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**BY POST AND BY E-MAIL**

Dear Gareth,

## FORMER GENE METALS SITE, TREFOREST PRELIMINARY GEOTECHNICAL AND GEO-ENVIRONMENTAL ASSESSMENT

Further to your recent discussions with Matthew Eynon, and your verbal instruction to proceed, we are pleased to present our findings of our preliminary assessment on the above site.

### 1.0 Background

We understand that you are considering the development of the site as residential properties for a local Housing Association, and that 34 no one and two storey dwellings with a new access road and private gardens are proposed. The proposed layout is presented as Figure 1.

We understand that outline planning has been granted for the site but a condition has been included with regards to contamination at the site. We have not yet had sight of this condition.

### 2.0 Scope of Works

You require a preliminary assessment of the ground conditions with regards to constraints to the proposed development in a short timescale. In order to provide a preliminary assessment, we have undertaken an accelerated desk study review of local geological maps, a Coal Authority mining report, historical Ordnance Survey maps, an environmental data report, and information readily available on websites. We have also excavated a number of trial pits across the site to provide initial information on the shallow soil conditions.

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### 3.0 Limitations

ESP consider that it is important that the reader appreciates the limitations of this assessment. It should be appreciated that the report has been accelerated and uses information on the likely ground conditions which could be obtained in the available time.

Further information is likely to be available, which has not been procured in the available timeframe. In particular, although trial pitting has been undertaken across the site and samples of the shallow soils collected, no laboratory testing has yet been undertaken.

On this basis, this assessment should be considered preliminary only. Should development proceed, as a minimum, further intrusive investigation including laboratory testing of shallow soils and an assessment of risks from contaminants to future site users and controlled waters would be required.

### 4.0 Site Description

The site is located on the western side of the village of Treforest, just to the south of Pontypridd in the County Borough of Rhondda Cynon Taff. The National Grid Reference of the centre of the site is 307850 189030. A Site Plan, showing the salient features, is presented as Figure 2, and plates showing salient site features are attached.

It comprises an irregular shaped parcel of land some 140m in length (east-west) and between 30 and 70m in width (north-south), and occupying an area of some 0.7ha. It is bounded by:

- To the north and west: open agricultural land, partly overgrown with some ruins of masonry walls and scrap vehicles to the west;
- To the north-east: a steep, heavily vegetated slope up to a football pitch on an elevated plateau;
- To the east: a small enclosure with structures used to keep pigeons, followed by the ground of Treforest Football Club, at a lower level to the site; and
- To the south/south-east: residential properties at a considerably lower level within a former quarry, on Birchley Close.

The site lies on the upper, east-facing slopes of the valley of the River Taff, and has until recently been used as the premises of Gene Metals (a metal recycling company). Recent (and historical) maps indicate the site was formerly a scrap yard. The site is now derelict, and comprises three basic zones as shown on Figure 2:

- **Zone A:** a lower area in the east of the site, indicated by a topographic survey provided by the Client to be at between 98 and 99m OD and comprising a plateau partly used for the storage of skips. A large, now derelict, steel sheet clad former industrial building (Building A) is located in this area, with smaller buildings to the south-west (believed to be outside the site boundary). Building A contains an open vehicle inspection pit.
- **Zone B:** a central plateau area is currently undeveloped apart from a now derelict, large steel clad industrial building in the north-east (Building B), and forms a plateau at between 101 and 102m OD.
- **Zone C:** the western area is more elevated than the remainder of the site and forms a flat plateau area in the south, with slopes up to the land to the north. The plateau is at an elevation of around 105m OD with the slopes to the north up to around 109m OD.

The overgrown banks between Zones B and C and between Zones A and B (to the rear, west) of the Building in Zone A) are both between 1 and 2m in height. A retaining wall of 2 to 2.5m height separates Zones A and B in the north-east of the site (adjacent to the building in Zone B – Plate 3). A further lower retaining wall is present in the south of Zone A. The southern boundary apparently lies on the back wall of a former quarry (see Section 5.1), and comprises an apparently sub-vertical face, which is partly overgrown.

The site surface is predominantly loose gravel with fragments of metal and other debris evident, and some concrete slabs which comprise old external hardstandings, but also apparent former building floor slabs. A now backfilled, former weighbridge is located to the south-east of Building B. The site is predominantly overgrown with grass and scrub vegetation, and stockpiles of vegetation are also present.

The site is presently accessed via a narrow track which runs between the Treforest FC ground to the south and a steep, overgrown slope to the north. We understand that this access would need to be widened towards the north for development – see Section 8.2.

A stream is present in the west of Zone C (Figure 2 and Plate 11). It appears to flow into the site from the north, collecting in a pool, before being culverted beneath the majority of the width of the site in this area. This culvert empties into a further pool on the southern boundary where the stream enters a further culvert carrying it further downhill to the south-east.

Ochre coloured staining in the base of the pools suggests some contamination of the water by acid mine drainage (from abandoned coal workings), however the water flowing from the culverts did not appear discoloured at this time. Further standing water in the west of the site may indicate the presence of a spring in this area – some of this water flows into the pool in the north of Area C.

## **5.0 Findings of Desk Study**

### **5.1 Historical Map Review**

Historical Ordnance Survey maps obtained as part of this assessment are included as Enclosure A of this report.

The First Edition of the County Series maps, dating from 1874/1875 indicate the site to comprise an open, undeveloped hillside above the Fforest Iron and Steel Works, immediately to the east (beneath the current football ground and houses to the south). A stream is shown to flow north to south down the hillside in the west of the site (apparently now culverted beneath this). A track is shown to cross the site.

The Second Edition dating from 1898/1900 shows the site to be similar but with woodland over Area C. The iron and steel works to the east had expanded considerably with many railway sidings and areas of tipped waste materials to the north-east, i.e. to the north of the access road.

By the Third Edition of 1915/1919, the iron and steel works and railway sidings had been dismantled, although areas of obvious filling remain. A quarry is shown to the south of the site, with the back face along the southern site boundary. The site itself remains unchanged. No significant changes are shown on the edition of 1948.

The first development on the site is shown on the map of 1959. It had been divided into a number of enclosures with buildings in the eastern area (Zones A and B). The stream remained in the west of the site. By this time the quarry to the south had become disused, and the land to the east had been developed as a football ground.

The edition of 1989 indicates the site to be a scrap yard and the layout to be similar to the present day. The large buildings in Zones A and B are shown, along with further buildings in the north-east of Zone A (now evident only by their remnant floor slabs). A 'tip' is shown within the quarry to the south, the football ground appears to be similar to the present day, and the filled ground to the north-east had been levelled to construct a second football pitch. By 1991, the housing development within the quarry was encroaching towards the back wall (and the site boundary), however, an area of tipping is indicated apparently within the quarry immediately to the south-east of the site.

## **5.2 Geological Setting**

The published geological map for the area indicates the site to be underlain by glacial soils over bedrock of the Brithdir Beds of the Coal Measures. It lies just to the north-east of the Llanwonno Fault.

Recent up-to-date mapping published in the website of the British Geological Survey (BGS, May 2015) indicates no superficial deposits over bedrock of the Brithdir Sandstone of the Coal Measures.

Reference to the BGS website indicates no available borehole records for the immediate vicinity of the site. However, records for boreholes in a similar geological setting to the south of the site suggest a grey/brown, gravelly clay to be present above the Coal Measures bedrock. This is likely to be glacial in origin and, based on our local knowledge, is also likely to be present beneath the site.

## **5.3 Mining Setting**

The site is underlain by Coal Measures bedrock. Reference to the website of the Coal Authority (May, 2015) indicates that it is not located within a 'High Risk Development Area', nor is it located within an area of known past or probable past shallow underground coal workings. Nonetheless, a mining report has been obtained from the Coal Authority and is presented in Enclosure B of this report.

The mining report indicates that, based on the records held by the Coal Authority:

- The property is not within the zone of likely physical influence on the surface from past underground workings;
- There are no known mine entries within, or within 20m of, the boundary of the property;
- The Authority has not received any damage notice or claim for the property or any property within 50m.

Based on the available information, we consider that the mining subsidence risk at the site is low. However unrecorded mine entries may be present and should form part of a more detailed review.

## **5.4 Hydrogeological Setting**

Reference to the website of the Environment Agency (May, 2015) indicates the Coal Measures bedrock beneath the site to be classified as a Secondary A aquifer, with the groundwater vulnerability classed as 'minor aquifer high'.

## **5.5 Environmental Setting**

An environmental data report for the site has been obtained from the Groundsure Group and is presented as Enclosure C of this report.

This confirms the past industrial use of the vicinity of the site, including the former scrap yard on-site, the iron and steel works to the south, the tipping and railway standings to the north-east, and the tipping within the quarry to the south-east. A sign above the entrance of Building A indicates that Gene Metals was operated under waste management license no SY/03/94 issued by Taff Ely Borough Council.

## 6.0 Findings of Intrusive Investigation

### 6.1 Site Works

Fifteen trial pits were excavated across the site on 20<sup>th</sup> May 2015 using a wheeled backacting excavator (JCB 3CX). The trial pit locations are presented on Figure 3, and the records presented in Enclosure D.

### 6.2 Identified Ground Conditions

The following ground conditions were identified in each of the three zones across the site:

#### Zone A (TP6, TP7, TP8, TP13, TP14 and TP15):

- **Made Ground:** encountered in all pits to depths of between 0.3 and 1.3m as predominantly a gravelly sand of brown and black colour, with some cobbles and fragments of brick, glass, pipe, timber, glass, metal and tile. Apparent PFA (sand sized particles of pulverised fuel ash from coal fired power stations) was encountered between 0.2 and 1.3m in TP6 and 0.3 and 1.0m depth in TP13, and significant quantities of slag were observed in TP14. Hydrocarbon odours were evident in the Made Ground in TP15.
- **Glacial Till:** encountered beneath the Made Ground generally as a light brown, gravelly sand, with a light brown, clayey, gravelly silt of soft consistency identified between 0.9 and 1.3m depth in TP7.
- **Coal Measures bedrock:** encountered at the base of all pits from depths of 1.4 and 1.9m as a medium grained sandstone which could not be excavated.

#### Zone B (TP1, TP3, TP5, TP9 and TP12):

- **Made Ground:** encountered in all pits to depths of between 0.7 and 1.9m as predominantly a gravelly sand of brown and black colour, with some cobbles and fragments of brick, glass, pipe, timber, glass, metal and tile. PFA was identified to 1.9m in TP5 and to 1.6m in TP9. The PFA and much of the Made ground in Zone B contained old car parts, including parts of suspensions and tyres. Hydrocarbon odours were observed in all pits apart from TP5 (alongside Building B).
- **Glacial Till:** encountered beneath the Made Ground as light brown, gravelly clay or silt of soft consistency, and brown/grey gravel and sand with some cobbles.
- **Coal Measures bedrock:** encountered at the base of all pits apart from TP12 from depths of between 1.1 and 2.2m as a medium grained sandstone which could not be excavated.

#### Zone C (TP2, TP4, TP10 and TP11):

- **Made Ground:** encountered in all pits to depths of between 0.1 and 1.3m as predominantly a gravelly sand of brown and black colour, with some cobbles and fragments of brick, glass, pipe, timber and metal. Hydrocarbon odours were observed in TP10 and TP11 on the southern plateau area.
- **Glacial Till:** encountered beneath the Made Ground as up to 1m of light brown, gravelly clay or silt of soft consistency in TP10 and TP11, and as brown/grey gravel and sand with some cobbles in TP2 and TP4.
- **Coal Measures bedrock:** encountered at the base of all pits from depths of between 0.5 and 2.0m as a medium grained sandstone which could not be excavated.

Overall, the Made Ground soils appeared to predominantly be materials probably used to raise lower lying site levels (e.g. the PFA in TP6 and TP13 in Zone A), as backfill behind retaining walls (e.g. the PFA in TP5 alongside Building B), or tipped materials containing substantial quantities of probable remnant scrapyards materials such as car parts, scrap metal, glass, tile, timber and brick. Buried car parts were particularly evident in Zone B. Slag gravel was identified in TP14 adjacent to the site entrance.

Sandstone bedrock was evident beneath all three zones, from depths of 1.5 to 2.0m in the south-east (Zone A) immediately above the back wall of the quarry to 0.5m in the north of Zone C.

### **6.3 Identified Groundwater**

Generally no groundwater was encountered in the trial pits across the site.

A shallow groundwater strike was recorded in TP4 on the northern boundary alongside Building B, and at 2.2m depth in TP5, on the eastern side of Building B. These may represent perched water bodies, although given they are located in the same area they may represent a localised source of water (e.g. a spring).

### **6.4 Site Evidence of Contamination**

Made Ground was identified across the site, containing fragments of probable former scrapyards materials, particularly across Zone B. Man-made materials, such as metal, concrete and brick, were also evident in the site surface across much of the site.

Strong odours of petroleum hydrocarbons were identified in several pits (TP1, TP3, TP9, TP12, TP15, TP10 and TP11). All but TP5 (excavated in PFA) in Zone B indicated hydrocarbon odours.

We consider that it should be assumed that similar Made Ground is likely to be present across the three zones. However, in our experience of old scrapyards sites, pockets of other, so far unidentified contamination are likely to be present.

## **7.0 Preliminary Assessment of Soil Contamination**

### **7.1 Introduction**

The following section is based on the findings of the desk study and trial pitting. As discussed in Section 3.0, no laboratory testing has been undertaken to date. Further sampling and testing would be required to allow a full assessment to be made of risks to human health and controlled waters and disposal options prior to development.

### **7.2 Potential Contamination Sources**

The Made Ground present across in all three zones is considered to probably be the main source of contamination at the site. As discussed above, it contained fragments of remnant scrapyards materials and also emitted strong odours of petroleum hydrocarbons.

### **7.3 Risks to Human Health**

Although no laboratory analysis of the Made Ground materials has been undertaken to date, based on our experience of similar waste scrapyards materials, we consider that they are likely to contain elevated levels of contaminants such as metals and polyaromatic and petroleum hydrocarbons. Localised pockets of contamination should also be anticipated, for example, soils of low pH where old vehicles batteries were stored and the battery acid allowed to seep into the ground, and PCB contaminated soils where old transformers were recycled.

We recommend that at this stage, the levels of contamination within the Made Ground across the site are assumed to be sufficiently elevated to pose a potential risk to the health of site users, and remedial actions would be required. Given the current changes in elevation on the site and the proposed regarding of site levels to create a development platform, the thickness of Made Ground present within each garden or open space area could change from the present situation, e.g. the northern block of dwellings is likely to require lowering of site levels in Zone B, and part of Zone C, which may result in the removal of all Made Ground (i.e. the removal of the main anticipated contamination source). We have not had the time to assess individual plots so the following comments should be taken as generalised only.

Technically the simplest solution would be to remove the Made Ground soils from all areas of gardens and public open space, however, this could be expensive. If the levels of contaminants and finished ground levels allow, a clean cover layer of at least 600mm may be suitable for mitigating the risks from non-volatile contaminants where Made Ground remains, subject to detailed review and investigation.

At our site meeting yesterday, the possibility of encapsulating the Made Ground beneath a hard surface (e.g. patio slabs) in garden areas was raised. From a technical viewpoint, encapsulation of contaminated soils beneath such a hard surface would be a feasible option to mitigate risks from non-volatile contaminants (e.g. metals and PAH compounds), however, the hard surfacing would need to be of an agreed thickness and permanent, and the Local Authority and warranty providers are likely to require a guarantee that it cannot be removed in the future by residents. For this reason, this approach is not normally a feasible option for private dwellings, however, given these properties will be managed by a housing association, regulators may agree to this option provided that a clause is inserted into the tenancy agreement prohibiting the removal of the hard surfacing and regular checks are made.

Further assessment of the risks to human health and mitigation options would require further intrusive investigation including analysis of soil samples for a range of contaminants including metals, pH value, cyanide, polyaromatic and petroleum hydrocarbons, chlorinated solvents and PCBs. This should not be restricted to the Made Ground but also to the underlying glacial soils where they are to be present at shallow depth beneath the finished ground levels.

### **7.3 Risks to Controlled Waters**

The bedrock beneath the site is potentially sensitive to contamination as it is classified as a Secondary A aquifer. The investigation has also identified that it lies generally within 2m of the site surface. Therefore, we consider that groundwater within the bedrock is likely to be potentially vulnerable to any leachable contamination present within the Made Ground, particularly as there is only a limited thickness of natural soil which would have the capacity to attenuate any contamination movement.

As discussed in Section 4.0, a stream flows across the western part of Zone C, predominantly in a culvert. Visual observations suggest that the stream water has been impacted by acid mine waters, and it is possible that contaminants in the near-surface Made Ground in Zone C may also be impacting on the quality of the stream water. In the south-east of the site, two old skips and an old 55 gallon steel container are present - these should be removed.

We recommend that prior to development an assessment of the risk from leachable contaminants within the Made Ground to controlled ground and surface waters be undertaken.

### **7.4 Disposal of Arisings**

Although no laboratory testing has been undertaken to date, given our visual observations and the identified hydrocarbon odours, we consider that the Made Ground across the site is likely to be classed as hazardous waste and would need to be disposed of at appropriate licensed facilities.

Alternatively, the soils may be removed to a soil treatment centre where it may be feasible to treat them and make them suitable for re-use on other sites. However, the suitability of the soils for this approach would depend on the levels of contaminants therein, which is presently unknown.

## **8.0 Preliminary Assessment of Geotechnical Conditions**

### **8.1 Site Stability**

Reference to available geological information has not identified any evidence of recorded landslips in the vicinity of the site.

The site lies immediately above a former quarry, with the back wall of the quarry forming the south-eastern boundary. Although access to the quarry is restricted, we have estimate that the quarry back wall is at least 10m in height and comprises the Brithdir Sandstone. We understand that the proposed layout (Figure 1) has been adjusted to move the dwellings away from the top of the quarry face.

We recommend that prior to development, the topographic survey be extended to include the top of the quarry back wall and a geotechnical inspection of the quarry wall be completed to assess the stability of the upper part of the face and the potential for any future movement. This is likely to require access to the quarry face, possibly via the rear gardens of the properties on Birchley Close. However, it is possible that much of the survey may be done using roped access from the site itself. If a full geotechnical survey of the quarry face cannot be undertaken, we recommend that the dwellings are constructed a 'safe' distance from the top of the quarry face - this would need to be determined via further investigation.

The site elevation varies between around 109m OD in north-west and 95m OD in the east. As discussed in Section 4.0, the site can be currently considered as three broad zones (Zones A to C) with 1 to 2m slopes and retaining walls separating the zones. Apart from the south-eastern boundary above the quarry face, no significant stability issues are anticipated however, any slopes or retaining walls should be designed to ensure the long term stability of the site and considered based on the findings of the detailed investigation and any new information.

### **8.2 Access**

We understand that the existing access track will need to be widened by 2 to 3m for the development. The southern edge of the track comprises the fenceline to the football club and is, therefore, fixed (Plate 12). Hence, any widening will have to involve the excavation of the overgrown slopes to the north (Plate 12).

The historical maps suggest that these slopes comprise waste materials from the former iron and steel works and were tipped in the late 19<sup>th</sup> Century. The upper levels were reprofiled in the 1980s to construct a plateau for a football pitch to the north-east. However, the lower slopes, adjacent to the site access, are likely to remain in their origin condition. At one location along the access, an exposure at the toe of the slope indicates white slag gravel and cobble sized materials with fragments of metal.

We consider that, as the materials within the slopes to the north of the access track are likely to have been end-tipped, the existing slopes are likely to be close to their equilibrium stability. Therefore, any excavation into the toe for widening would cause over-steepening and possible instability in the slope materials. The presence of gabion baskets on the slopes in one area suggests previous instability issues.

We recommend that prior to widening a thorough geotechnical investigation be undertaken into the slopes to confirm their composition and determine the best means of supporting the slopes to allow widening of the access. As a minimum this would require trenches excavated into the slope. These should only be undertaken after gaining the permission of the land owner.

### **8.3 Foundation Options**

Based on the current investigation information, we consider that conventional spread foundations are likely to be suitable for the proposed dwellings at the site. The foundations should be taken down into the Glacial Till or sandstone bedrock.

The depths to these founding strata will depend on the final layout and finished ground levels, but we anticipate that, based on the currently available information, they are likely to be present within 1.0 to 1.5m of the final ground surface over much of the site. However, in some areas, deep Made Ground and soft glacial soils were encountered (e.g. TP5, TP9, TP10) and, here depending on final levels, trench fill foundations may be required. Confirmation of this would be required following detailed investigation and suitable geotechnical testing and assessment.

Given the available information, at this stage, we recommend that suspended floor slabs should be allowed for. As discussed in Section 6.4, strong hydrocarbon vapours were identified within the Made Ground in some trial pits, particularly across Zone B, and a historic 'tip' is indicated at the base of the quarry. Therefore, at this stage, we recommend that appropriate gas protection including a gas membrane and ventilated sub-floor slab be allowed for in preliminary design. The installation and monitoring of gas wells would clarify the risks from hazardous ground gas and vapours, and the resulting protection measures required. We cannot rule out active measures at this stage and the soil gas conditions may present a significant financial constraint.

Depending on the amount and type of slag present, some excavation and replacement may be required.

### **8.4 Excavation**

Based on the findings of the investigation, excavation is anticipated to be mainly within the capabilities of conventional excavators. However, the trial pits were terminated on sandstone bedrock and this is likely to require breakers for its removal, particularly in small excavations such as foundation trenches. The upper horizons of the sandstone is anticipated to be fractured and, therefore, for mass excavation (e.g. lowering of general site levels) large capacity excavators may be sufficient to remove much of the rock.

### **8.5 Soakaway Feasibility**

Given the presence of a substantial thickness of Made Ground across the site, which is suspected to contain contaminants, we consider that conventional shallow soakaways in these soils are unlikely to be suitable for the development. The underlying glacial soils contain a high proportion of fines, which is likely to inhibit infiltration.

We consider that soakaways could be technically feasible for the development provided that they are constructed within the sandstone bedrock at depths of up to around 2m below present ground levels across the site. However, this would lead to the introduction of water directly into the aquifer, known as 'direct discharge'. Based on their published general principles and our experience, we consider that Natural Resources Wales (NRW) are likely to accept roof run-off in such soakaways, but will initially refuse the discharge of surface run off (e.g. from pavements) into the aquifer due to the potential for the contamination of the groundwater. We recommend that further discussions are held with NRW regarding the use of soakaways at the site.

If considered feasible, following detailed assessment, the soakaways would have to be constructed within the bedrock (probably requiring breaking out of the sandstone) and should be completely sealed from any Made Ground present to ensure that no contaminants are able to leach into the soakaway. Soakaway testing to BRE 365 would be required.

## 9.0 Summary

In conclusion, we consider that development of the site as a residential development is feasible, however, a number of ground related constraints would require further investigation and assessment, including:

- Stability of the quarry face on the south-eastern boundary;
- Levels of contamination within the Made Ground across the site and the potential risks to site users and impact on disposal costs;
- Potential for leachable contaminants impacting on the stream in the west of the site and groundwater;
- Potential instability when widening the access track to the site;
- Potential for hazardous petroleum vapours on site and landfill gas from tipped materials within the quarry to the east impacting on the development.

We trust that the report meets your present requirements. However, should you have any queries, or require further clarification, please do not hesitate to contact us.

Yours sincerely,

**Jeremy Hucker**

Principal Geologist

Enc. Figure 1: - Proposed Development

Figure 2 - Site Plan

Figure 3 - Trial Pit Locations

Enclosure A - Historical Maps

Enclosure B - Coal Authority Mining Report

Enclosure C - Environmental Data Report

Enclosure D - Trial Pit Records