were identified during opencast mining, or in trial trenching. The report concludes that collapse of mine entries or levels / roadways within the opencast mining area are unlikely to be within 5m of the surface and therefore the hazard from these is low to moderate.

In areas outside the opencast mining, these features could be present at shallow depth and hence are considered to represent a moderate to high hazard.

Depth and Consistency of Backfilled Excavations

The report considers that the nature of materials used and the standard of compaction achieved is of a high quality, in combination with the low settlements recorded means that the hazard from future settlement is low to moderate in areas of opencast mining, and low outside the opencast mining area.

4.7. Recommendations for Foundations and Ground Treatment

On the assumption that a future development would comprise lightly loaded structures, it is concluded that the use of deep foundations such as piles, or ground improvement techniques such as dynamic compaction or vibro treatment will not only be technically unnecessary, but would also be impractical to implement at the site, due to the density of the placed fill material. Conventional foundations are considered appropriate, following drilling and grouting to consolidate any shallow mine workings below proposed buildings in areas of high and moderate risk from these features.

It is also stated that areas of landscaping and car parking can proceed in all areas of the site without any form of treatment of special measures being taken.

4.8. Recommendations for Further Investigations

The report recommends that the following ground investigation works be undertaken prior to finalising development layouts, in particular the footprint of any buildings:

- Rotary openhole drilling along the line of suspected mine roadways in high risk areas (N.B., without the drawings included in the Robert West report, it will not be possible to target these).
- Limited rotary openhole drilling in the southern section of the site to confirm the absence of shallow mine workings.
- Rotary openhole drilling in high and moderate risk areas.
- Cable percussion drilling in the area of former coal extraction, to inform foundation design.

5. COAL MINING RISK ASSESSMENT

Table 5.1 summarises the potential risks associated with coal and ironstone mining legacy for the proposed development.

Table 5.1 Coal and Ironstone Mining Risk Assessment

Coal / Ironstone Mining Issue	Yes	No	Risk Assessment
Underground Coal Mining (recorded at shallow depths)	✓		The CA Consultants Mining Report states that there are three spine roadways at shallow depth within the site; no further details are given.
Underground Coal Mining (probable at shallow depth)	✓		Review of the available geological and coal mining information suggests that the mine workings in five seams of ironstone, and the Garw Coal seam, could underlie the site at shallow depth; either <30m bgl in the west of the site, which has not been subjected to opencast coal mining, or <30m below the base of the opencast mine, in which case it is possible that collapse of historical mine workings could cause instability at the ground surface. It is also possible that shallow unrecorded mine workings in the Lower Four Feet, and younger coal seams, are present on the western side of the Penyarden Fault within the site.
Mine entries (shafts and adits)	✓		There are six CA recorded mine entries within the site. Although it is likely that later opencast coal mining removed most of these, it is possible that CA recorded mine adit, ref. 306206-005, and / or unrecorded mine entries, lie at shallow depth within the western part of the site, outwith the former opencast area. It is also possible (but considered unlikely) that remnants of CA recorded mine shaft refs. 306206-008, -009 and -067 remain below the base of the backfilled opencast mine.
Coal mining geology (fissures)		✓	The CA is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining.
Record of past mine gas emissions		✓	There is no record of a mine gas emission requiring action by the CA within the boundary of the property.
Recorded coal mining surface hazard		✓	The CA states that the property has not been subject to remedial works by following report of a hazard relating to coal mining under the CA's Emergency Surface Hazard Call Out procedures.
Surface mining (opencast workings)	✓		The majority of the site has been subject to opencast coal mining.

6. PRELIMINARY CONCEPTUAL SITE MODEL

Based on an assessment of the published information, a preliminary conceptual site model (CSM) has been developed for the proposed future land-use. This summarises the understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors in order to assess potential contaminant linkages.

A qualitative risk assessment has also been made of the likelihood of any pollutant linkage operating and its potential significance.

The preliminary CSM has been produced and is presented in schematic form as Drawing No. C8341/04 Rev A in Appendix A.

In summary, the preliminary CSM has identified the following potential contaminant linkages, which could result in an unacceptable risk to the proposed end-use (an unacceptable risk is defined as being higher than 'low risk', as defined within the risk assessment methodology included in Appendix D):

- Ingestion, inhalation of dust, and dermal contact with potential heavy metals, polyaromatic hydrocarbons (PAH) and asbestos in made ground, topsoil and shallow natural soils, posing a **moderate** risk to site end users in areas not covered by hardstanding, adjacent site users and construction workers.
- Possible heavy metals and organic contaminants in made ground posing a **moderate** risk to controlled waters (un-named surface water courses running through the site) via migration of contaminated shallow perched groundwater and surface water run-off.
- Phytotoxic effects of heavy metals (e.g., copper and zinc) within made ground / soils on planting and landscaping within the proposed development, posing a **moderate risk**.
- Damage to buried services from smouldering of combustible material (e.g., ash and coal) within made ground / opencast backfill, posing a **moderate risk** to the built environment.
- Damage to concrete foundations by sulphates and acids within made ground, soil and groundwater, posing a **moderate** risk to the built environment.
- Migration of hazardous ground gases (e.g., methane and carbon dioxide) into confined spaces within proposed structures, from deep made ground and mine workings, posing a **moderate to high risk** to construction workers, future site users and proposed buildings.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1. General

It is understood that consideration is being given to development of the site for industrial use, comprising a plastics recycling and processing facility, broadly as shown on Sirius Planning Drawing No. JAY1001/04/06 Rev 0.

A Proposed Development Platform Isopachytes drawing (Sirius Planning Drawing No. JAY1001/04/04 Rev 0), shows that cut and fill earthworks are required to achieve the required finished development levels, with up to c. 1.8m of cut in the eastern and central parts of the site, and up to c. 1.0m of fill in the north-western and south-western parts of the site.

If the proposed site layout and development levels change significantly from those referenced above, this assessment will require revision.

7.2. Flood Risk

According to the NRW website, the site is at low risk of flooding from rivers and the sea.

It is understood that a Flood Consequence Assessment report, produced by others, will accompany the planning application for the proposed development.

7.3. Mining Risk Assessment

Based on the Coal Mining Risk Assessment, summarised in Section 5, it is considered that at this stage, the site can be zoned into two areas in relation to stability risks from historical coal and ironstone mining:

- 1) Within the former opencast mining area.
- 2) Outside the former opencast mining area.

There are historical underground mine workings in several coal and ironstone seams below the site and surrounding area. Within the former opencast mining area, these workings, and mine entries into them, there is evidence to suggest these have been stabilised below the base of the opencast. However, the opencast mine only went as deep as the Lower Four Feet coal seam; there is known to be historical pillar and stall mine workings below this level, within five ironstone seams, and the Garw Coal seam, all of which could be within 30m of the rockhead base of the former opencast mine below the site.

In addition, there is potential for remnants of recorded mine shafts (i.e., CA mine entry refs. 306206-008, -009 and -067), to lie below the base of the backfilled opencast mine. Hence, should any future collapses in these mine workings, and potential buried mine entries occur, it is possible that surface stability could be affected.

The recorded mine adits within the proposed development area (i.e., CA mine entry refs. 306206-006 (Ton-y-ffald Level; shown on the earliest OS map) and -083) are considered to have almost certainly been removed by the later opencast mining and are therefore unlikely to affect the stability of the proposed Building 2 and bale storage area, respectively.

Outside the former opencast mine, there is potential for unrecorded shallow coal and ironstone workings and mine entries, as well as roadways / levels to deeper historical mine workings to the east of the site, to be present.

The proposed site layout shows proposed buildings in the western half of the development area; these are likely to straddle the former opencast mine highwall, and therefore be affected by four separate ground stability risks:

- Unrecorded mine entries, and potentially recorded mine adit, CA ref. 306206-005;
- Collapse of shallow mine workings;
- Differential settlement across buried opencast mine highwalls;
- Differential settlement within opencast mine backfill that varies in depth (likely to be an overall increase to the east).

It is therefore recommended that intrusive site investigation works are undertaken in order to inform an assessment of the identified mining stability risks.

Should historical mine entries be identified by the recommended site investigation works, it should be noted that this does not preclude construction above a mine entry, or within its zone of influence (see the *CA Policy For Building Over Or Within The Influencing Distance Of A Mine Entry*²). However, the CA Policy states that this is only permissible when expert advice allows a suitable

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/363064/policy-for-building-over-or-within-the-influencing.pdf

engineering design to be developed and agreed, to take account of all relevant safety and environmental factors including mine gases and mine water, appropriate engineering precautions are taken to safeguard the safety of the public and structures, during and following completion of, the works. Approval for any construction works above, or within the zone of influence of, a known mine entry, must be given by the CA Permissions Service.

Construction of portal frame buildings and paved external areas in industrial developments over / within the zone of influence of mine entries has been successfully undertaken elsewhere with CA approval. Investigation, location and treatment of any mine shafts which may influence the development would be required. Dependent on the depth to any mine shafts that remain on the site following opencast mining, possible treatment options, as outlined in CIRIA Report C758D³, could include filling shafts with suitable granular material, provision of a concrete shaft plug, drilling and grouting, provision of geosynthetic reinforcement of shallow soils, construction of shaft caps at rockhead, or above rockhead, supported on piles, or a combination of two or more of these procedures.

Treatment of mine adits may include excavation at near surface, and placement of suitable engineered fill materials, and filling by drilling and grouting, at greater depths.

Any treatment works on coal mine entries, and subsequent construction of buildings, paved surfaces, etc., potentially within the zone of influence of the mine entries, must be agreed in advance with the CA.

7.4. Geotechnical

Settlement

The Robert West report states that the former opencast mine was backfilled under controlled conditions, in 500mm thick layers, using primarily re-worked mudstone and siltstone fill. The report also states that settlement monitoring was undertaken, with effectively zero settlement recorded over the monitoring period (weekly, over a month).

³ Parry, N.D., and Chiverell, C.P. (eds), 2019. *Abandoned Mine Workings Manual*. CIRIA, London.

However, in the absence of detailed records of the backfilling works, earthworks specification, verification data, etc., it is considered that there is currently insufficient evidence available to conclude that future settlement is a low risk to the proposed development.

The made ground present should be assumed to be susceptible to at least one of the below settlement mechanisms:

- Self-weight (creep) settlement;
- Consolidation settlement;
- Collapse compression / inundation settlement.

Settlement by any of the mechanisms outlined above could result in surface deformation of sufficient magnitude to preclude serviceability of the site, e.g., stepped changes in levels between piled structures and surrounding ground, failure of services, and failure of paved surfaces, resulting in cracking and areas of depression. In addition, settlement could cause ultimate failure of buildings constructed upon spread foundations constructed on made ground.

Self-weight Settlement

Self-weight settlement can be significant and occur over a long period of time. BRE Report FB75⁴ states that in non-putrescible materials, creep settlement is caused as the fill particles become more closely packed. It is recommended that intrusive site investigation is undertaken to determine actual fill depth, composition and degree of compaction, etc., in order to refine estimates of creep settlement at the site.

Consolidation Settlement

Consolidation settlement of the made ground should also be expected if any additional load is applied to the material, e.g., by raising ground levels, or application of structural loads imposed by buildings. The magnitude of consolidation settlement will be dependent upon the shape, size and magnitude of the load applied.

⁴ Watts, K., and Charles, J. 2015. *Building on Fill: Geotechnical Aspects*. Third Edition.

Where ground levels are to be raised, the placed fill could impose a significant surcharge load to the underlying existing made ground. This could result in long-term total and differential settlement and / or shear failure of the underlying made ground / fill, as well as initiating additional creep settlement.

Prior to any proposed development, comprehensive site investigation and settlement calculations would be required in order to accurately assess likely magnitudes of consolidation settlement.

Collapse Compression / Inundation Settlement

Reference to BRE Report FB75 indicates that collapse compression can be the most damaging settlement hazard for buildings on fill. Inundation settlement can occur, particularly in cohesive soils, when compacted dry of optimum and become wetted, e.g., in the event that groundwater levels rises, or an increase in water infiltration at shallow depth occurs (e.g., from leaking drains).

Although the Robert West report indicates that the opencast mine backfill is primarily granular in nature, this is not substantiated in detail and it is possible that there are significant thicknesses of cohesive or loose granular material within the backfill that are susceptible to inundation settlement.

Inundation settlement is difficult to predict through soil mechanics theoretical modelling. In order to quantitatively determine the propensity of the fill material present to settle via this mechanism, it is recommended that inundation settlement testing is undertaken at the site, e.g., by monitoring of fixed points located in proximity to boreholes or deep trenches that are filled with water to various depths within the fill, as outlined in BRE Report FB75.

Treatment of Fill

Given the risks associated with ground settlement of this filled site, and lack of data relating to the compaction of the opencast backfill, ground improvement / treatment may be required prior to development to mitigate the effect of the settlement mechanisms described above.

At this stage (i.e., Preliminary Appraisal), consideration could be given to typical solutions which can include systematic excavation and compaction in controlled layers (including removal of unsuitable materials), dynamic compaction, rapid impact compaction, surcharging, or combinations of these methods.

Notwithstanding the above, detailed site investigation would be required to determine the types and depth of materials compacted, and if treatment is required. The most effective method of ground improvement will be dependent on a number of factors, including the proposed development layout

and levels, the underlying soil profile and groundwater regime, potential constraints imposed by the presence / sensitivity of neighbouring structures / infrastructure.

Slope Stability

The Development Platform Formation Isopachytes drawing in Appendix A indicates that ground levels are to be cut by up to 1.8m at the eastern margin of the site, i.e., in proximity to the base of the embankment to the A4060 road.

Where the proposed development alters levels, drainage, etc., in proximity to the embankment, further assessment of slope stability should be undertaken.

Foundations

The type and depth of foundations used will be dependent on the detailed site geology, including the presence / thickness of made ground, nature of ironstone and coal mine workings and nature of intact rock below proposed buildings. The following also assumes that an adequate assessment of shallow abandoned mine workings has been undertaken beneath the site and, where required, stabilisation of mine workings has also taken place prior to development.

At this stage, it is considered unlikely that shallow spread foundations (i.e. strip / trench fill / pads) would be suitable for use, as it is likely that deep made ground, as well as sudden variations in depth due to buried opencast highwalls, are present below the proposed locations of buildings.

Alternative foundation solutions may be required if deep made ground is proven. This may include the use of shallow spread foundations (rafts) constructed on fill material subjected to ground improvement, or piled foundations, which would need to be taken through fill materials into rockhead (possibly below the level of any abandoned mine workings within the influencing depth of piles).

Overall, the nature and depth of foundations will be dependent on loadings, development levels and the detailed site geology, including:

- Location, thickness and nature of made ground and / or newly placed fill materials.
- Depth to, and strength of, intact rock.
- Presence of shallow coal mine workings and mine entries.
- Groundwater levels.

- Contamination status of shallow soils.

It is therefore recommended that a ground investigation be undertaken to confirm ground conditions and foundation requirements.

If shallow coal mine workings and / or mine entries are encountered, these may need to be treated; additionally, foundations may need to be designed to accommodate risk posed by residual movement. The construction details of foundations potentially affected by coal mine entries (included treated mine entries) should be agreed in advance with the CA.

Floor Slabs

The floor slab design will be subject to proven ground conditions, development levels and required loading and settlement tolerances, and may vary from building to building. However, at this stage, the possibility for a requirement for suspended floor slabs, or for ground-bearing floor slabs following ground improvement works, should be anticipated.

Dependent on the findings of the recommended ground gas risk assessment, ground gas protection measures may be required to be incorporated into the ground floor construction.

External Works

The existing made ground may be unsuitable for support for settlement-sensitive pavements in its current condition, without specific mitigation measures.

It is therefore recommended that intrusive site investigation is undertaken in order to determine ground conditions for the purposes of identifying whether ground improvement is required in this respect, and if so, which techniques may be suitable.

The construction details of external works (e.g., paved surfaces, services, etc., potentially affected by coal mine entries (included treated mine entries) should be agreed in advance with the CA.

7.5. Contamination

Risk Evaluation for the Proposed Land Use (Industrial)

The preliminary conceptual site model indicates that pollutant linkages are possible to a variety of receptors. Potential heavy metals, inorganic compounds, organic compounds (e.g., PAHs and petroleum hydrocarbons) and asbestos may pose potential risks to human health (construction

workers and site end-users), controlled waters (the SWLCMF Secondary A Aquifer below the site and surface water courses running through the site) and construction materials (including concrete foundations). Risks related to these potential linkages are currently considered **moderate**.

A Phase II (intrusive) geoenvironmental / contamination investigation should be undertaken to confirm the presence or otherwise of contaminants sources and quantify the risks to identified receptors.

7.6. Hazardous Ground Gases

The site is possibly underlain by abandoned shallow coal and ironstone mine workings. These could act as a source of hazardous ground gases, e.g., methane and carbon dioxide. Furthermore, there is potential for unrecorded mine entries and other pathways for ground gas migration to the surface, e.g., crownholes and rock discontinuities. The site is underlain by deep made ground, which may act as a source of hazardous ground gases. At this stage, the risks to the identified receptors from hazardous ground gases are considered to be **moderate to high**.

A ground gas risk assessment should be undertaken to determine the risk of migration of ground gases to the surface, and whether gas protection measures are required in this respect.

The Envirocheck report states that '*no radon protective measures are required*'.

7.7. Invasive Plants

A Japanese Knotweed Mitigation Strategy has been produced for the site by FPCR Environment and Design Ltd, dated December 2020. This identifies that there are stands of Japanese knotweed in the central and western parts of the site, and gives a recommended mitigation strategy for development works.

8. FURTHER INVESTIGATION

The following ground investigation works are recommended to allow foundation design and determination of any potential contamination constraints and abnormal costs, in relation to the proposed development:

- Trial pitting to investigate near-surface soil, rock and groundwater conditions and to allow recovery of soil samples for chemical and geotechnical testing.
- Targeted trial trenching to expose the western edge highwall of the former opencast coal mine.
- Rotary probehole drilling to determine depth, thickness and condition of coal and ironstone seams and mine workings, both within and outwith the area of former opencast coal mining (this will require permission from the Coal Authority).
- Targeted investigation of the recorded mine entries that may remain below the proposed developed areas following opencast mining, using trial trenching and rotary probehole drilling (this will require permission from the Coal Authority).
- Cable percussion and window sampler boreholes, with standard penetration tests (SPTs) in order to provide geotechnical data and install ground gas / groundwater monitoring wells.
- If ground conditions revealed by the above are suitable, static cone penetration testing (CPT), in order to derive continuous geotechnical parameter profiles to assist in assessment of settlement and foundation design.
- Geotechnical and contamination testing at UKAS accredited testing laboratories to adequately characterise made ground, shallow soils, surface water and groundwater.
- A programme of ground gas monitoring visits should be undertaken, to allow a quantitative ground gas risk assessment to be produced for the site.
- Reporting.

Intrusive ground investigation works should be carried out by a suitably qualified geoenvironmental consultant.

Statutory utilities information should be procured, to identify the position of buried services within the site.

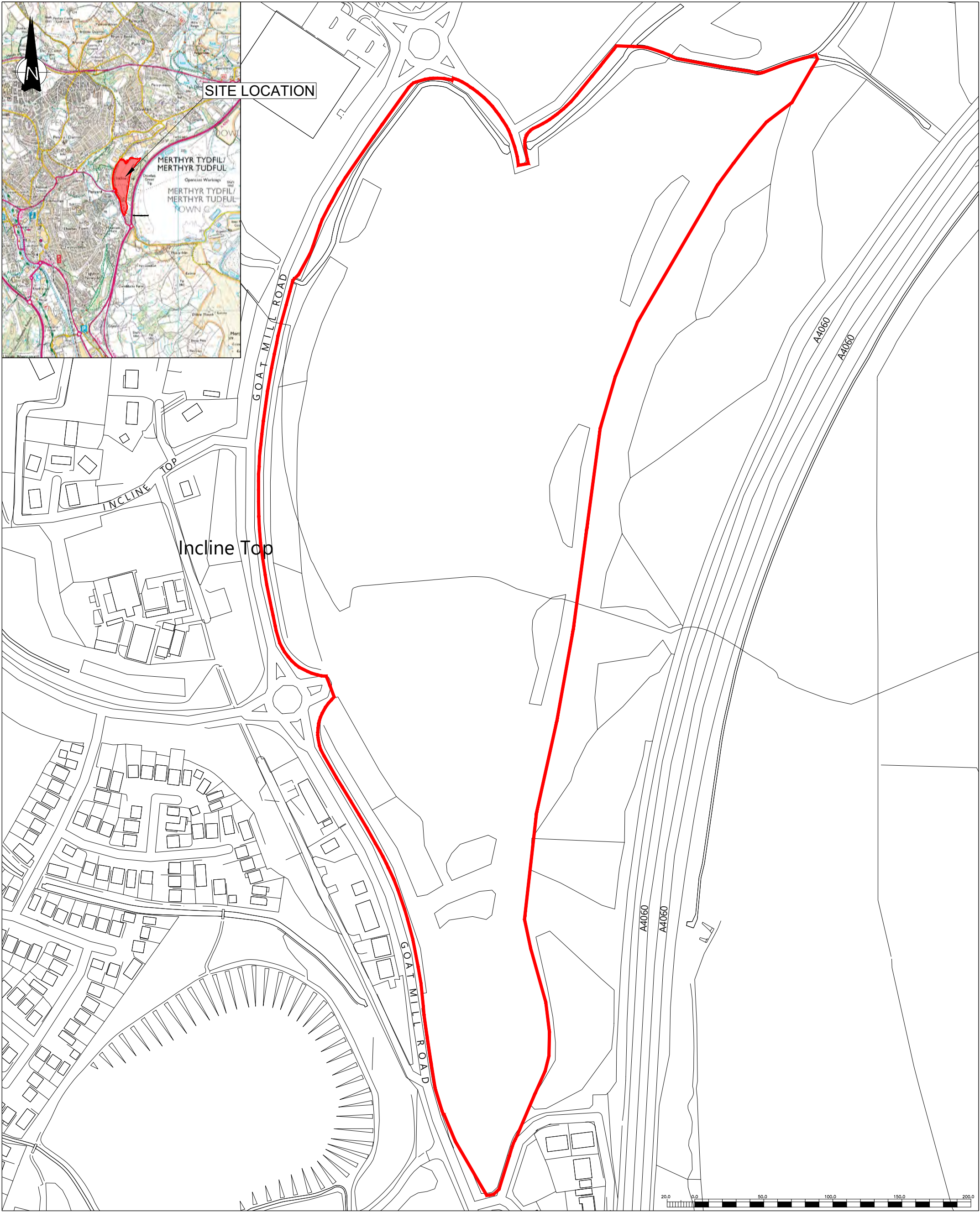
9. REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the findings of the Preliminary Appraisal. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and / or other organisations for their comment and approval prior to undertaking any works on site.



APPENDIX A

DRAWINGS



CLIENT

jayplas

Sirius Planning

4245 Park Approach, Thorpe Park, Leeds. LS15 8GB. 0113 264 9960

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JOB TITLE

GOAT MILL ROAD, MERTHYR

DRAWING TITLE

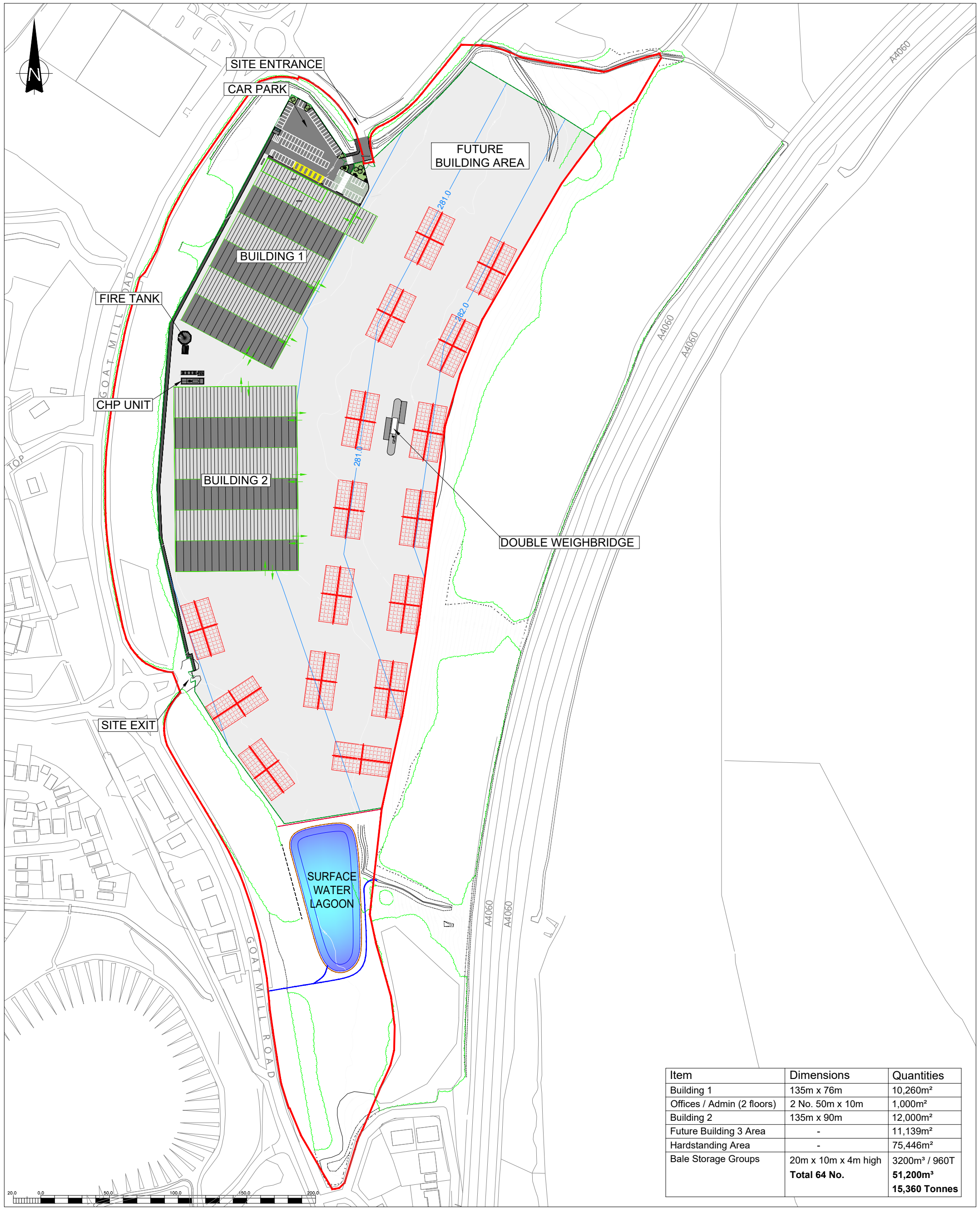
SITE LOCATION PLAN

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REV	DESCRIPTION	DATE	BY

DRAWN	DATE	APPROVED	DATE
S.T	27/11/2020	F.W	13/8/2021

SCALE	SHEET	DRAWING NUMBER	REVISION
1:2500/ 1:50000	A3L	JAY1001/04/01	0



Item	Dimensions	Quantities
Building 1	135m x 76m	10,260m ²
Offices / Admin (2 floors)	2 No. 50m x 10m	1,000m ²
Building 2	135m x 90m	12,000m ²
Future Building 3 Area	-	11,139m ²
Hardstanding Area	-	75,446m ²
Bale Storage Groups	20m x 10m x 4m high	3200m ³ / 960T
Total 64 No.		51,200m³ 15,360 Tonnes

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JOB TITLE

GOAT MILL ROAD, MERTHYR

DRAWING TITLE

SITE LAYOUT

KEY

PLANNING APPLICATION BOUNDARY

PROPOSED DEVELOPMENT PLATFORM CONTOURS

PROPOSED PALADIN SECURITY FENCE

PROPOSED TIMBER CLOSE BOARDED FENCE

PROPOSED TIMBER POST AND RAIL FENCE

PROPOSED FOOTPATH

PROPOSED BALE STORAGE

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REV	DESCRIPTION	DATE	BY
S.T	13/1/2022	D.B	25/2/2022

SCALE	SHEET	DRAWING NUMBER	REVISION
1:2500	A3P	JAY1001/04/06	0



Colour, Band, Volume				
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	-1.600	-1.400	0.2%	57
	-1.400	-1.200	0.4%	113
	-1.200	-1.000	0.8%	248
	-1.000	-0.800	3.4%	988
	-0.800	-0.600	10.7%	3151
	-0.600	-0.400	18.1%	5326
	-0.400	-0.200	28.1%	8293
	-0.200	0.000	38.2%	11260
	0.000	0.200	47.3%	5955
	0.200	0.400	31.9%	4007
	0.400	0.600	15.8%	1993
	0.600	0.800	4.7%	597
	0.800	1.000	0.2%	25



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JOB TITLE
GOAT MILL ROAD, MERTHYR

DRAWING TITLE
DEVELOPMENT PLATFORM
FORMATION ISOPACHYTES

KEY
— PLANNING APPLICATION BOUNDARY
— SURVEY CONTOURS
— PROPOSED FORMATION CONTOURS

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REV	DESCRIPTION	DATE	BY
DRAWN	DATE	APPROVED	DATE
S.T	13/1/2022	D.B	25/2/2022
SCALE	SHEET	DRAWING NUMBER	REVISION
1:2500	A3P	JAY1001/04/04	0



1. Photo showing culvert



2. Possible noise monitoring station



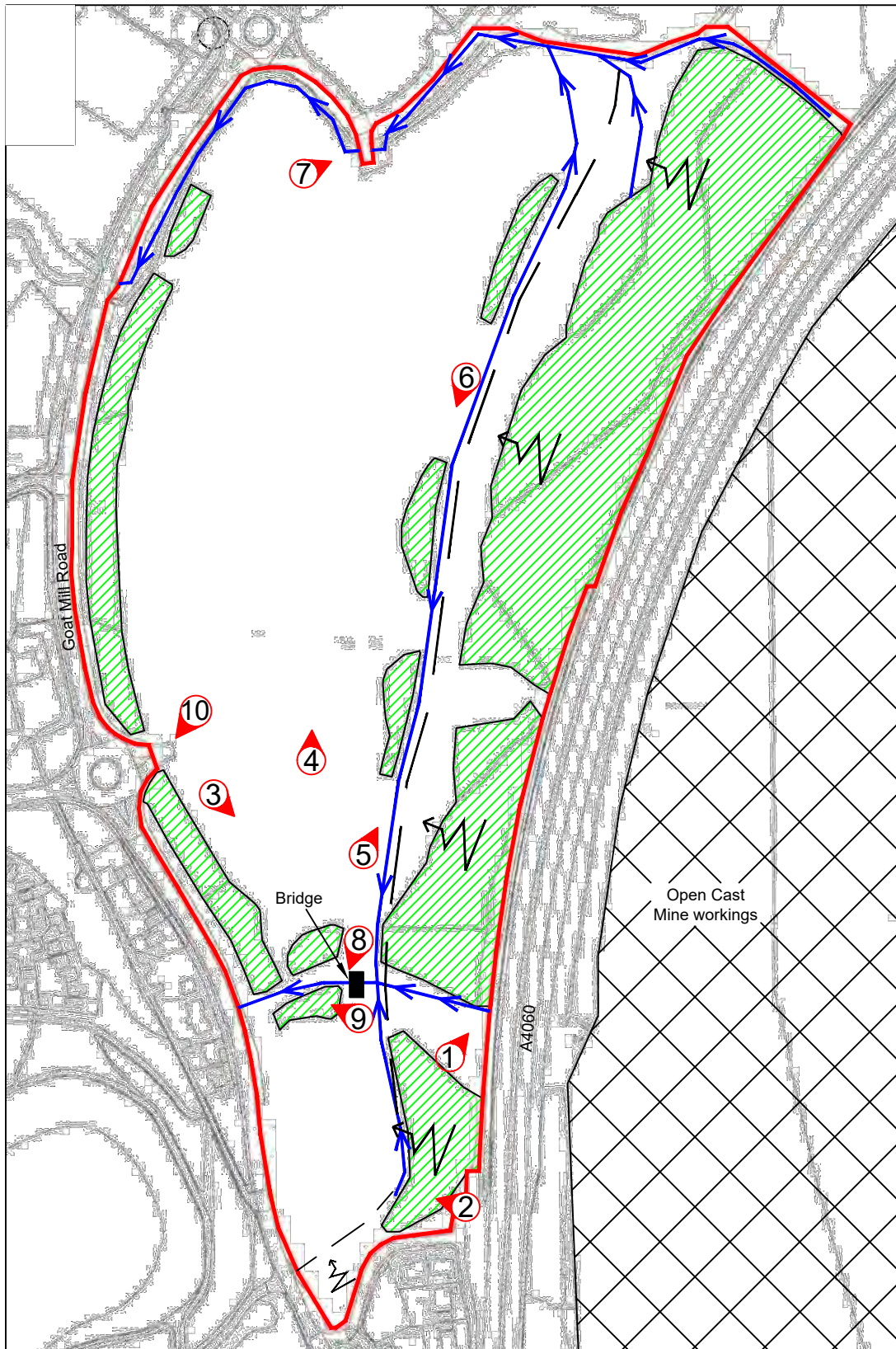
3. General photo



4. General photo



5. General photo



6. General photo



7. Photo of bridge



8. Photo of bridge



9. Photo showing watercourse



10. Photo showing site access

NOTES

- Survey Boundary
- Slope Direction
- Photo Location and Direction
- Base of Slope
- Woodland / Dense Vegetation
- Watercourse and Flow Direction

REVISION		BY	DATE
0	For Information	MF	28/02/20
A	>>	>>	>>
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>

SIRIUS
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4245 Park Approach,
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Leeds
LS15 8GB
www.thesiriusgroup.com
TEL: 0113 264 9960
FAX: 0113 264 9962



CLIENT

J&A Young (Leicester) Ltd

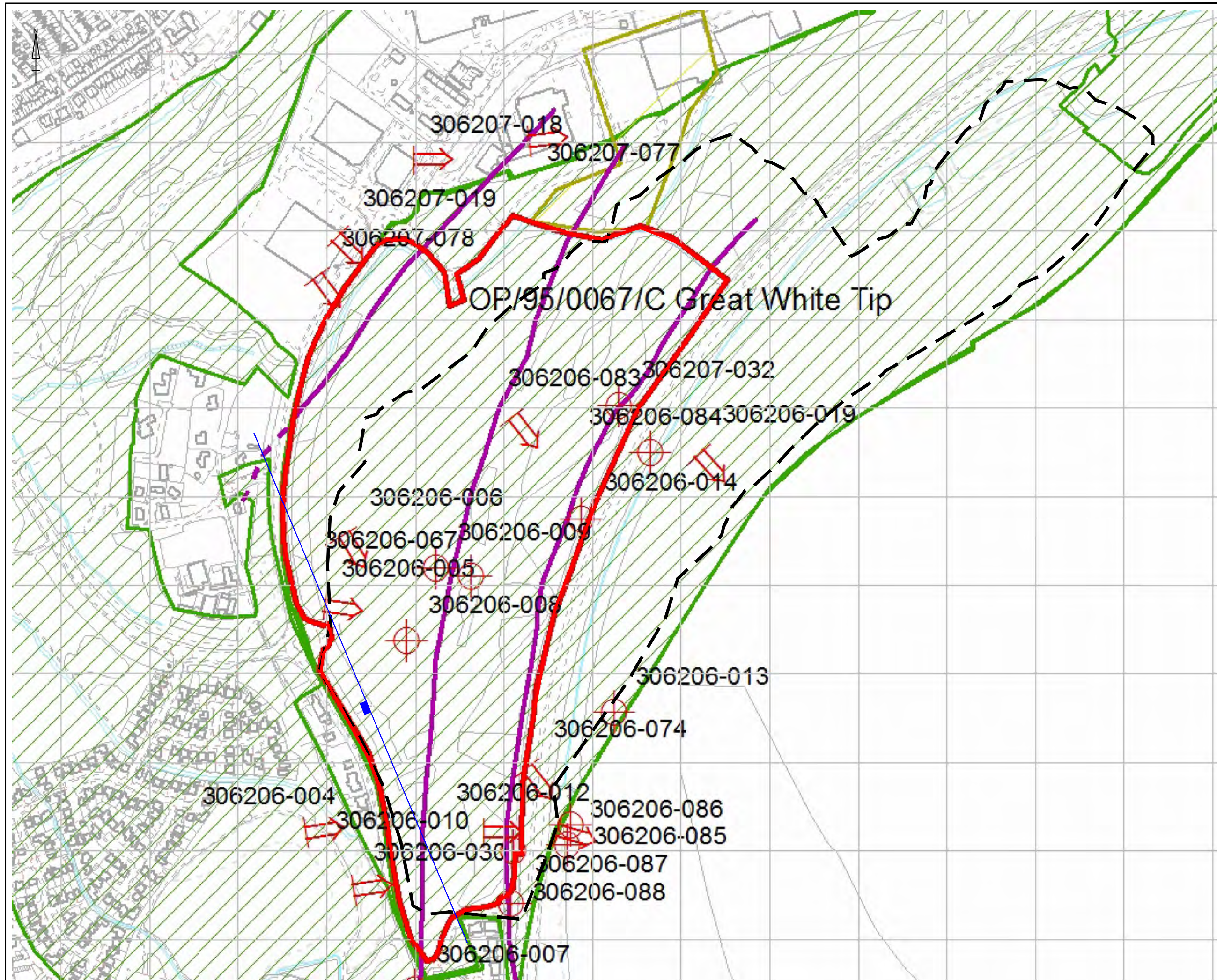
SITE

**Goat Mill Road,
Merthyr Tydfil**

DRAWING TITLE

Site Features Plan

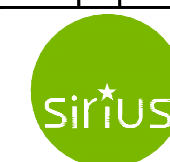
DRAWING NO. C8341/02		REVISION NO. 0	
DRAWN BY MF		APPROVED BY AW	
DATE February 2020	SCALE 1:4000		PAPER SIZE A3



- NOTES**
- Survey Boundary
 - Approximate Extent of Opencast Mining
 - Mine Shaft
 - Adit
 - Approximate Trace of Penydaren Fault Western Side Downthrown

REVISION		BY	DATE
0	For Information	MF	02/03/20
A	>>	>>	>>
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>

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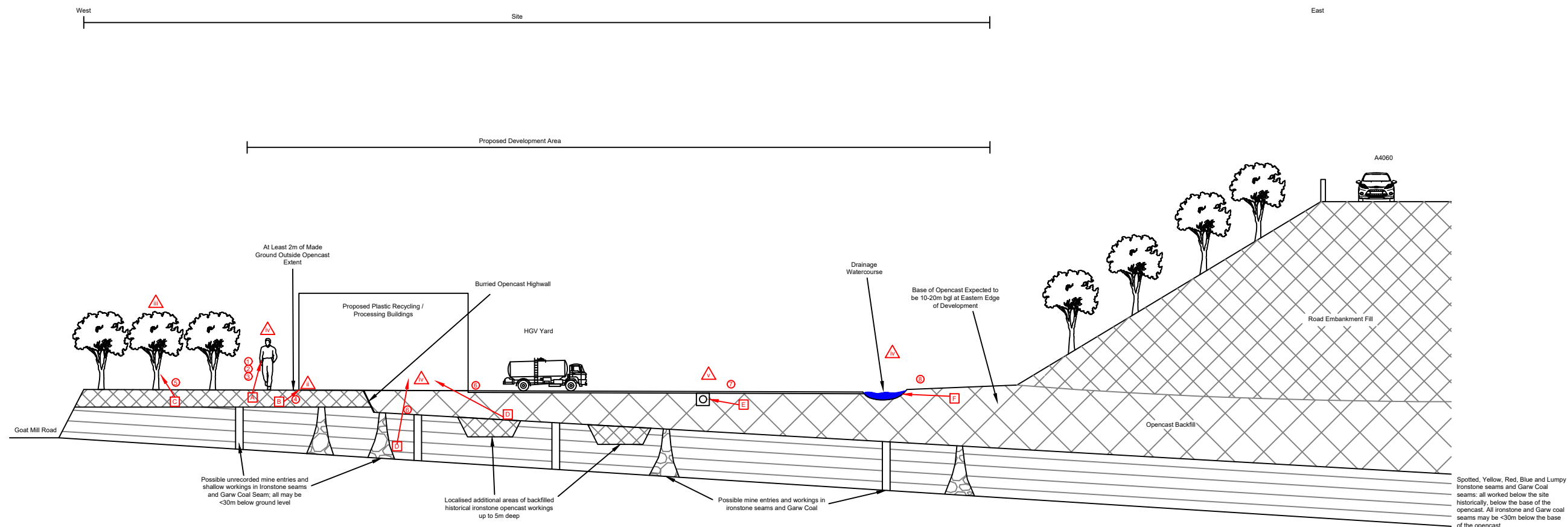


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SITE
**Land off Goat Mill Road,
Merthyr Tydfil**

DRAWING TITLE
**Historical Mining
Features Plan**

DRAWING NO. C8341/03	REVISION NO. 0	
DRAWN BY MF	APPROVED BY AMG	
DATE March 2020	SCALE 1:4000	PAPER SIZE A3



Contamination Source	Contamination Pathway	Potential Receptors	Risk of Significant Contaminant Linkage
A - Metals, metalloids, asbestos and organic contaminants (including PAHs and petroleum hydrocarbons) within made ground.	① Direct and indirect ingestion of soil	i - Construction workers / site end-users / adjacent land users	Moderate
	② Inhalation of contaminated particles and dust		Moderate
	③ Dermal contact		Moderate
B - Acids and sulphates within made ground, natural strata and groundwater.	④ Acid / sulphate attack	ii - Concrete substructures to proposed buildings	Moderate
C - Phytotoxic metals within made ground.	⑤ Plant uptake	iii - Landscaping within proposed development.	Moderate
D - Hazardous ground gases from on-site deep made ground and shallow mine workings	⑥ Gas migration / Inhalation / Explosion of methane	iv - Construction workers / end-users within buildings	Moderate to High
E - Combustible material within made ground.	⑦ Damage via combustion / smouldering.	v - Buried services within proposed development.	Moderate
F - Metals, metalloids, and organic contaminants (including PAHs and petroleum hydrocarbons) within made ground.	⑧ Migration of shallow perched groundwater / surface run-off.	vi - Surface water courses within the site.	Moderate

NOTES

REVISION		BY	DATE
0	For Information	MF	03/03/20
A	Development Site Extent Revised	AMG	25/08/21
B	>>	>>	>>
C	>>	>>	>>
D	>>	>>	>>

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FAX: 0113 264 9962



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(Leicester) Ltd

SITE

Land off Goat Mill Road,
Merthyr Tydfil

DRAWING TITLE

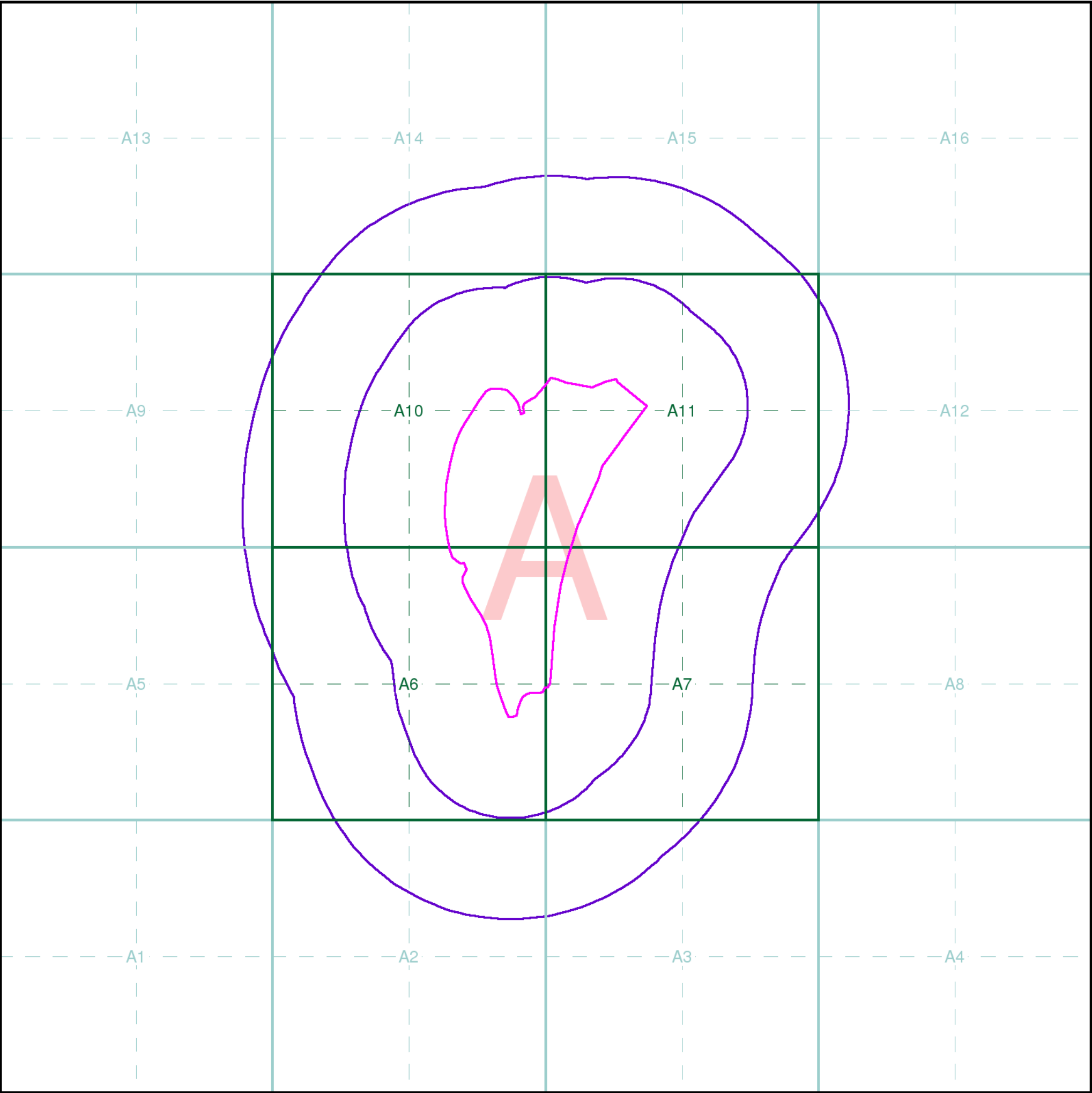
Preliminary Conceptual
Site Model

DRAWING NO. C8341/04		REVISION NO. A	
DRAWN BY MF		APPROVED BY AMG	
DATE March 2020	SCALE NTS	PAPER SIZE A3	



APPENDIX B

ENVIROCHECK REPORT



Index Map

For ease of identification, your site and buffer have been split into Slices, Segments and Quadrants. These are illustrated on the Index Map opposite and explained further below.

Slice

Each slice represents a 1:10,000 plot area (2.7km x 2.7km) for your site and buffer. A large site and buffer may be made up of several slices (represented by a red outline), that are referenced by letters of the alphabet, starting from the bottom left corner of the slice "grid". This grid does not relate to National Grid lines but is designed to give best fit over the site and buffer.

Segment

A segment represents a 1:2,500 plot area. Segments that have plot files associated with them are shown in dark green, others in light blue. These are numbered from the bottom left hand corner within each slice.

Quadrant

A quadrant is a quarter of a segment. These are labelled as NW, NE, SW, SE and are referenced in the datasheet to allow features to be quickly located on plots. Therefore a feature that has a quadrant reference of A7NW will be in Slice A, Segment 7 and the NW Quadrant.

A selection of organisations who provide data within this report:



Envirocheck reports are compiled from 136 different sources of data.

Client Details

S Howson, Sirius Geotechnical Ltd, 4245 Park Approach, Thorpe Park, Leeds, LS15 8GB

Order Details

Order Number: 233970729_1_1
Customer Ref: 19839/C8341/AMG
National Grid Reference: 306250, 206880
Site Area (Ha): 21.81
Search Buffer (m): 500

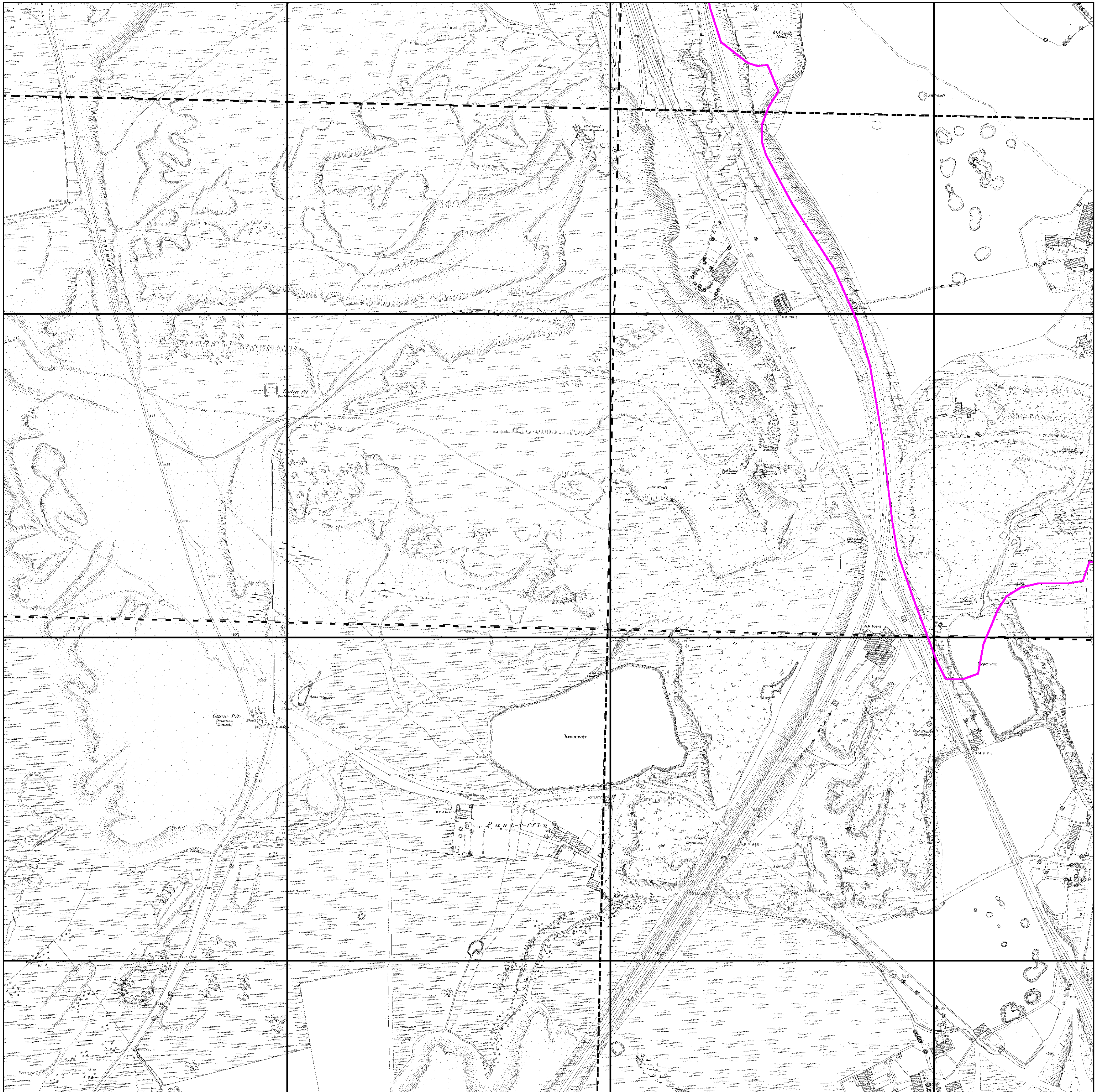
Site Details

Goat Mill Road, Merthyr Tydfil, CF48 3TD

Full Terms and Conditions can be found on the following link:
<http://www.landmarkinfo.co.uk/Terms/Show/515>



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Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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Glamorganshire

Published 1875

Source map scale - 1:528

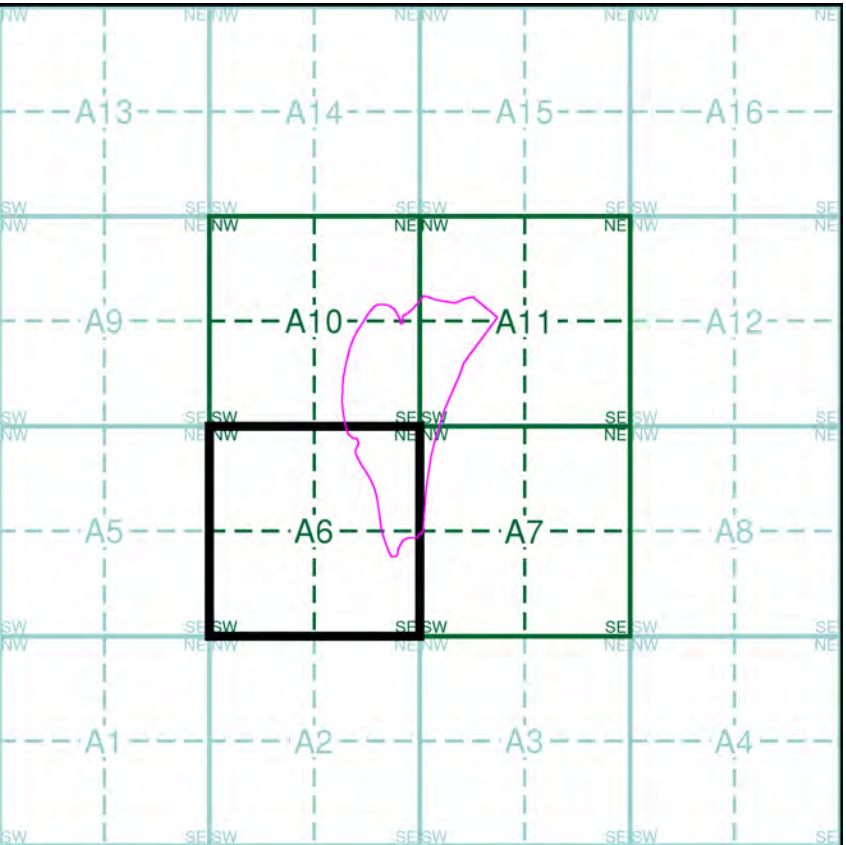
The 1:528 scale Ordnance Survey mapping was adopted in 1850 as an alternative to the 1:1056 scale, that had been deemed to be inadequate for sanitary planning, which had come very much to the fore following the passing of the Public Health Act of 1948. Around 29 towns in England and Wales were surveyed at this scale, the bulk of which were undertaken between 1850 and 1855. These were predominantly towns that were outside the areas being surveyed at 1:10,560 or 1:2500 scale. As well as showing the details characteristic of the later 1:500 plans, they show features of sanitary interest such as privies, taps, cow houses, cess pits, brew and bake houses and cart sheds and stables.

Please note: Due to the partial coverage of Historical Town Plans, it is possible that not all segments within an order will contain mapping. Only the segments that have Town Plan coverage will be generated.

Map Name(s) and Date(s)

012_01_015	012_02_011
1875	1875
1:528	1:528
012_01_020	012_02_016
1875	1875
1:528	1:528
012_01_025	012_02_021
1875	1875
1:528	1:528

Historical Town Plan - Segment A6



Order Details

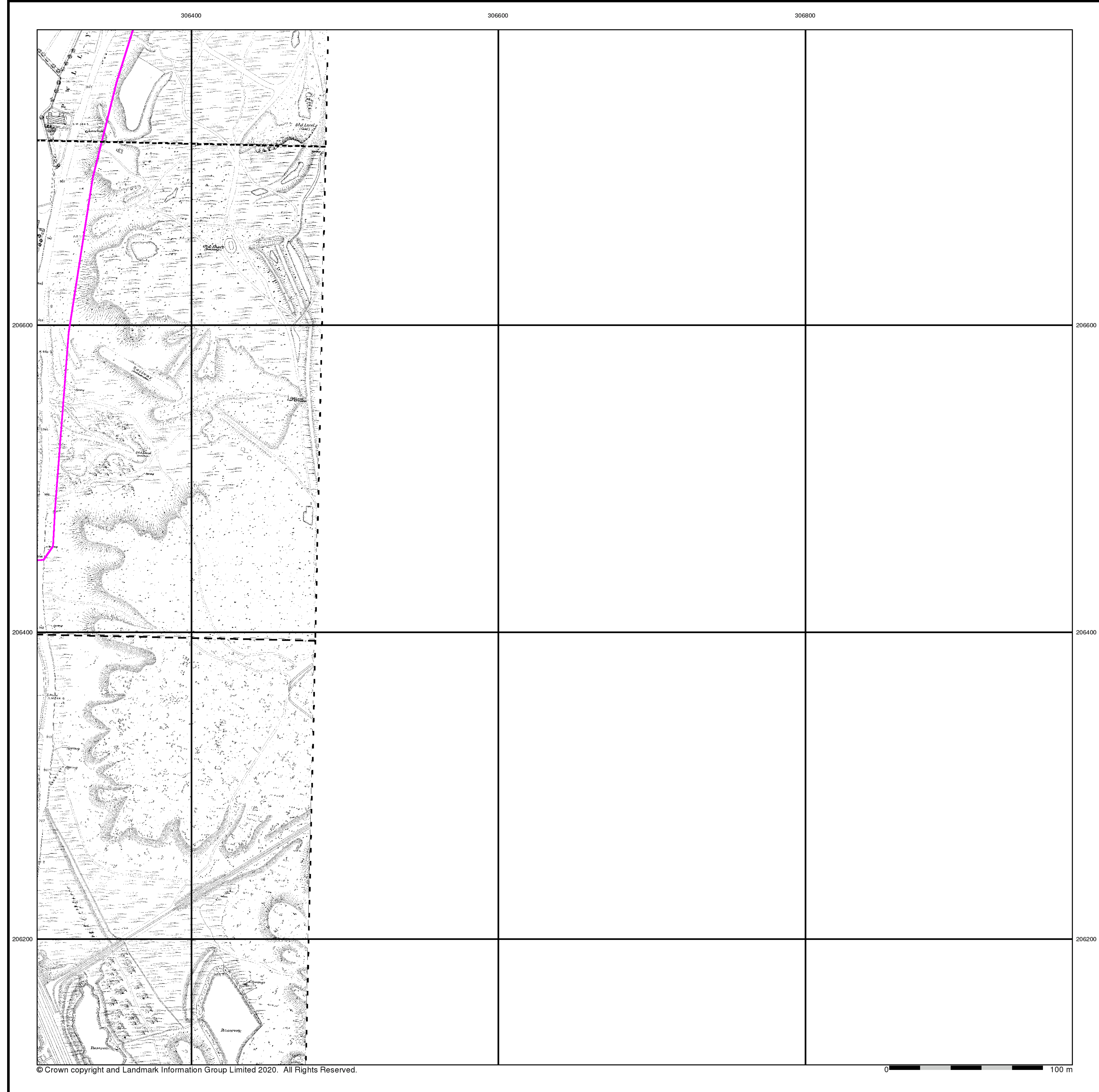
Order Number:	233970729_1_1
Customer Ref:	19839/C8341/AMG
National Grid Reference:	306270, 206850
Slice:	A
Site Area (Ha):	21.81
Search Buffer (m):	0

Site Details

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Glamorganshire

Published 1875

Source map scale - 1:528

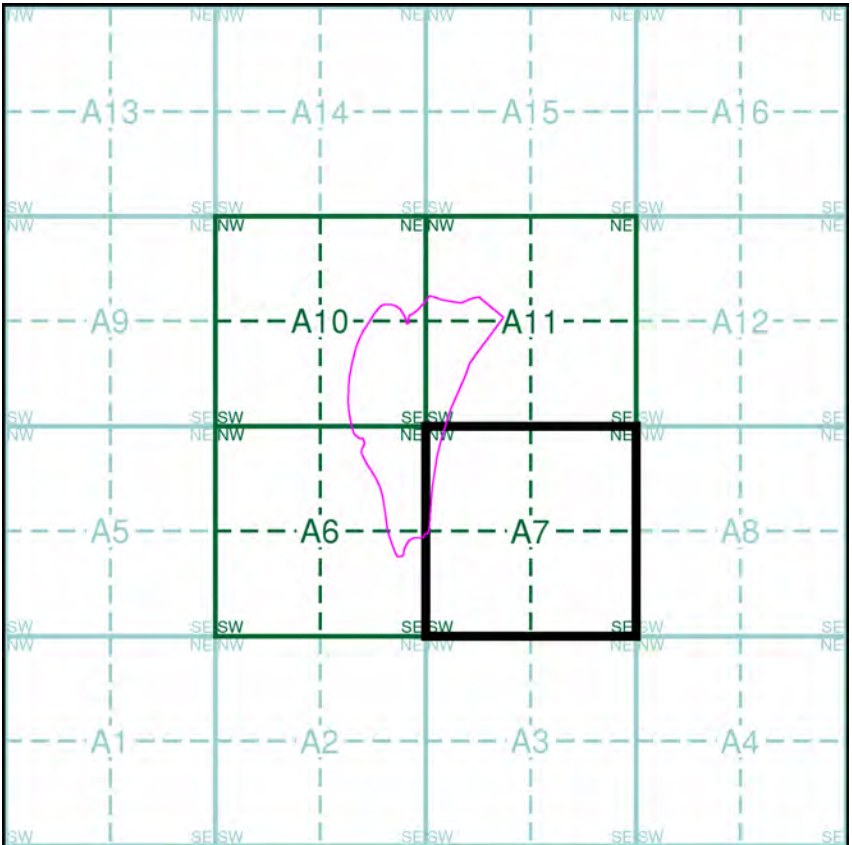
The 1:528 scale Ordnance Survey mapping was adopted in 1850 as an alternative to the 1:1056 scale, that had been deemed to be inadequate for sanitary planning, which had come very much to the fore following the passing of the Public Health Act of 1948. Around 29 towns in England and Wales were surveyed at this scale, the bulk of which were undertaken between 1850 and 1855. These were predominantly towns that were outside the areas being surveyed at 1:10,560 or 1:2500 scale. As well as showing the details characteristic of the later 1:500 plans, they show features of sanitary interest such as privies, taps, cow houses, cess pits, brew and bake houses and cart sheds and stables.

Please note: Due to the partial coverage of Historical Town Plans, it is possible that not all segments within an order will contain mapping. Only the segments that have Town Plan coverage will be generated.

Map Name(s) and Date(s)

012_02_011	1875	1:528
012_02_016	1875	1:528
012_02_021	1875	1:528

Historical Town Plan - Segment A7



Order Details

Order Number:	233970729_1_1
Customer Ref:	19839/C8341/AMG
National Grid Reference:	306270, 206850
Slice:	A
Site Area (Ha):	21.81
Search Buffer (m):	0

Site Details

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Glamorganshire

Published 1875

Source map scale - 1:528

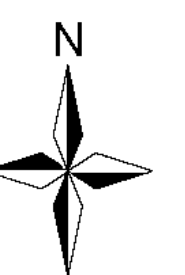
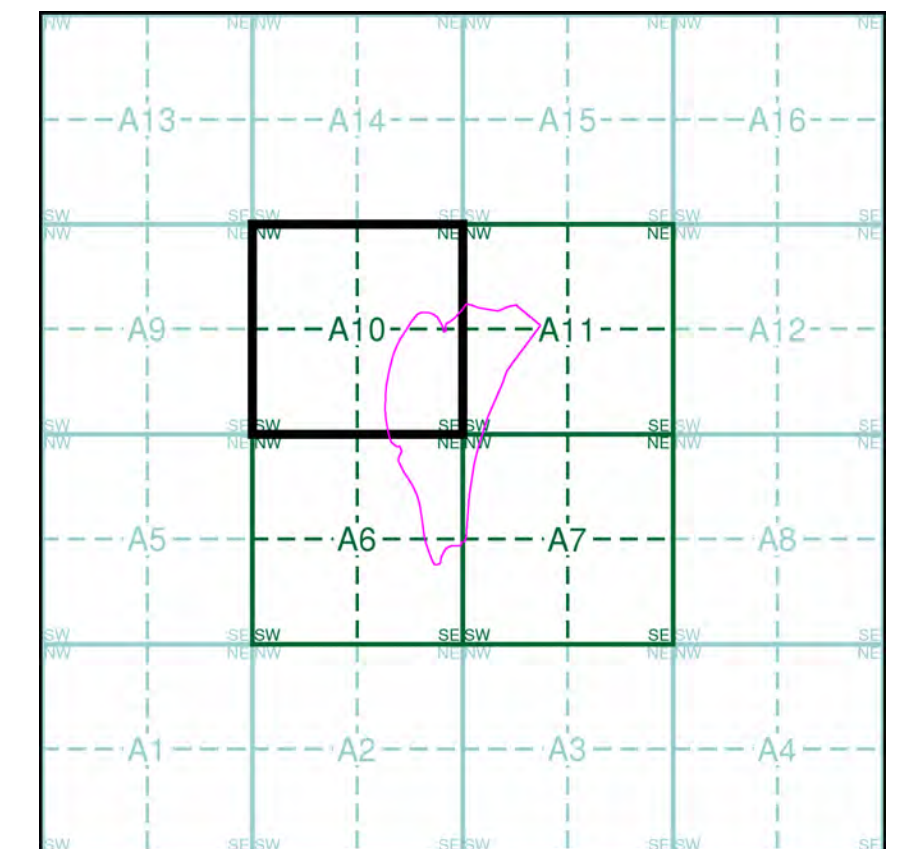
The 1:528 scale Ordnance Survey mapping was adopted in 1850 as an alternative to the 1:1056 scale, that had been deemed to be inadequate for sanitary planning, which had come very much to the fore following the passing of the Public Health Act of 1948. Around 29 towns in England and Wales were surveyed at this scale, the bulk of which were undertaken between 1850 and 1855. These were predominantly towns that were outside the areas being surveyed at 1:10,560 or 1:2500 scale. As well as showing the details characteristic of the later 1:500 plans, they show features of sanitary interest such as privies, taps, cow houses, cess pits, brew and bake houses and cart sheds and stables.

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Map Name(s) and Date(s)

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1875	1875
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1875	1875
1:528	1:528

Historical Town Plan - Segment A10



Order Details

Order Number: 233970729_1_1
Customer Ref: 19839/C8341/AMG
National Grid Reference: 306270, 206850
Slice: A
Site Area (Ha): 21.81
Search Buffer (m): 0

Site Details

Goat Mill Road, Merthyr Tydfil, CF48 3TD

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