

Appendix 9.1 Geo-environmental Desk Study

APPENDIX 9.1 – GEO- ENVIRONMENTAL DESK STUDY

9.1 Introduction

9.1.1 This Phase 1 Geo-environmental Desk Study of the site has been prepared by AECOM to support Chapter 9 of the PEIR. The report has been produced on the assumption that the site will be redeveloped as an internal power generation enhancement to Port Talbot Steelworks with a cable route to the existing on site substation.

9.1.2 AECOM has reviewed readily available information on the geo-environmental characteristics of the site and undertaken a site reconnaissance visit to make a preliminary qualitative assessment of the potential ground-related risks associated with the proposed development.

Report Objectives

9.1.3 This report has been prepared in general accordance with the procedures described in the Model Procedures for the Management of Land Contamination, CLR 11 (Defra/EA, 2004), BS 5930:1999 (as amended) Code of Practice for Site Investigations (BSI), and BS 10175:2011 Investigation of Potentially Contaminated Sites – Code of Practice (BSI), to:

- Describe the environmental setting of the site;
- Describe the findings of a site reconnaissance visit;
- Summarise the history of the site;
- Summarise the underlying geology and hydrogeology;
- Summarise the findings of any historical ground investigation work;
- Provide a Conceptual Site Model for the prevailing ground conditions;
- Present a preliminary qualitative evaluation of potential land contamination risks;

- Present a preliminary qualitative evaluation of potential geotechnical issues.

9.1.4 The report concludes with a series of recommendations for undertaking further investigative work. The purpose of such is to substantiate the findings of the preliminary evaluation and thereby reduce uncertainty in the Conceptual Site Model.

Sources of Information

9.1.4.1 This report has been prepared using a combination of published records, information held by the Client and other sources such as the Local Authority. These include statutory records and historical mapping supplied within a Landmark Envirocheck Report, published geological and hydrogeological mapping, historical borehole records, and observations made during the site reconnaissance. A complete listing of all information sources is included in the References section.

Limitations

9.1.5 The opinions expressed in this report and the comments and recommendations given are based on a desk assessment of readily available information and an initial site reconnaissance by an AECOM Engineer. At this stage intrusive investigations have yet to be undertaken at site to establish actual ground and groundwater conditions and to provide data for an assessment of the geo-environmental status of the site.

9.1.6 The information, views and conclusions drawn are based, in part, on information supplied to AECOM by other parties. AECOM has proceeded in good faith on the assumption that this information is accurate. AECOM accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to AECOM from others.

9.1.7 The site reconnaissance consisted of a general external inspection of the site aimed at identifying any obvious signs of geotechnical hazards and potential sources of ground contamination affecting the site. An environmental compliance audit and/or detailed structural inspection of

existing buildings were outside the project brief. Similarly, the site visit excluded detailed consideration of the ecological or archaeological aspects of the site, and if such are believed to be of potential significance then it is recommended that specialist advice is sought.

- 9.1.8 Reference to historical Ordnance Survey (OS) maps provides invaluable information regarding the land use history of a site. However, it should be noted that historical evidence will be incomplete for the period pre-dating the first edition and between successive maps.
- 9.1.9 Any risks identified in this report are perceived risks, based on the information reviewed during the desk study and therefore partially based on conjecture from available information. The study is limited by the non-intrusive nature of the work and actual risks can only be assessed following a physical investigation of the site.
- 9.1.10 The copyright in this document (including its electronic form) shall remain vested in AECOM Limited (AECOM) but the Client shall have a licence to copy and use the document for the purpose for which it was provided. AECOM shall not be liable for the use by any person of the document for any purpose other than that for which the same was provided by AECOM. This document shall not be reproduced in whole or in part or relied upon by third parties for any use whatsoever without the express written authority of AECOM.
- 9.1.11 Subsequent to the site walk over and Landmark Envirocheck report, minor changes have been made to the cable route. The changes have not fallen outside the scope of the Envirocheck, however the new route corresponds to the redline boundary shown in Figures 1 and 2.

9.2 Site Description & Setting

- 9.2.1 The site is located at the TATA Steel UK Port Talbot Steel works, located immediately west of Margam, a suburb of Port Talbot. The nearest post code is SA13 2NG. The proposed power generation site is centered on National Grid Reference 277275, 188429 with the associated cable route

end centred on National Grid Reference 278475, 186081. A site location plan is provided as Figure 1.

9.2.2 The site covers approximately 26 hectares and is defined by the red line boundary shown in Figure 2. The surrounding area is predominately industrial, situated within the TATA Steel UK Port Talbot Steelworks boundary, with residential areas to the north and east. Margam Docks are situated to the north west of the site. The general topography of the site is generally level at an approximate ground level of 15m Above Ordnance Datum (AOD).

9.2.3 Relevant features immediately surrounding the site are summarised in Table 2.1.

Table 9.1: Features Surrounding the Site	
Direction	Summary
North	Great Western Railway, Margam Wharf, the Port Talbot Industrial Estate and a large residential area.
South	To the south the land comprised of farmland and the Eglwys Nunydd Reservoir.
East	The Great Western Railway Line runs along the eastern boundary of the site with a residential area beyond.
West	To the west the site is predominantly occupied by Port Talbot Steel works with Margam Moors beyond where Lower Mother Ditch and a large reservoir are situated.

9.3 Site Reconnaissance

9.3.1 An external inspection of the site was completed by an AECOM Engineer on the 16th October 2013. The aim of the visit was to identify the range of activities carried out on the site and any obvious potential sources of ground contamination.

9.3.2 During the visit the AECOM Engineer was accompanied by a representative of TATA, Guy Simms, the project manager for the proposed development.

9.3.3 Figure 3 identifies the principal observations made during the visit and a summary is provided below. A photographic record of the visit is included as Appendix A.

- The site area is located within the Port Talbot Steelworks to the south the A48 and to the north of Margam wharf.
- The site layout corresponds to the most recent mapping. The northern redline boundary following the newly constructed Periphery Distribution Road (PDR) and the south the outer edges of the steelworks, the cable line generally follows the path of the disused railway line
- Within the main body of the site the land comprises hard standing to the north, where half is temporarily fenced off, as shown in Photo 5. The area comprising hard standing represents the former location of the coke ovens associated with the Margam works.
- A town sewer runs through the centre of the site, with an access chamber present in the centre of the site.
- To the middle of the main site the land generally comprises low lying flat scrubland, with a small number of ditches located across the site. There is also a water pipe running through the centre (Photo 11). During the site walkover it was stated that depending on the positioning of the new power generator the water pipe maybe re-routed.
- To the south of the site, the current power generators for the steelworks are located. Behind these it was apparent that waste materials had been placed.
- The cable route will run from the north west of the main site (within the area covered in hardstanding) and extend west to the Grange electricity sub-station. The cable route is proposed to run alongside the route of a disused rail line; this land was previously occupied by railway sidings.
- The cable route will run through the existing steelworks under a newly constructed elevated road (Photo 19).
- The cable route will run into Cefn Gwrgan substation which will then carry on through the existing embankment. In order to facilitate the cable a gantry maybe installed however this is still in planning stages.

- A trial hole was carried out for onsite electricity cabling works where the road is currently located indicating the ground conditions comprised tarmac underlain by 0.8m thickness of concrete overlying slag.
- An excavation for current site works was inspected for a representation of the underlying strata to depths of 1m below ground level (bgl). This indicated made ground, with thin bands of darker material, with possible alluviums. This is located to the south of the Cefn Gwrgan electricity substation next to the disused railway line.
- The route of the cable is proposed to run into the Grange substation where it will end. Next to the Grange substation were stockpiles of finely ground slag, kept to be used for infill, shown in Photos 26, 27 and 28.
- The disused railway line owned by Network Rail runs along the western boundary of the site and cable route boundary. This rail line has not been dismantled and is to be kept until further notice, as it may be utilised again in the future. The construction of the cable route will not disrupt the railway line.

9.4 Information from Statutory Authorities

Landmark Envirocheck Report

9.4.1 Table 2.2 summarises information contained in the Landmark Envirocheck report (Appendix B). The report collates data from a variety of sources including the Environment Agency (EA) and the British Geological Survey (BGS). All data suppliers are referenced in the report.

Table 9.2: Summary of Regulatory Information				
Subject	Number Present			Details
	On Site	0-250m	250-500m	
Contaminated Land Register Entries and Notices	0	0	0	N/A
Discharge Consents	0	14	8	Relate to a number of differing water bodies including controlled sea waters, freshwater stream/river, tidal waters and land/soakaways

Table 9.2: Summary of Regulatory Information				
Subject	Number Present			Details
	On Site	0-250m	250-500m	
Integrated Pollution Controls	0	0	1	Relating to carbonisation and associated processes within the Fuel and Power Industry for Bitmac Ltd (309m south)
Integrated Pollution Prevention and Control	1	0	0	Environmental permit relates to various steel making processes at the TATA site.
Local Authority Pollution Prevention and Controls	0	0	2	Relates to air pollution controls for Quarry processes (276m south) and waste oil burners (477m east)
Pollution Incidents to Controlled Waters	0	3	2	The incident severity for 4 of the incidents is classified as a minor incident however 1 located 400m south east of the site was classified at a significant incident relating to crude sewage from the Margam British rail yard (December 1991).
Waste				
Licensed Waste Management Facilities	0	1	1	South Wales Jap Spares, located 206m to the east which accepts end of life vehicles and Avalon Services, located 468m to the north west which is a special waste transfer station.
Contemporary Trade Directory Entries	0	2	17	Various industrial and engineering associated companies.
Fuel Station Entries	0	0	1	Fuel station entry is now classified as obsolete

Consultees

9.4.2 An environmental search request was made with the Contaminated Land Officer at NPTCBC. The response can be found in Appendix C and is summarised below:

- With respect to the site the historical maps show the study area was part of the greater steel works and is therefore potentially contaminated.

- No further information was available on site although reference made to recently work and ground investigation related to the new Harbour Way Peripheral Distributor Road (PDR) which runs close to the study area.

Sensitive Land Uses

9.4.3 The Sensitive Land Uses Map of the Envirocheck Report (Appendix B) indicates that there are no sensitive land uses within 1000m of the site.

9.4.4 It is also noted that the Bristol Channel, located 1km southeast of the site, is a protected area under the Shellfish Waters Directive.

Unexploded Ordnance

9.4.5 According to regional unexploded bomb (UXB) mapping published by Zetica, the site lies within a zone that experiences a moderate risk of UXB. Moderate-risk regions are those that show a bomb density of between 11 and 50 bombs per 1000 acres and that may contain potential WWII targets. Action to mitigate the risk is considered to be essential, however the scope of the works required will not be as significant compared with that needed for high-risk regions.

9.5 Development History

Summary of Findings

9.5.1 The historical Ordnance Survey (OS) maps obtained with the Landmark Envirocheck report date between 1877 and 2013.

9.5.2 The maps show that the site was initially coastal land with large areas covered by marsh land and farmland. This area was a good location for industrial works due to its close proximity to the Bristol Channel providing access to a number of important trading areas.

9.5.3 The mapping shows that a copper and gas works was initially located in the north of the site in 1877. By 1940 the site was completely redeveloped into Margam Iron and Steel Works. A significant amount of the land was also used for mineral lines and other railway lines linking Port Talbot to the Dockyard and the rest of South Wales (Great Western Railway). Since the construction of the works the land use hasn't changed significantly, with the

exception of changes in configuration of building and expansion to the south of the site. The majority of the site is currently unoccupied.

Detailed Review of Historical Mapping

9.5.4 Table 9.3 provides further information which was determined from a review of the historical OS mapping. Due to the size of the site, the site will be shown as three separate sections. The first section will represent the western section of the proposed development site, the second section will represent the eastern section of the proposed development site and finally the third section will represent the proposed area for the cable route.

Table 9.3: Summary of Historic OS Mapping		
Subject	Number Present	Details
1877 [1:2500] 1884-1885 [1:10,560]	To the north, the site is comprised of Margam Copper and Gas Works, indicating Coke Ovens are present and railway sidings. The site is split by a water body from the River Severn acting as a mooring area for boats. To the south, the site comprises marsh land with an old break water present to the south east.	The west of the site comprises marsh land/ mudflats. Margam village is present to the north of the site where a small settlement is apparent. The train line extends through this area. An old river is present to the south of the site.
1917 [1:2,500] 1921 [1:10,560]	By 1917 the Copper and Gas works is no longer used. The coke ovens and Works buildings are no longer present and the railway lines have been dismantled. A railway line was constructed to the very south of the site labelled Port Talbot Railway, providing access to the nearby docks. A Military Road is also apparent to the west of the site, most of this land is now characterised by rough pasture and marsh land .	Approximately 450m to the west of the site is the Crown Preserved Copper Works and the Rio Tinto Copper Works. The Port Talbot Railway Dock Branch extends west 972m west of the site. The Port Talbot Steel work is located approximately 954m north west of the site. A copper works is present 150m north of the site. Two Tin Plate works are also located 360m north of the site. A sewage chamber is also present approximately 150m south of the site.
1940 [1:2,500]	Site has been redeveloped with the construction of the Margam	A number of residential developments are shown to the north of the site. Llywelyn Quay is

Table 9.3: Summary of Historic OS Mapping

Subject	Number Present	Details
	Works (Iron&Steel), which includes a number of tanks and chimneys and a significant number of railway lines running into the site from the Great Western Railway.	located 387m north west of the site. Margam Works extends to the 340m north of the site.
1960 [1:2,500]	The site shows no signs of significant change, the only differences to note are slight change in the configuration of the buildings at the works .	Margam Wharf has developed immediately west of the site. An additional works is present 95m west of the site. The rest of the area remains relatively unchanged.
1978-1991 [1,250]	By 1978 the maps show that some of the Steel Works has been reconfigured, as it is no longer present to the east of the site.	No significant change
1993 [1:1,250 and 1:10,000]	The site shows no significant change.	The scale of the steel works has significantly reduced to the north.
2013 [1:10,000]	The site shows no significant change with the exception of a pipe line no longer established to the east of the site.	No significant change
Eastern Section of Proposed Development Site		
1877 [1:2500] 1884-1885 [1:10,560]	The western area of the site primarily comprises marsh land and shingles, with the exception of a Brick Works in the centre and part of the Margam Copper Works present to the north of the site. Part of the Old Breakwater is also present to the south west of the site.	Tai-bach village is located 340m to the east of the site. The surrounding land to the south and south east of the site is predominantly, marsh land and farmland.
1917 [1:2,500] 1921	By 1917 the site has changed significantly, with two main railway lines (Port Talbot	A small residential area has developed 265m east of the site. To the south of the site the land

Table 9.3: Summary of Historic OS Mapping

Subject	Number Present	Details
[1:10,560]	Railway) covering the majority and marshland and rough pasture characterising the rest.	is characterised as Saltings. A series of quarries are located approximately 700m east of the site. The rest of the land has remained as farmland. A gas holder is present 60m to the east of the site, forming part of the gas works.
1940 [1:2,500]	The site has undergone significant change with the development of Margam Works to the west of the Great West Railway line (previously Port Talbot Railway). A number of tanks and site buildings are now featured on the site.	Tai-bach has expanded, resulting in a large residential area to the east of the site. A pumping station is located 730m south of the site.
1960 [1:2,500] 1965 [1:10,000]	By 1960 the positioning of the Great Western Railway line has moved further south east of the site. The railway line featured now follows the southern boundary of the site. As a consequence of this move the Works has expanded into this section of the site.	The south of the site has significantly changed, the land mainly comprises railway sidings. An additional gasholder is present immediately east of the site. The rest of the site remains unchanged.
1978-1991 [1,250]	By 1978 the whole of the site has been cleared of the Works with the exception of a Pipeline and a small development to the east of the site and a railway track running through the east of the site. The railway line immediately east of the site has now been dismantled.	No Significant change
1993 [1:1,250] and [1:10,000]	The site shows no significant change since 1991.	No significant change however the railway sidings to the south are now dismantled.
2013 [1:10,000]	The site shows no significant change since 1993.	No significant changes with the exception of an additional residential area 270m south east.

Table 9.3: Summary of Historic OS Mapping

Subject	Number Present	Details
<i>Proposed Cable Route (further East)</i>		
1877 [1:2500]	The majority of the site comprises of farm land however to the north of the site the land is representative of marshes with a Tramway Line cross at two points.	The Great Western Railway Line runs along the western boundary of the site. Morfa Colliery is present approximately 800m west of the site. The tramway runs from the colliery to the north of the site. The surrounding land is generally comprises farmland and marshland.
1918 [1:2,500]	To the north of the area the marshes are now characterised as Saltings however to the south of the area there is no significant change.	The site surroundings remain relatively unchanged with the additional development of small residential areas.
1940 [1:2,500]	To the north of the area the land has been developed on and now comprises of a Mineral Railway Line that runs into Margam Works. The south of this area has now been labelled Middle Mother Ditch and displays no significant change	No significant change.
1953-1964 [1:2,500]	The north of the area is now generally made up of the Margam railway sidings The south of this area is now part of the Abbey Works however most of the land is disused.	A large residential area has developed 400m the east of the site. Railway sidings extend west from the north of the site. The rest of the land remains the same.
1964-1991 [1,250]	To the north of the area there has been no significant change how to the south of this area still occupies buildings from the Abbey Works. A Road also runs through this part of the site.	Significant development has occurred immediately to the west of the site labelled 'Works', comprising the works building and a number of mineral rail lines. Margam railway sidings immediately east have also been constructed.
1993 [1:1,250]	By 1993 the north of the site no longer comprises of railway sidings and to the south there has been no significant change.	The configuration of the buildings within the works has changed.

Table 9.3: Summary of Historic OS Mapping

Subject	Number Present	Details
2013 [1:10,000]	To the north of the area the land is characteristic of woodland however to the south of the area Grange Road runs within the boundary.	No significant change.

Aerial Photograph

- 9.5.5 An aerial photograph of the site can be seen in Appendix B, the map is dated from 1949, displaying industrial works present on the site.

Other Sources

- 9.5.6 A request for information was made to the National Grid Archive. No further information was available relating to the gas works.

9.6 Geology

Published Records

- 9.6.1 The published 1:50,000 scale geological map of the area produced by the BGS (Sheet 247, "Swansea", 2011) indicates the site is underlain by the geological succession summarised in Table 9.4.

Table 9.4: Geological Succession from Published Mapping

Age	Group	Geological Stratum
Quaternary	Post Glacial Deposits	Older Coastal Zone Deposits
Quaternary	Glaciofluvial Ice Contact Deposits	Sands and Gravels (localised to the a small area in the south)
Carboniferous	South Wales Coal Measures Group	Middle Coal Measures

Made Ground

- 9.6.2 Made ground is anticipated across the site. The BGS map indicates that the site overlies an area where extensive earth moving has occurred. With reference to "The Steel Company of Wales Technical Survey" (Iron and Coal Trades Review, 1952) during the construction of the steel works the significant volumes of dune sands along with hard fill (slag) were imported

to raise levels and improve ground conditions in the southern part of the Abbey Works by up to 3m.

Superficial Deposits

9.6.3 Older Coastal Zone Deposits comprising clay, silt, sand and peat formed in the Quaternary Period in a predominantly coastal environment are indicated across the site.

9.6.4 A localised area of Glaciofluvial Sands and Gravels is indicated in the south, along the proposed cable route.

Middle Coal Measures

9.6.5 The Carboniferous Middle Coal Measures comprises mudstone with coal seams, seatearths and thin sandstone beds. The maximum thickness of the deposit is 480m.

9.6.6 The geological map displays the Morfa Fault Line running through the site area with a general trend from northwest to southeast. The fault gives rise to varying thickness of the middle coal measures in the locality.

9.6.7 The coal measures have been historically mined at depth.

Historical Exploratory Hole Records

9.6.8 The BGS maintains an archive of historical exploratory hole logs throughout the UK. AECOM has searched the database and a summary of those which are considered to provide useful information on the ground profile at the site is given in Table 9.5. Copies of the logs are included as Appendix D.

Table 9.5: Historical Exploratory Holes in BGS Archive					
Boreholes reference NGR Distance from the site Date	Stratum	Description	Depth to Top of Stratum² (m bgl)	Level of Top of Stratum (m AOD)	Thickness (m)
SS78NE108 277490,	Older Coastal	Clay	G.L	14.92	2.74

Table 9.5: Historical Exploratory Holes in BGS Archive					
Boreholes reference NGR Distance from the site Date	Stratum	Description	Depth to Top of Stratum² (m bgl)	Level of Top of Stratum (m AOD)	Thickness (m)
188210 150m Southeast (1999)	Zone Deposit	Peat	2.74		1.82
		Gravel	4.3		1.72
		Clay, Cobbles, & Gravel	6		7.31
		Sand	13.3		1.70
		Clay and cobbles	15.01		3.98
	Coal Measures	Pennant Cobbles with traces of Coal	20.52		1.52
		Pennant Rock	22.76		1.11
SS78NE209 277592, 18828110m Southeast (1977)	Made Ground	Loose ash, slag and clay	GL		3.80
	Older Coastal Zone Deposit	Soft grey silty sandy CLAY	3.80		0.80
		Soft dark grey organic silty CLAY with numerous bands of peat	4.60		2.10
		Firm grey brown mottled sandy gravelly CLAY with pockets of sand	6.70		3.90
		Dense coarse sandy GRAVEL with cobbles	10.60		4.40

Table 9.5: Historical Exploratory Holes in BGS Archive

Boreholes reference NGR Distance from the site Date	Stratum	Description	Depth to Top of Stratum² (m bgl)	Level of Top of Stratum (m AOD)	Thickness (m)
SS78NE102 277570, 188490 50m East	Topsoil	Very sandy	GL	49.2	0.15
	Made Ground	Loose sandy ash, cinder and brick	0.15		2.15
	Older Coastal Zone Deposit	Soft dark brown mottled organic CLAY	2.30		0.15
		Very Soft dark brown mottled organic CLAY	2.45		0.75
		Medium dense brown clayey SAND and GRAVEL	3.20		1.25
		Stiff brown silty sandy stony CLAY	4.45		0.30
		Medium dense brown clayey sandy GRAVEL with occasional cobbles	4.75		3.50
		Very dense brown SAND and GRAVEL with occasional boulders	8.25		2.40

Notes:

1. The geological classification is based on information available on the logs and is therefore indicative only.
2. G.L. is Ground Level.

Soil Chemistry

9.6.9 British Geological Survey (BGS) Soil Chemistry datasets detail the topsoil concentrations of five potentially harmful elements (PHEs): Arsenic (As), Cadmium (Cd), Chromium (Cr), Nickel (Ni) and Lead (Pb), as presented

within the Envirocheck report. Elevated concentrations of these PHEs can exist because of natural geological conditions or possible human contamination. The following estimated soil chemistry levels are attributed to the site:

Arsenic 15 to 45mg/kg, Cadmium <1.8mg/kg; Chromium 60 to 90mg/kg; Lead <150mg/kg and Nickel 15 to 30mg/kg.

Mineral Resources

9.6.10 With reference to the British Geological Survey (2010) 1:100 000 scale Mineral Resource of Wales mapping for South-east Wales the site is indicated to lie on an area of Tertiary Shallow Coal reserves. These coals form a resource and some of these coals have been previously deep mined. However, they do not generally form an attractive target for opencast mining due to factors such as high overburden ratios and hardness of the overburden.

9.6.11 A small pocket of Glacialfluvial Sands and Gravels are indicated in the south, in the route of the proposed cable.

9.7 Hydrogeology

Aquifer Classification

9.7.1 The EA's Groundwater Protection Policy adopts aquifer designations that are consistent with the Water Framework Directive. According to this system:

9.7.2 The Middle Coal Measures is classified as a Secondary A aquifer. These are 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.

9.7.3 The superficial deposits classified at the site are predominantly a Secondary Undifferentiated Aquifer. This is assigned in cases where it has not been possible to attribute either category A or B to a rock type and has previously been designated as both minor and non-aquifer in different locations. The section representing the cable route also displays areas of

superficial deposits characteristic of a Secondary A aquifer therefore comprising of more permeable materials capable of supporting water supplies at a local scale.

Vulnerability of Groundwater Resources

9.7.4 The EA's Groundwater Vulnerability Map of the area shows that the soils overlying the Secondary A aquifer have a High Leaching Potential (U). These are soils that readily transmit liquid discharges because they are either shallow, or susceptible to rapid by-pass flow directly to rock, gravel or groundwater. Soil information for restored mineral workings and urban areas is based on fewer observations than elsewhere and therefore a worst case vulnerability classification (H) is assumed until proven otherwise

9.7.5 Mapping produced by the EA and supplied with the Envirocheck report shows that the site does not lie within 1km of a Source Protection Zone.

Site Characteristics

9.7.6 The regional direction of base groundwater flow is expected to be to the west towards coastal waters of Swansea Bay.

9.7.7 Given the proximity to coastal waters the underlying groundwater is potentially tidally influenced.

Licensed Groundwater Abstractions

9.7.8 There are no groundwater abstractions within 1km of the site.

9.8 Hydrology

Surface Water Courses and Drainage

9.8.1 The nearest surface water feature to the west site appears to be the Margam Wharf, forming part of Port Talbot Docks, located 60m to the west of the site. The River Ffrwd Wylt is located approximately 100m northeast of the site and is a tributary from the River Afan.

9.8.2 Numerous drains are indicated to the east of the cable route with the Middle Mother Ditch immediately east of the site running north to south. Eglwys Nunydd Reservoir is located approximately 400m south east of the site. Aranllt Brook is indicated to the east of the cable route, flowing east to west.

A further reservoir and more drains are indicated in the main works area to the west of the site.

9.8.3 From historical maps (1877-1940) it is apparent that an “Old River” is marked indicating that a water body used to flow into the main body of the site where ‘shingles’ were shown.

9.8.4 Five surface water abstractions have been identified relating to the wider Tata Steel Limited Port Talbot Steelworks site operations. These are for Metal: Non-Evaporative Cooling and Metal: Process Water. Three further surface water abstractions are registered within 1km of the site, all for dust suppression activities.

9.8.5 The Development Advice Maps, developed as part of the Welsh Assembly Government Technical Advice Note 15: Development & Flood Risk (July 2004) (TAN15), indicates that the site lies within Zone 2C an area without significant flood defence infrastructure and Zone B an area known to have been flooded in the past. Therefore, the site is considered to be susceptible to fluvial/marine flooding.

9.9 River Basin Management Plan

9.9.1 The Water Framework Directive requires a Management Plan to be published for each River Basin District. These are plans that set out the environmental objectives for all the water bodies within the district and how they will be achieved.

9.9.2 The regime has introduced the concept of safeguard zones, which identify a catchment or other zone around a point where water is abstracted for potable use and where actions may be taken to protect water quality, prevent deterioration, and so minimise the need for treatment. Where water is abstracted for human consumption the water body is designated as a Drinking Water Protected Area (DrWPA). If there is reasonable confidence that a DrWPA objective will not be met, a safeguard zone will be identified.

9.9.3 The WFD has also brought about Water Protection Zones. These areas are a regulatory mechanism to address diffuse water pollution by restricting or forbidding activities that are polluting the most vulnerable waters (e.g.

DrWPA). They can be used if it appears there is a risk of a water not achieving good ecological and chemical status by 2015.

9.9.4 The River Basin Management Plan for West Wales Basin District has been reviewed. The site lies within the Ogmores to Tawe Catchment, which is with a Freshwater Fish Directive area. The current status is moderate however is said to be good by 2027; therefore no further action is required.

9.10 Radon

9.10.1 The Envirocheck report indicates that the main body of the site is within an area that is not affected by Radon however the area proposed for the cable is within an area affected by Radon. The risk from Radon is generally considered as low.

9.11 Quarrying and Mining

Planning Policy for Mineral Use

9.11.1 Planning Policy Wales, Minerals Planning Policy Wales requires minerals planning authorities to promote sustainable use of mineral resources in their Local Plans. This includes defining mineral safeguard zones to ensure that specific mineral resources of local or national importance are not sterilised by non-mineral development (but not assuming that the identified minerals will be worked). If it is necessary for non-mineral development to take place then the local planning authority should set out policies to encourage the prior extraction of minerals, where practicable and environmentally feasible.

9.11.2 When determining planning applications local planning authorities must ensure that, amongst other matters, that there are no unacceptable impacts on the natural and historic environment, human health or aviation safety (taking into account cumulative effects from multiple sites); unavoidable noise, dust and particle emissions, and vibrations are controlled, mitigated or removed at source; and to not normally permit other developments in mineral safeguard zones.

9.11.3 Reference has been made to the Neath Port Talbot Unitary Development Plans; the data provided shows that there are no implications on the development. With reference to the geological records the underlying

superficial deposits, predominated by Tidal Flats deposits are not considered to represent a significant or viable mineral resource.

Quarrying

9.11.4 An attempt has been made to identify any quarrying operations, past and present that have taken place in the vicinity of the site.

9.11.5 The sources of information referenced in this element of the desk study include:

- Envirocheck datasheets supplied by Landmark
- Historical Ordnance Survey maps and plans
- Geological maps

9.11.6 These records indicate that seven BGS Recorded Mineral Sites were located within 1km of the site. Five of these relate to open cast mining of sandstone to the north and east, all inactive, with the nearest record 643m to the east. One relates to underground mining, discussed below. The last record relates to an operational site present 710m from the western boundary of the site. This is operated by Lafarge- Tarmac and relates to slag aggregates.

Mining

9.11.7 With respect to the Landmark report the site is indicated to lie in an area which may be affected by coal mining activity. A BGS mineral site relating to deep coal is registered 808m to the east. As such coal authority reports were obtained for the site.

9.11.8 Coal mining reports are obtained from the Coal Authority, covering the three sections, as presented in Appendix F and summarised below:

- No coal mine entries are noted on or within 20m of the site. No records of historical open cast workings on site, current open cast mining within 200m or within 800m of an area determined for or granted a license for future open cast workings.
- There are no records of mine gas emission requiring action by the Coal Authority within the boundary of the site.

- All three reports suggest that the site used to be within a likely zone of influence from a number of historic coal seams. The main body of the site is said to be influenced by one coal seam found between 740 and 770m below ground level situated within the site surroundings.
- The area proposed for the cable is said to have been influenced by four coal seams between 120m and 770mbgl also within the site surroundings. The reports state there has been no damaging affects arising due to geological faults or other lines of weakness that have been affected by coal mining directly beneath the site.
- The coal seams have not been worked since the early 1900's (1906 and 1913) and it is stated that any ground movement from these workings should have stopped by now.
- At present, the reports indicate that the site does not lie within the likely zone of influence on the surface from current operational underground coal workings. The site is located on underground coal resources which could potentially be worked in the future.

9.11.9 With reference to “The Steel Company of Wales Technical Survey” (Iron and Coal Trades Review, 1952), it is stated that the Grange and Abbott pits were located to the west of the steelworks. These were in operation from the 19th century until 1906. These workings were understood to extend under the site of the steelworks with veins worked to depths of between 125m and 460m.

9.12 Landfilling

9.12.1 An attempt has been made to identify any landfilling operations, past and present that have taken place in the vicinity of the site. The sources of information referenced in this element of the desk study include:

- Envirocheck datasheets supplied by Landmark
- Records held by Local Authority / Environment Agency

9.12.2 These records indicate that there are four operational Licensed Waste Management Facilities present within 1km of the site.

9.12.3 With reference to the Landmark datasheets there are no recorded historical landfill sites, however, with reference to the historical data there have clearly been some demolition activities on site and therefore the presence of made ground is likely to be present.

9.13 Previous Ground Investigations

9.13.1 There are no records of intrusive investigation works out within the area of the proposed development; therefore it is not possible to comment specifically on ground conditions and ground contamination at the proposed site. Limited observations made during the site walkover on 16 October 2013 noted a trial hole excavated for on-site electricity cabling works where the road is currently located. This indicated tarmac underlain by 0.8m of concrete overlying 0.75m of slag.

9.13.2 In the wider area intrusive investigations have been carried out by Jacobs for the PDR development comprising of a number of boreholes and trial pits concentrated along the length of the PDR. It is recognised, however, that the relevance of these exploratory works (given the passage of time and the fact that many of them are not specifically located within the steel works boundary, but rather the general vicinity of it) is limited, but they are considered to contain useful information on general ground conditions and historical contamination.

9.13.3 Exploration Associates undertook a site investigation in October 2001 at Blast Furnace 3 within the Port Talbot site but outside the redline boundary of the proposed development. Made Ground comprised 1.2m to 6.3m of fused slag, concrete, sand and bricks overlying an estuarine alluvium comprising soft to firm sandy clay, dense brown clayey sand, with numerous gravels cobbles was encountered to thicknesses of up to 8.8m. No bedrock was encountered. Groundwater was present between 0.7mbgl to 2.8mbgl. Soil samples were tested for a range of heavy metals, polyaromatic hydrocarbons (PAHs), phenols, cyanide, sulphur, sulphate, sulphide and total petroleum hydrocarbons (TPH). The ranges of concentrations were all below industrial Tier 1 SGVs/SACs.

9.13.4 Ground investigations were undertaken by Geotechnology in December 2001 into the ground conditions at the Port Talbot site on behalf of Tata Steel UK, this investigation was outside the redline boundary of the proposed development. Groundwater was encountered between 1.4m to 2.7m. Contaminants of concern were copper and zinc with the majority of samples exceeding the Tier 1 SAC for potential phytotoxicity. In addition, the maximum concentration of arsenic was in excess of the Soil Guideline Values (SGV).

9.14 Preliminary Ground Model

Table 9.6: Geological Succession from Published Mapping		
Geology		
Stratum	Typical Description	Anticipated Thickness (m)
Made Ground	Comprises of slag, concrete, sand and bricks	2-4
Superficial Deposits	A sequence of clays, sand, gravels, cobbles and peat. Localised sands and gravels in south of proposed cable route and buried alluvial river channel running across site.	15 -20
Middle Coal Measures	Mudstone with coal seams, seatearths and thin sandstone beds.	Unknown
Groundwater		
Designation	Description	Anticipated Groundwater depth
Secondary A Aquifer	Older Coastal Zone Deposits	< 2mgl.
Secondary A Aquifer	Middle Coal Measures	No data

9.15 Review of Geo Environmental Risk

9.15.1 This section is aimed at identifying possible risks, if any, arising from substances used or deposited on-site, or from other sources of land contamination. Both past and current potentially contaminative land uses have been considered.

9.15.2 The legislative framework for land contamination risk assessment and the principle of contaminant linkages to derive a Conceptual Site Model (CSM) are described in Appendix G.

Potential Sources of Contamination

Historical Usage

9.15.3 Historical OS maps of the area reveal that the site was formerly occupied by Margam Copper and Gas Works, Margam Iron and Steel Works, with coke ovens present within the red line boundary and a number of railway sidings and mineral lines. A possible release of contamination may therefore have historically taken place on the site.

9.15.4 With reference to the DoE Industrial Profile's for Metal Manufacturing, Refining and Finishing Works, Iron and Steel Works, non ferrous metal works, Railway Land, and a Gas Works, the following list indicates the potential contaminants that may be associated with the existing land use.

Organic: Hydrocarbons: diesel, lubricating oils, paraffin.

Polychlorinated biphenyls (PCBs)

Polycyclic aromatic hydrocarbons (PAHs)

Solvents

Ethylene glycol

Creosote

Herbicides

Metals: Heavy metals

Ferrous residues (Metal rich leachates)

Metal fines

Acids: Sulphuric

Hydrochloric

Hydrofluoric and Nitric

Alkalis: Sodium hydroxide

	Calcium hydroxide
Inorganics:	Asbestos
	Ash and fill (possibly containing metals, phenols, sulphates and PAHs)
	Sulphates
	Ammoniacal Liquor
	Slag, coal and coke
	Cyanide
	Halogenated Solvents

9.15.5 In addition to the schedule given above, the land may have become contaminated by filling and/or other construction activities, or by illegal dumping. Contaminated fill maybe significant where the gas works was situated. A gas holder was also present immediately south east of the proposed development area therefore it is likely that the holders have been backfilled. Landfill/soil/mine gases and/or other mobile contaminants may also potentially be present. It is important to note that peat is present within the geology; therefore the construction on top of this could result in the build up of methane, carbon dioxide or hydrogen sulphide.

Recent and Current Usage

9.15.6 The proposed development at present forms part of an operational steel works. Other parts of the site are occupied by disused railway land. The majority of the proposed red line site boundary is essentially derelict land that was previously used for Margam Works.

9.15.7 The site reconnaissance revealed that wastes including scrap metal and wood and other materials have been dumped across the site where spare derelict land is available.

Off Site Sources

9.15.8 The following sources of potentially significant off-site contamination have been identified:

- Two historical gas holders previously located to the east of the proposed development area;
- Steel Works;
- Railway sidings.

Summary

9.15.9 The potential sources of contamination can be summarised as follows:

- Slag and other associated contaminants from the previously located coke ovens and other associated contaminants relating to copper and gas works present within the made ground
- Potential buried tanks associated with the gas works
- Contaminants associated with the historic and current usage of on-site and surrounding railway land
- Contaminants associated with the current steel works on and off site, primarily heavy metals and fuel oils
- Contaminants associated with the materials dumped within the on-site and surrounding derelict land.

Pathway for Migration

9.15.10 For the purpose of this assessment, the principal pathways for contaminant migration are considered to be as follows:

- Dermal contact / Ingestion / inhalation of potentially contaminated material;
- Inhalation of dust generated during any groundworks;
- Migration and accumulation of soil gas;
- Migration of contaminants through preferential pathways i.e. service runs, deep foundations

- Migration of contaminants through groundwater;
- Migration of contaminants through lateral migration / surface overflow.

Potential Receptors

9.15.11 For the purpose of this assessment, the principal receptors are considered to be as follows:

- Humans – current site users;
- Humans – demolition, construction and maintenance workers;
- Humans – adjacent site users;
- Humans – future site users of the building;
- Groundwater (Secondary A Aquifer);
- Surface Waters (Coastal Waters, Eglwys Nunydd Reservoir);
- Building structures and services.

9.16 Assessment of Plausible Contaminant Linkages

9.16.1 A CSM illustrating plausible contaminant linkages has been formulated for this site. It is presented in tabular format in Appendix H.

Summary of the Qualitative Risk Assessment

9.16.2 The contaminant linkages have been individually assessed (Appendix H) and a summary of the potential geo-environmental risks associated with the site in the context of the proposed development is provided in Table 9.7.

Table 9.7: Summary of Geo-Environmental Risks		
	Risk Rating	Justification/Comments
Contamination Potential		
Potential for Significant On Site Contamination	High	Significant contamination suspected on site
Potential for Contaminants to Migrate On to Site	Moderate	Potential off site sources and potential contaminant linkage

Potential for Contaminants to Migrate Off Site	High	Likely sources of contamination identified on site and potential contaminant linkage to off-site receptors
Environmental Risks		
Risk of Harm to Human Health - Existing Conditions	Moderate / Low	Likely sources of contamination identified but no plausible pathway exists. No existing site users.
Risk to Construction Workers	High	Potential contamination risks on site. Minimise contact with soils/dust using appropriate PPE. Suitable precautions required for any persons entering confined spaces.
Risk of Pollution of Controlled Water	High/ Moderate	Likely sources of contamination identified on site and potential contaminant linkage to Secondary Aquifer, estuary and River Ffrwd Wylt
Hazards to Flora and Fauna	Moderate / Low	No significant areas of soft landscaping
Hazards to Building Structures and Services - Excluding Ground Gas	Moderate / Low	Potential sources of elevated concentrations of sulphate
Liabilities		
Likelihood of designation as Contaminated Land under Part IIA EPA 1990	Moderate	Some potential for contamination identified - but likely to be addressed under the planning regime
Liability issues for owner	High/Moderate	Potential liability issues identified in relation to groundwater contamination/ ground gas and off site migration
Development Implications		
Possible Requirement for Remediation of Soil	High/Moderate	Significant remedial works likely to be required. Details to be confirmed following ground investigation and remedial options appraisal.
Possible Requirement for Remediation of Groundwater	High/Moderate	Significant remedial works may be required. Details to be confirmed following ground investigation and remedial options appraisal.
Possible Requirement for Gas Protection Measures	High/Moderate	Likely requirement for basic gas protection measures to be adopted for a commercial development.

Special Requirements for Water Supply Pipes	High	Likely requirement for specialist pipe materials to be specified.
Potential Limitations on Foundation Design	Moderate	Limitations of the use of piled foundations due to contaminated land.
Risk of Encountering Materials classified as Hazardous Waste	Moderate	Significant potential sources of contamination have been identified. Ground investigation required to clarify potential risks.

Note Part 2A of the Environmental Protection Act 1990. Refer to Appendix D for further information.

9.16.3 The geo-environmental risk assessment should be reviewed in the event that the proposed end use is significantly altered from that described in Section 1. It has been assumed that appropriate health and safety practices will be adopted during site clearance, preparation, earthworks and construction, and appropriate environmental protection / mitigation measures will be employed. It is also assumed that the proposed development will not introduce contaminative substances into the ground.

9.17 Geotechnical Hazards

9.17.1 The anticipated ground conditions beneath the site are discussed in Section 4. A summary of commonly occurring ground-related hazards, excluding ground contamination, is given in Table 9.8. The hazards identified as being potentially present on site could have potential implications on ground engineering and foundation design.

Table 9.8: Summary of Potential Geotechnical Hazards	
Geotechnical Hazard Category (excluding contamination issues)	Engineering Considerations
Filled and Made Ground	Extensive made ground anticipated with the potential to contain a range of contaminants. Likely to affect ground engineering and foundation design and construction. It is anticipated that shallow foundations will not be suitable for likely heavy loads with ground improvement and/or deep foundation i.e. piling, required.
Lateral changes in ground conditions	Variable made ground and superficial coastal deposits anticipated, comprising peat, gravels,

Table 9.8: Summary of Potential Geotechnical Hazards	
Geotechnical Hazard Category (excluding contamination issues)	Engineering Considerations
	sand, silt and clay.
Shrinkable clay soils	With reference to the Envirocheck report, a low hazard potential for shrinkable clay soils is present onsite.
Highly compressible / low bearing capacity soils, (including peat / soft clay)	Compressible ground anticipated, suggested to be a moderate hazard potential on site, as a result of variable made ground over alluvial soils. Likely to affect ground engineering and foundation design and construction. It is anticipated that shallow foundations will not be suitable for likely heavy loads with ground improvement and/or deep foundation i.e. piling, required.
Karstic dissolution features (including 'swallow holes' in Chalk terrain)	No Hazard
Evaporite dissolution features and/or subsidence	No Hazard
Ground subject to or at risk from landslides	No Hazard
Ground subject to periglacial valley cambering with gulls possibly present	No Hazard
Ground subject to or at risk from coastal or river erosion	No Hazard
High groundwater table / and/or flooding (including waterlogged ground)	Site and surrounding area is susceptible to flooding. Historical maps show the site is marshy, close to mud flats and the edge of the estuary. Marshy ground and a high water table are anticipated. May affect deep foundations, basements and tunnels. Excavations may be unstable and require shoring / dewatering during construction works.
Underground mining	Coal mining reports addressed in Section 4, the site is in the zone of influence of historic mining activity. The previously worked coal seams have not been worked since the early 1900's and hence are not considered to present a significant hazard to

Table 9.8: Summary of Potential Geotechnical Hazards

Geotechnical Hazard Category (excluding contamination issues)	Engineering Considerations
	ground movement.
Existing sub-structures (e.g. foundations, basements, and adjacent sub-structures). Existing services.	Remnant structures are likely to be present in selected locations across the site due to former demolished buildings. Existing buried services may require spanning, diversion or suitable wayleaves.
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	Based on previous site use, aggressive ground conditions are likely. Site specific assessment and suitable specification of materials in accordance with BRE SD1 and in with respect to statutory authorities (water supplies).
Unexploded Ordnance (UXO)	The site has been identified with a moderate risk of aerial UXO and specialist UXO risk assessment is required prior to any intrusive works.

9.18 Conclusions

- 9.18.1 The information summarised in this report has identified several potentially significant sources of contamination. The sites former use as a copper works, railway and iron and steel works with gas works in proximity are likely to have resulted in the presence of contaminated soils and groundwater beneath the site.
- 9.18.2 It is considered that the results of the preliminary assessment suggest an overall moderate to high geo-environmental risk associated with the proposed site development as a power station.

9.19 Recommendations

- 9.19.1 It is recommended that a ground investigation be undertaken in the area of the proposed development and along the route of the new cable conduit. The purpose of the investigation is to clarify the presence, nature and extent of any contamination as a result of former land uses. The geo-environmental investigation should be designed with due consideration of the requirements of BS 10175:2011+A1 (2013).
- 9.19.2 In summary, key objectives to be addressed by the investigation include:

- Confirmation of the ground and groundwater conditions and validation of the conceptual site model (CSM)
- Chemical status of made ground and natural soils for the purpose of risk assessment to human health, groundwater and for preliminary waste classification
- Chemical status of groundwater in order to determine risks to controlled waters
- Ground gas monitoring to determine the potential risks to the proposed development
- Identification of geotechnical design parameters for earthworks and preliminary foundation design
- Confirmation of infiltration characteristics.

9.19.3 The investigation will allow a quantitative assessment as to whether any of the potential risks identified in this study are present and are of material concern to the proposed development.

9.19.4 The geotechnical elements of the investigation should be designed with consideration of BS EN 1997-1:2004, BS EN 1997-2:2007 (Eurocode 7: Geotechnical Design – Parts 1 and 2) and BS 5930:1999.

9.19.5 If deep foundation solutions are proposed then a Foundation Risk Assessment should be undertaken to assess the risk of construction piling activities creating pathways for contaminated soil to travel into aquifers beneath the site and a geo-chemical assessment of the soil to determine the risk of soils chemically attacking the foundations of new buildings is required

9.19.6 The geo-environmental risk assessment should be reviewed in the event that the proposed end use is significantly altered from that described in Section 1. It has been assumed that appropriate health and safety practices will be adopted during site clearance, preparation, earthworks and construction, and appropriate environmental protection / mitigation

measures will be employed. It is also assumed that the proposed development will not introduce contaminative substances into the ground.

9.20 References

AECOM (2013) Geoenvironmental Desk Study Report, reference 60275968 – PI (00), dated November 2013 (presented in Appendix 9.1.)

British Geological Survey (2011) Bedrock and Superficial Deposits. Swansea, sheet 247 (England and Wales), 1:50000.

British Geological Survey (2010) Report OR/10/032 The Mineral Resource of Wales with supporting 1:100 000 scale mapping for South-east Wales

British Standards Institution (1999) BS 5930:1999 Code of practice for site investigations (+A2:2010). London, BSI.

British Standards Institution (2004) BS EN 1997-1:2004 Eurocode 7: Geotechnical design. General rules (incorporating corrigendum February 2009). London, BSI.

British Standards Institution (2007) BS EN 1997-2:2007 Eurocode 7: Geotechnical design. Ground investigation and testing (incorporating corrigendum June 2010). London, BSI.

British Standards Institution (2013) BS 10175:2011+A1 Investigation of potentially contaminated sites – Code of practice. London, BSI.

Building Research Establishment (2007) Soakaway design. Bracknell, BRE. (Digest 365).

Department for Communities and Local Government (2012) National Planning Policy Framework. London, HMSO.

Department for Environment, Food and Rural Affairs (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance. London, HMSO.

Department for Environment, Food and Rural Affairs and Environment Agency (2004) Model Procedures for the Management of Land Contamination. Bristol, Environment Agency. (Contaminated Land Report 11).

Department of the Environment, Industrial Profiles (1995) Metal Manufacturing, refining and finishing works: Iron & Steel works and Non-ferrous metal steel works, Railway Land and Gas works, coke works and other coal carbonisation plants. DOE.

Environment Agency (2013) What's in your backyard? [Internet], Bristol, Environment Agency. Available from: <<http://www.environment-agency.gov.uk/homeandleisure/37793.aspx>> [Accessed October 2013].

Environment Agency Remedial Target Methodology Calculation spreadsheets, v3.1, October 2006.

Environment Agency (2009) River Basin Management Plan: Western Wales River Basin. Annex B: Water Body Status Objective. [Accessed October 2013]

Environmental Protection Act 1990 (c. 43) London, HMSO

Jacobs Babtie, Port Talbot Peripheral Distributor Road – Stage 2 Ground Investigation Interpretative Report (2006).

National House Building Council and Environment Agency (2008) Guidance for the Safe Development of Housing on Land Affected by Contamination. NHBC, Environment Agency and Chartered Institute of Environmental Health. (R&D Publication 66).

Neath Port Talbot Unitary Development Plans 2005 Map 8 May07, Neath and Port Talbot County Council

Port Talbot Peripheral Distributor Road – Stage 2: Environmental Statement. Volume 1 – Main Report Rev A; Chapter 15 Ground Contamination (2010)

Stone, K. and others (2009) Unexploded ordnance (UXO): a guide for the construction industry. London, CIRIA. (Publication C681).

Zetica Map (October 2013) Regional Unexploded Bomb Risk – Glamorgan. Long Hanborough, Zetica.

Appendix 9.1 Geo-environmental Desk Study (Envirocheck on CD)