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Project	AFAN LIDO, PORT TALBOT PHASE I GEOENVIRONMENTAL ASSESSMENT
Client	NEATH & PORT TALBOT COUNCIL



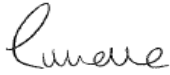
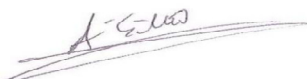
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AFAN LIDO, PORT TALBOT PHASE I GEOENVIRONMENTAL ASSESSMENT

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CONTENTS

EXECUTIVE SUMMARY	i
1.0 INTRODUCTION	1
1.1 Instruction	1
1.2 Scope of Works	1
1.3 Report Layout	1
1.4 Limitations	1
2.0 PHASE I ASSESSMENT	2
2.1 Site Location	2
2.2 Site Description	2
2.3 Geology	2
2.4 Hydrology and Hydrogeology	3
2.5 Site History	3
2.6 Coal Mining Report	4
2.7 Environmental Database	4
3.0 PRELIMINARY CONCEPTUAL MODEL	6
4.0 GEOTECHNICAL AND ENVIRONMENTAL CONSIDERATIONS	8
4.1 Proposed Development	8
4.2 Anticipated Ground Conditions	8
4.3 Geotechnical Considerations	8
4.4 Environmental Considerations	9
4.5 Recommendations for Further Investigation	10
FIGURES	
2.1 - Site Location Plan	
APPENDICES	
A – Photofile	
B – Historic Maps	
C – Coal Mining Report	
D – GroundSure Reports	

EXECUTIVE SUMMARY

Client	Neath & Port Talbot County Borough Council
Site	Afan Lido, Port Talbot, South Wales
Site Location	Approximate Grid Reference E274678, N189504.
Proposed Development	No development plan exists at present, but likely to be commercial and leisure.
Site History	Historically sand dunes up to development of Lido in 1960's (recently demolished and site cleared). Site currently contains a small sub-station (c.1961), car park areas, some fly tipping and a bund of unknown content. A further sub-station (c.1952) lies just north of the site and several unknown tanks once lay just north east of the site.
Geology	Made Ground - Unknown type and depth estimated as GL-1m. Superficial - Wind Blown Sands/Tidal Flat Deposits/Diamicton, to 25-30m estimated depth. Solid – Coal Measures.
Environmental Considerations	The site lies over a Secondary 'A' aquifer and is adjacent to the Bristol Channel. There are no water abstractions noted close to the site. The site is almost certainly subject to saline intrusion. Existing Made Ground – The site could potentially be underlain by Made Ground. There is also an existing bund. The chemical composition of these is not known. Invasive Species –Japanese Knotweed or other invasive species have not been observed on site. A detailed site survey should be completed during the spring to confirm the absence of Knotweed. Car Parking –There is the potential of hydrocarbon impact from fuel oils/lubricant leakage from the existing car parking areas. Asbestos – Asbestos could potentially be present within the electricity substation in the eastern corner. An asbestos survey should be carried out, and the shallow soils analysed for its presence (from demolition of former buildings). Contemporary Trade Entries – Electricity sub-stations (both on- and off- site) could be sources of contamination. Above Ground Storage Tanks – Tanks were noted on the adjacent site to the north. The potential for contamination from these tanks to be present in the shallow depth soils should be considered in any site investigation and risk assessment. Ground Gases - Precautions due to the presence of ground gases may be a consideration at this site, due to the probable presence of Made Ground. Installation of gas monitoring standpipes and an appropriate gas-monitoring regime should be completed as part of future site investigations. Radon Gas – Radon protection measures are not required.

Geotechnical Considerations	Foundations - Made Ground and loose windblown sand are unlikely to provide an adequate bearing stratum for conventional shallow foundations. Ground improvement or piled foundations are likely to be required. The risk to the site from coal mining is considered as negligible. An intrusive site investigation should be completed to confirm the soil profile across the site. Floor Slabs - Ground bearing floor slabs may be appropriate depending on the nature of the shallow soils. Buried Concrete - Special measures for the protection of buried concrete may be required. Testing to establish soil chemistry is required to assess this risk. Site Drainage – Whilst the Wind Blown Sand should be suitable for soakaway drainage, the potential presence of groundwater at ~2m-3m depth and it's tidal nature may negate this. Excavation stability - Excavation stability could be an issue in the loose beach deposits. If deep excavations are required significant groundwater control measures could be required. Flood Risk - The promenade is a boundary to a Zone 3 flood plain. A flood risk assessment may be required by the local planning authority
Risk Rating	The general geotechnical risk is considered to be low/medium. Caution in this respect arises principally from the possible presence of running sand in the drift deposits, their loose density and potential for shallow (~2-3m) groundwater. The general risk of significant chemical contamination is considered low.
Site Investigation Recommendations	• Trial Pitting including in-situ strength testing, soakaway potential and in-situ CBR testing. • Cable percussion boreholes with SPT testing. • Groundwater and gas monitoring standpipe installations. • Gas and groundwater monitoring over a tidal cycle. • Geotechnical laboratory testing that is recommended includes pH and water soluble sulphate, Atterberg limits, gradings and natural moisture content. • Contaminated land testing that is recommended includes a general indicator suite, speciated Total Petroleum and Polyaromatic Hydrocarbons, asbestos screening and PCB's.

1.0 INTRODUCTION

1.1 Instruction

Clarkebond (UK) Ltd was commissioned by Neath & Port Talbot County Borough Council to undertake a Phase I Geoenvironmental Assessment on a site known as Afan Lido, Port Talbot, Gwent.

1.2 Scope of Works

The objectives of the investigation were to determine the sub-surface conditions in respect of:

- Preliminary geotechnical advice relating to the anticipated ground conditions
- Preliminary contamination assessment to consider potential significant pollutant linkages arising from the historic usage of the site and surroundings.

1.3 Report Layout

Section 2.0 - provides a record of the Phase I assessment including the site history.

Section 3.0 - presents a preliminary Conceptual Model for the site.

Section 4.0 - details the anticipated geotechnical and environmental conditions.

1.4 Limitations

This report is provided for the benefit only of the party to whom it is addressed and we do not accept responsibility to any third party for the whole or any part of the contents and we exercise no duty of care in relation to this report to any third party.

This assessment has been based to a large extent on third party data. This data has been taken at face value and has not been subjected to any validation.

Where intrusive investigations have been completed, information, comments and opinions given in this report are based on the ground conditions encountered during the site work and on the results of laboratory and field tests performed during the investigation. However, subsoils are inherently variable and hidden from view such that no investigation can be exhaustive to the extent that all soil conditions are revealed. Conditions may therefore be present beneath the site that were not apparent in the data reviewed as part of this assessment. In particular, it should be noted that groundwater levels vary due to seasonal and other effects and may at times differ to those measured during the investigation.

2.0 PHASE I ASSESSMENT

2.1 Site Location

The site is located approximately 1km to the south west of Port Talbot town centre. It has an approximate National Grid Reference of E274678, N189504. A site location plan is presented as Figure 2.1.

2.2 Site Description

The site was visited on 6th September 2013 and the following site description completed. The weather at the time was sunny. Typical photos of the site are included in Appendix A.

The site is located close to the coast. It can be subdivided into two areas, the northwest which was the former Lido site and the southeast which is mainly open ground and a former car park. The sites are separated by Channel View and is bound by The Princess Margaret Way to the south west.

The northwest site measures approximately 125m by northeast to southwest and 135m southeast to northwest, equating to an area of approximately 1.6hectares. It is currently completely surrounded by wooden hoarding. All the buildings within the site have been demolished and cleared with no spoil heaps remaining. Along the southwest boundary with The Princess Margaret Way are some soft landscaping area and, the majority of the rest of the site is either tarmac hardstanding or levelled hardcore. A gas governor structure lies in the north east of this area and there is also minor fly-tipping in that area.

The northeast end of this part of the site drops down by approximately 1m in elevation. In the northern corner the site steps down and in the eastern corner there is a sloping area of grass.

The southwest site measures approximately 42m northeast to southwest and 240m southeast to northwest, equating to an area of about 1 hectare. At the northwest end there is a tarmac car park, which currently services a small portakabin building used as a gym. The rest of the site is open ground with some low vegetation growth, interspersed with small areas of tarmac. There is another significant area of tarmac at the south eastern end. There is a small electricity substation in the eastern corner.

There is a small low bund of material stacked against the boundary wall to the eastern end.

The northern site is bound to the north west by a football ground and an indoor bowls site together with some housing, a restaurant and a small electric sub-station. To the south west is a promenade play area beyond which is a beach. To the north east of the southern site is a school grounds and off the southern corner is housing, on the opposite side of The Princess Margaret Way.

The walk over did not reveal any evidence of Japanese Knotweed or other invasive species and no evidence of contamination in the form of spills or staining was noted.

2.3 Geology

The geology of the site is shown in the Groundsure report which are extracted from the British Geological Survey Digital Geological Map of Great Britain at 1:50,000 scale.

The site is directly underlain by superficial blown sand deposits. This is underlain by the South Wales Middle Coal Measures Formation comprising mudstones, siltstones and sandstones of Carboniferous age.

There are several borehole records available close to the site, mainly completed by water works or for cola exploration. The deep boreholes suggest at least 30m of drift deposits above the bedrock. Boreholes completed for the promenade proved 12-13m of sands. No strengths are indicated, although in the deep boreholes running sands are referred to and in the promenade boreholes peat is also referred to.

2.4 Hydrology and Hydrogeology

The nearest surface water features to the site are the Bristol Channel and also the Afon Afan which enters the sea some 500m to the south. Due to the proximity, the potential risk to the former receptor from potential contamination on site could be deemed to be medium.

Guidance from the Environment Agency indicates that the both the superficial and bedrock deposits are classified as Secondary 'A' aquifers. The definition is *permeable layers capable of supporting water supplies on a local rather than strategic scale*.

There are no water abstractions noted close to the site and since the site is almost certainly subject to saline intrusion, then the site sensitivity in terms of the it being a potential contaminating source to the aquifers is regarded as low.

2.5 Site History

Historical maps of the site area have been obtained via Groundsure and copies are included as Appendix B. Pertinent information determined from review of these maps is set out in the following table:

Table 2.1 - Historic Mapping Review

Date	On-site	Off-site
1881	The site comprises dunes and mudflats	Dunes and mudflats
1899	No significant change	There is some development of a track and railway to the southeast which leads to the north pier. A band stand is indicated to the south.
1917-1921	No significant change	A hotel and skating rink has been built close to the southern corner of the site. There is a brick works indicated remote to the north
1939	No significant change	Some additional development to the southeast of the site
1952-1955	No changes apart from in the northern area the site encroaches into a site that contains several tanks (no tanks shown on our site).	There has been significant development of residential housing and a school to the northeast, and southeast. There is an industrial unmarked site adjacent to the north east which contains 6no. tanks. There is an electricity sub-station immediately north.
1961-1966	The lido and indoor sports centre is shown (with slopes down to the latter) and the southern site is indicated as a car park. Channel View now cuts the site in two. A small electric sub-station now lies in the south eastern corner of the site.	The tanks are not now shown to the north east. The promenade is being developed to the southwest. The Princess Margaret Way has been built.
1971	No significant change	No significant change
2012	No significant change	No significant change apart from retail development to the northwest.

In summary the site has remained undeveloped until the Lido and sports centre were built sometime before 1961. The site is within an area used for sand works and brick works and this should be considered. The 1955 maps show an unmarked site to the north which contained tanks and onto which our current site slightly encroached (no tanks were shown within our site). This tank site has been redeveloped as a football ground and whilst it is possible that any contamination issues regarding these tanks may have been dealt with at that time, the

presence of potential contamination from the tanks should be considered in any future risk assessment and investigations.

In the surroundings an electric sub-station appeared sometime before 1952 and remains to date.

2.6 Coal Mining Report

A coal mining search was commissioned from The Coal Authority, a copy of which is included in Appendix C.

The report confirms that the site is not within the likely zone of influence of past or present mining and thus the risk to the site is considered as negligible.

2.7 Environmental Database

A Groundsure report was commissioned to provide an indication of the site history and surrounding land uses available on the public registers. The report provides data from a number of service providers including the British Geological Survey, Environment Agency and English Nature. The report is included in Appendix D.

The location of data point references is provided relative to the National Grid Reference for the site centre. The search radius extends 1km from the site boundary.

Table 2.2 below indicates the risk scoring used on the potential pollutant linkages identified from the historic data search. The degree of risk (R) is calculated by multiplying the likelihood (L) with the effect (E):

Table 2.2 - Degree of risk (R) = Likelihood (L) x Effect (E)

Likelihood (L)	Description	Probability	Effect (E)	Description	Increase In Cost And Time
5	Almost certain	>70%			
4	Probable	50-70%	4	Very high	>10%
3	Likely	30-50%	3	High	4-10%
2	Unlikely	10-30%	2	Low	1-4%
1	Negligible	<10%	1	Very low	<1%
Risk (R)	Risk Level	Action			
1-5	Trivial	None			
6-10	Significant	Undertake appropriate mitigation measures to reduce the risk level by appropriate on-site practice at little additional cost.			
>10	Substantial	Designers should take such risks into account and avoid or reduce risk level to acceptable levels. Additional resources required.			

The following table (overleaf) provides a summary of the data reference points, together with an indication of the hazard, likelihood, severity and degree of risk.

In summary the environmental report highlights the main risk to the site are the electricity sub stations which can be a source of asbestos, hydrocarbons and Polychlorinated Biphenyls (PCB's) and the presence of these contaminants should be investigated. A pollution incident from 2009 is noted, although this was smoke and there is unlikely to be any residual risk.

Although the site is not within a designated flood risk zone, the promenade marks the extent of a Zone 3 flood plain. A flood risk assessment may be required by the local planning authority.

No radon protective measures are required.

Table 2.3 - Environmental Data Review

Data Type	Distance from site	Hazard	Likelihood	Effect	Degree of risk	Mitigation measures
Substantiated Pollution Incident Register	On site	Contamination from pollution incidents – 2009, Pollutant=smoke	5	1	5	None required
Extreme flooding from rivers or sea without defences.	On site	Risk from Flooding – Site within 100m of Zone 3 Flood Plain	2	3	6	Undertake Flood Risk Assessment
Registered Landfill sites, Waste Transfer Stations		None within 500m	--	--	--	None required
Shallow Mining Hazard	On site	Risk from past & current coal mining	2	3	6	None Required
Potential for running sand ground stability hazards	On site	Ground instability induced by running sand in excavations	3	2	6	Site Investigation
Radon Affected Areas	On site	1-3% Above action levels	2	2	4	No Radon Protective Measures required.
Contemporary Trade Directory Entries	On site and 29m	Electricity sub stations in the southeast corner and 29m to the north	2	3	6	Site Investigation
Environmentally Sensitive Areas		None	--	--	--	None required

3.0 PRELIMINARY CONCEPTUAL MODEL

The site characterisation attempts to identify potential previous and existing site sources of contamination. The conceptual model links the identified sources likely to cause significant possibility of significant harm via pathways to identified critical receptors. The conceptual model is therefore based on a number of identified source-pathway-receptor scenarios. For land to be classified as contaminated a significant pollutant linkage will need to be identified which will include each component of the conceptual model. The absence or removal of a source or interception of a pathway will 'break' the pollutant linkage.

The conceptual model is characterised by identification of the following:

- **On-site** sources, which may impact **on-site** receptors via plausible pathways.
- **On-site** source, which may impact **off-site** receptors via plausible pathways.
- **Off-site** sources, which may impact **on-site** receptors via plausible pathways.

In the event of a change of land use assessment will be required of the new site development layout within the context of introducing new exposure pathways. The planning regime will require assessment of the site to ensure any new development will not be classed as contaminated land.

A preliminary conceptual model is indicated in Tables 3.1, 3.2 and 3.3. This indicates the site and environs are considered as posing trivial/significant risk with respect to contamination. Indicators above trivial risk include:

- Composition of made ground on, or adjacent to, the site and potential contamination related to the former tanks (off-site) to the north east, the electricity sub-station in the south eastern corner and the further sub-station just off-site to the north. There is a small bund of material of unknown content against the wall along the boundary wall with the school which should be considered in any risk assessment and site investigation

Table 3.1 - On-Site to On-Site Source - Pathway - Receptor Model

Source 1	Source 2	Migration Pathway	L	Exposure Pathway	E	Receptor	R
Made Ground soils and former site uses	Heavy metals and/or hydrocarbons PCB's from sub stations	Migration of liquids & vapours through unsaturated zone; Migration through saturated zone/groundwater; Preferential flow paths (e.g. drains, service runs etc.)	2	Migration to groundwater	3	Groundwater and/or surface waters, and/or eco-system	6
Made Ground soils and former site uses	Heavy metals and/or hydrocarbons Asbestos and PCB's from sub stations	Ingestion of soil & household dust; Dermal contact with soil and household dust; Inhalation of indoor vapours and household dust; Inhalation of outdoor vapours and fugitive dust.	3	Migration to site users	3	Human beings	9

Table 3.2 - On-Site to Off-Site Source - Pathway - Receptor Model

Source 1	Source 2	Migration Pathway	L	Exposure Pathway	E	Receptor	R
Made Ground soils and former site uses	Heavy metals and/or hydrocarbons PCB's from sub stations	Migration of liquids & vapours through unsaturated zone; Migration through saturated zone/groundwater; Preferential flow paths (e.g. drains, service runs etc.)	2	Migration to groundwater	3	Groundwater and/or surface waters, and/or eco-system	6
Made Ground soils and former site uses	Heavy metals and/or hydrocarbons Asbestos and PCB's from sub stations	Ingestion of soil & household dust; Dermal contact with soil and household dust; Inhalation of indoor vapours and household dust; Inhalation of outdoor vapours and fugitive dust.	2	Migration to adjacent land users	3	Human beings	6

Table 3.3 - Off-Site to On-Site Source - Pathway - Receptor Model

Source 1	Source 2	Migration Pathway	L	Exposure Pathway	E	Receptor	R
Made Ground soils and adjacent site uses	Heavy metals and/or hydrocarbons, PCBs	Migration of liquids & vapours through unsaturated zone; Migration through saturated zone/groundwater; Preferential flow paths (e.g. drains, service runs etc.)	2	Migration to groundwater	3	Groundwater and/or surface waters, and/or eco-system	6

4.0 GEOTECHNICAL AND ENVIRONMENTAL CONSIDERATIONS

4.1 Proposed Development

There are no firm development proposals for the site at present, although it is likely to be developed for leisure or commercial usage.

4.2 Anticipated Ground Conditions

The anticipated ground conditions for majority of the site are summarised in the table below and are based on the available geological information and previous site investigation data from nearby sites.

Depth (m)	Brief Description
0.00 to 1.0/2.0	POTENTIAL MADE GROUND
1.0/2.0 to 7.0/8.0	Fine SAND locally with pebbles and peat (BEACH DEPOSITS)
7.0/8.0 to 25-30	Interbedded Blue sandy Clay with sand horizons (DIAMICTON)
Below 25-30	Coal Measures Bedrock

The nearest boreholes with geotechnical testing suggest that the windblown sands are typically loose, with the sands and gravels below that being medium dense to dense. Some of the boreholes in the vicinity in the same anticipated geology describe running sands at depth.

Groundwater is likely to be encountered at 2-3m below existing ground levels and is likely to be saline and have a tidal influence.

4.3 Geotechnical Considerations

The following geotechnical aspects should be considered:

- Made Ground may be present beneath the site, however this may be limited in thickness as the site was only undeveloped prior to the Lido. Brick works and sand extraction has been noted locally and there is thus the potential for backfilled pits to be present within the site confines.
- Based on boreholes in similar geology within the Afan area, the beach deposits are generally described as loose and for any development with moderate loads, are unlikely to be suitable as a bearing stratum. An intrusive site investigation should be completed to confirm the soil profile across the site.
- If significant organic or soft clays are not present then ground improvement maybe suitable within the sands and gravels. Following treatment design bearing capacities of 125-150kN/m² may be achievable. Moderate to high structural loadings may require a piled foundation solution.
- Ground bearing floor slabs may be appropriate depending on the nature of the shallow soils.
- Excavation stability could be an issue in the loose beach deposits. If deep excavations are required significant groundwater control measures could be required.

- Soakaway drainage may be possible in the beach sand deposits. If considered, then soakaway testing should be completed in line with BRE Digest 365: *Soakaway Design*, 2007. Consideration will have to be made to the groundwater level and its tidal fluctuation.
- The promenade is a boundary to a Zone 3 flood plain. A flood risk assessment may be required by the local planning authority
- Special measures for the protection of buried concrete may be required. Chemical analysis of the Drift Deposits should be completed and the grade of concrete assessed in line with BRE Special Digest 1, *Concrete in Aggressive Ground*, 2005, 3rd Edition.

4.4 Environmental Considerations

The desk study completed to date highlights the following sources of contamination on site:

Existing Made Ground – The site could potentially be underlain by Made Ground, the chemical composition of which is not known.

Invasive Species – Japanese Knotweed has not been observed on site. A detailed site survey should be completed during the spring to confirm its absence. It is commonly spread by fly tipping, soil movements about and to off-site, and via inappropriate treatments. Where poorly treated prior to construction, stands have regrown post construction causing significant structural damage, failure in some instances and loss of use.

Car Parking – There is the potential of hydrocarbon impact from fuel oils/lubricant leakage from the existing car parking areas.

Asbestos – Asbestos could potentially be present within the electricity sub station in the eastern corner. An asbestos survey should be carried out, and the shallow soils analysed for its presence (it could also have been present in the former buildings on site and following demolition may now be present in the ground).

Above Ground Storage Tanks – Tanks were noted on the adjacent site to the north east. Whilst contamination issues may have been dealt with in the development of that site and the lido site, the potential for contamination from these tanks to be present in the shallow depth soils should be considered in any site investigation and risk assessment. Sampling and contamination testing along the north eastern boundary should be completed to confirm or deny this.

Contemporary Trade Entries – The environmental database search found electricity sub stations that could be sources of contamination (both on- and off- site). If the underlying geological conditions were right, there could be the potential of contaminant migration beneath the site.

Ground Gases - Precautions due to the presence of ground gases (Carbon Dioxide, Methane and Hydrogen Sulphide) may be a consideration at this site, due to the probable presence of Made Ground. Installation of gas monitoring standpipes and an appropriate gas-monitoring regime should be completed as part of future site investigations.

Radon Gas – The environmental database showed that 1-3% of homes in the site vicinity were above the action level. Therefore, radon protection measures are not required.

Summary

The general risk of significant contamination at this site is considered to be low. The potential impact to the groundwater and local environment should be assessed by appropriate analysis of the soils and groundwater together with a risk assessment based on the site-specific criteria.

4.5 Recommendations for Further Investigation

Based on the desk study completed to date, the following broad scope of investigation is recommended in order to assess the environmental and geotechnical risks at this site:

- Trial Pitting including in-situ strength testing, soakaway potential and in-situ CBR testing.
- Cable percussion boreholes with SPT testing.
- Groundwater and gas monitoring standpipe installations.
- Gas and groundwater monitoring over a tidal cycle.
- Geotechnical laboratory testing that is recommended includes pH and water soluble sulphate, Atterberg limits, gradings and natural moisture content.
- Contaminated land testing that is recommended includes a general indicator suite, speciated Total Petroleum and Polyaromatic Hydrocarbons, asbestos screening and PCB's.

FIGURES

2.1 - Site Location Plan

APPENDICES

Appendix A – Photofile	(18 A4 sheets)
Appendix B – Historic Maps	(30 A3 Sheets)
Appendix C – Coal Mining Report	(4 A4 Sheets)
Appendix D – GroundSure Reports	(73 A4 Sheets)

Appendix A – Photofile (18 A4 sheets)

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