At this date, the surrounding area is largely agricultural in nature with numerous collieries, coal pits and air shafts noted to the north, east and west, with associated infrastructure.

Emlyn Colliery is first recorded on the site in mapping dated 1905, recorded as a series of earthworks, railway sidings and associated buildings, predominantly in the eastern half of the site. This area is later referred to as Emlyn Colliery and Brick Works in mapping dated 1913, which shows gradual development and expansion through the 1920s and 1930s. Quarries are also noted in the eastern extent of the site and the north-western corner of the site.

By 1965, the Emlyn Colliery and Brick Works is no longer named, however areas of filled ground / embankments and several buildings remain. A pond is also noted in the southern area of the site. The railway sidings have largely been removed and the Branch line present along the northern boundary is noted to be dismantled.

Mapping dated 1992, records the entire site as Opencast Workings, however it should be noted that the coal Authority do not record any surface workings on the site. This designation is likely to reflect the presence of colliery spoil placed across the site.

3.3 SUMMARY OF ENVIRONMENTAL SETTING

3.3.1 Introduction

Regulatory authority information relevant to the site and its surroundings has been obtained from the undertaking of an environmental database search (Groundsure™). The information is summarised below, and the environmental database records are enclosed in Appendix B.

The site is located within a primarily mixed residential and agricultural area, however localised industrial land uses are recorded in the immediate surrounding area, including a concrete batching works, as such only limited entries are recorded in the Groundsure report.

3.3.2 Waste

The Groundsure report provides information in relation to active and historical waste management facilities and landfill sites.

Details are provided with regards to a historical landfill on the site recorded between 1940 and 1952, only limited information is available however waste types are noted to include inert, industrial, commercial, household and special. This designation relates to the north eastern corner of the site which is recorded as a quarry within historical mapping.

3.3.3 Environmentally Sensitive Areas

The site is not located within any environmentally sensitive or areas of environmental designations.

3.3.4 Flooding

The absence or presence of flooding potential at the site is summarised in the table below.

Table 3-1 - Summary of Flooding Potential

Designation	On Site	Detail
Flooding at Surface (from Groundwater)	Yes	Negligible risk is recorded across the majority of the site with the exception of a small area along the western boundary which is defined as Low risk.
Surface water flooding	Yes (limited extent)	Only limited areas of the site are recorded as being at risk from flooding from surface water, with the highest recorded risk 1 in 30 year: 0.3 – 1.0m

3.4 UNEXPLODED ORDNANCE

Based on freely available mapping data from Zetica UXO (Zetica UXO, 2008), the site is located within a Low Risk Area with regards to Unexploded Ordnance (UXO). A 'Low Risk' area is defined by Zetica as:

> *'Low risk regions are those with a bomb density of up to 10 bombs per 1000 acres. These areas are considered to have a significant but low UXB risk. In general, further action to mitigate the risk is considered prudent, although not essential. Care is required when assessing the risk for specific sites where the risk may be higher because of local wartime activity'.*

4.0 PREVIOUS INVESTIGATIONS

A number of investigations and remedial works have been undertaken on the site and this section provides a review of the available reports, data and plans within the context of the proposed development.

It is assumed any reliance on the previous assessments and reports prepared for the site have since expired and as such the information is taken in good faith and Tetra Tech can no longer guarantee its accuracy. Many of the previous reports refer to former Phasing of the development (1-3) and so to aid the reading in understand which part of the site the report covers, we have included an indicative former Phasing Plan as Figure 2.

The following table provides a list of the reports which are discussed in more detail in the following sections.

Table 4-1 – Summary of Previous Reports

Author	Date	Title
AM Johnson	July 1992	Geological Report on the South-Eastern part of the Emlyn Brickworks
SRK Consulting	Oct 2001	Mining Geotechnical and Design Report
Memchem.		Asbestos Survey Report
Esterling Geological Associates	June 2002	Site Contamination Report
Soil Environment Services	Sept 2004	Contaminated Land Risk Assessment
Soil Environment Services	Nov 2004	Contaminated Land Risk Assessment (waste management update)
Soil Environment Services	Nov 2004	Contaminated Land Risk Assessment (scrap yard hydrocarbon assessment)
Soil Environment Services	Nov 2004	Contaminated Land Risk Assessment (cadmium risk assessment)
Land Quality Management for Soil Environment Services	Nov 2004	Final Report: review of the risk assessment for soil cadmium
Soil Environment Services	Jan 2005	Contaminated Land Risk Assessment (silica waste re-assessment)
WYG	Aug 2005	Geo-technical factual and interpretative report.
WYG	Sep 2005	Mining Summary Report
WYG	Apr 2007	Validation Report for Earthworks
Soil Environment Services	Jan 2007	Validation Report
Soil Environment Services	Aug 2007	Verification Report
Soil Environment Services	Nov 2007	Summary Report
Ground Investigation Wales	November 2013	Assessment of Mining Subsidence Risk
Earth Science Partnership	December 2017	Remedial Strategy to Mitigate Risks from Coal Mining

4.1 GEOLOGICAL REPORT ON THE SOUTH-EASTERN PART OF THE EMLYN BRICKWORKS – A. M. JOHNSON (JULY 1992)

4.1.1 Report Scope

To determine the geology and existence of abandoned mine workings under the south-eastern sector of the site. This report does not cover the whole of the present site but is limited to the south-eastern area of the Emlyn Brickworks.

4.1.2 Report Conclusions & Recommendations

- The Green Vein seam is present and was worked beneath the entire area and a thickness of 1m is assumed for void migration.
- The Big Vein seam was shallowly worked beneath the area to outcrop on the northern side of the anticline and a thickness of 2m is assumed.
- Where the strata are shallow dipping or horizontal the Green Vein is likely to have been worked very closely to the surface.
- It is unlikely that there are any strata below the Green Vein which will be of concern.
- There is likely to be only a very small area of the site which could be developed safely without treatment. This area is at the very centre of the anticline. Even in this area the absence of the Green Vein will have to be verified.
- Grouting of the old workings, voids and broken ground will be expensive because of the steep dips.
- It should be possible to excavate the old workings over much of, but not all, the area to permit development.

4.2 MINING GEOTECHNICAL AND DESIGN REPORT – SRK CONSULTING (OCTOBER 2001)

4.2.1 Report Scope

To provide input to the mining geotechnical assessment of the area and to identify the preliminary mining design parameters, to design and supervise a program of drilling and testing and to update the mining design study.

4.2.2 Report Conclusions & Recommendations

The report presented conclusions and recommendations for the exploitation of remaining coal reserves present on site by means of open cast mining. Conclusions and recommendations relate to coal, sandstone and spoil quantities and quality, mining operations, pit and overburden stockpile design and the environmental aspects of mining.

4.3 GEOTECHNICAL & DESIGN REPORT – ESTERLING GEOLOGICAL ASSOCIATES (OCTOBER 2002)

4.3.1 Report Scope

To present the results of the accumulated work completed to date by all relevant parties, (The Coal Authority, Wardell Armstrong, Esterling Geological Associates and SRK Consulting), and to make recommendations with regard to the mining methods and design, phasing of earthworks and backfilling procedures to be adopted. The

resulting geological model enables accurate estimates of volumes of coal, spoil and sandstone/mudstone/siltstone to be made together with waste volumes and related tonnage.

4.3.2 Report Conclusions & Recommendations

Conclusions and recommendations are presented for the reclamation and redevelopment of the site. which relate to coal, sandstone and spoil quantities and quality, excavation scheme, stabilisation of the shallow worked zone near Gorsddu Road, pit and overburden stockpile design and the environmental impact.

4.4 COAL AUTHORITY REPORT (JANUARY 2003)

4.4.1 Report Findings

Identifies seven shafts on site with a further one shaft close to the western boundary of the site. In addition, the report identifies four adits on site. The report also shows the two adits (ref: 049 & 050) were backfilled in 1979 to an unknown specification, and one shaft (ref: 058) was backfilled in 1972 to an unknown specification and resealed in 1979.

4.5 SITE MINING REPORT – ESTERLING GEOLOGICAL ASSOCIATES (JANUARY 2004)

4.5.1 Report Scope

To present the results of the accumulated work completed to date by all relevant parties, (The Coal Authority, Wardell Armstrong, Esterling Geological Associates and SRK Consulting), and to make recommendations with regard to past mining activities on the site.

4.5.2 Report Conclusions & Recommendations

The conclusions and recommendations presented in the report relate to the extent of works needed to stabilise the southern sector of the site and the treatment of known shafts and adits on site.

The conclusions included:

- The Stanllyd seam has been worked below the Green Vein but at such a depth as not to jeopardise the stability of the surface in this sector.
- Although the Green Vein is only 1m thick it has been worked extensively and the associated roadways would have been at least 2m high. This void would easily pass upwards by progressive collapse to reach the workings in the Big Vein.
- Workings in the Big Vein were a minimum of 3m high, making the combined void height 4-5m.
- The hydrogeological data for the site indicates that the water table is at a depth of at least 100m. Accordingly, groundwater fluctuations will have little or no effect.
- No traces of gas have been recorded during the drilling of boreholes at this site.
- Workings may be present in areas beyond and outside those indicated in the abandonment plans.
- Stability calculations indicate that a 20m stand off to Gorsddu Road is to be maintained. (This area was probe drilled and locally grouted in 2005/06 and therefore this recommendation was superseded by the WYG Mining Constraints Plan – 2007)

The following recommendations were presented with in the report.

- The minimum extent of the area recommended for stabilisation works in the southern sector of the site (this has been further assessed and carried through to Constraints Plan contained within the WYG Validation Report).
- All mine entries will be removed within the cut or treated and capped/sealed where they lie outside the proposed cut according to Coal Authority Specification.
- Special care must be observed at all times to monitor excavation work in case unrecorded mine entries are encountered.
- Gas monitoring to be undertaken at the beginning of each shift and at regular intervals during the normal working day.
- The cut is to be designed by a suitably qualified engineer.
- Following stabilisation, re-grading and compaction rigid rafts be used for the foundations of all habitable dwellings across the site.

4.6 CONTAMINATED LAND RISK ASSESSMENT. SES (JULY 2004)

4.6.1 Report Scope

This report presents a Contaminated Land Risk Assessment based on a Desk Top Study and intrusive investigation.

The report presents a Conceptual Site Model, outlining the key Sources, Pathways and Receptors identified through a review of available data and observations and testing from an intrusive investigation.

Historical sources of contamination are noted to be linked to the legacy of coal mining, associated railway infrastructure and materials brought to the site for brick making.

Contemporaneous sources of contamination were considered to be associated with the on site activities on the site, noted to be brick cutting works and a small vehicle dismantlers. It also notes the presence of materials deposited on the site associated with former land uses including, a silica based waste from NIPON Glass, effluent rolling mill sludge from ALCAN Aluminum, water treatment sludge from the water authority and concrete asbestos building cladding.

Sampling of soils was undertaken in two areas,

1. The main colliery spoil covered area, noted to include colliery spoil which has undergone soil washing on at least two occasions. Samples were obtained from depths ranging from 0.25m and 0.5m bgl.
2. From deposited materials in known locations in the east of the site.

4.6.2 Conclusions

The report presents the following conclusions:

- Within the colliery spoil, concentrations of arsenic are recorded in excess of the screening value[1] for a residential development with plant uptake, but below the threshold for a residential development with no plant uptake.
- The colliery spoil is relatively dense and not expected to have a high hydraulic conductivity, indicating that surface water run off will be more prominent than infiltration into the ground.
- A pH of 3.1 was recorded in a surface water sample obtained from the site.

[1] Screening value applicable at the time of writing.

- There is no immediate risk to humans or the environment related to the rolling mill effluent, silica waste or water authority waste in their current locations, however movement of this material as part of the development could potentially result in conditions which may cause risks to human health and controlled waters to become realised.
- No risks were associated with the vehicle dismantlers in the east of the site.
- The report makes reference to the MecChem Laboratories Report which considered the presence of asbestos cement on the site and provides recommends the removal of this material.

The report states that there are currently no significant risks from the site, but provides a number of recommendations for risk reduction:

1. An assessment of the volumes and pH of waters leaving the site to inform the requirement for any treatment works,
2. Removal of the silca and rolling mill waste (referred to as hydrocarbon waste).
3. Controlled excavations to minimise the generation of dust on the site.
4. Adoption of good practices by site workers to minimise exposure to soils.
5. Requirement for no colliery spoil to remain within public spaces and use of cover of uncontaminated soil or soil making materials for garden areas.

4.7 CONTAMINATED LAND RISK ASSESSMENT – ADDENDUM 2A. SES (SEPTEMBER 2004)

The report provides additional information as requested by the Contaminated Land Officer for Carmarthenshire County Council.

The report includes information on:

- The potential contaminants associated with a brickworks,
    - Considered to be related to materials brought to the site for brick making, namely ash, clinker, as well as risks associated with any heavy industry.
- Identification of materials brought to site for the brick making process.
    - Silica based waste from NIPON Glass, Cardiff
    - Effluent rolling mill sludge from ALCAN aluminium, Rogerstone, Newport.
- Justification for the use of a site-specific risk assessment for nickel;
    - SES state that they endeavour to produce site specific SGV for projects where possible. The calculated screening value for nickel was noted to be several orders of magnitude more lenient that the SGV, although it is also noted that the concentrations were below both the calculated value and the industry standard SGV.
- Calculation of the 95th percentile for soil arsenic and cadmium as per the relevant CLEA guidance at the time of reporting.
    - This information is provided in the report and notes that the 95th percentile concentrations of arsenic are below the SGV value.
    - With regards to cadmium the report states a 95th percentile concentration of 0.63mg/kg compared to a site specific screening value of 0.6988mg/kg.
- Re-evaluation of the risk associated with concentrations of lead in the silica waste on site.
    - The report states that the lead is considered to be locked within the crystal structure of the silica, however it recommends the removal of the material from the site.
- Statement to agree ongoing site contamination assessment during the development
- Confirmation that the previous assessments adhered to BS10175.

4.8 WASTE REMOVAL AND DISPOSAL STRATEGY. SES (OCTOBER 2004)

This document provides a summary of the material scheduled to be removed from the site for off site disposal and notes the following waste types which amount to approximately 1,300 tonnes of material.

- Rolling Mill sludge originating from ALCAN aluminum referred to as hydrocarbon waste (approximately 1000 tonnes)
- Silica waste originating from NIPON glass (approximately 300 tonnes).

The works were scheduled to commence on 18th October 2004.

The report provides a summary of laboratory testing of the material and formal waste classification codes for the purposes of disposal. It notes that both wastes are classified as non hazardous.

The report also notes that the soils below the areas of the stockpiled material will be sampled and tested to identify if they have been impacted.

4.9 REVIEW OF THE RISK ASSESSMENT FOR SOIL CADMIUM, LAND QUALITY MANAGEMENT (NOVEMBER 2004)

4.9.1 Report Scope

This report provides a review of the risk assessment previously presented by SES in a report dated July 2004 with regards to concentrations of cadmium within the soil present on site. Other contaminants were not considered within the report.

The report was commissioned by SES following comments from the Carmarthenshire County Council CLO requiring a more detailed review of the information which was presented in previous reports.

4.9.2 Conclusions

The report states that overall, the SES risk assessment did not demonstrate that soil cadmium is unlikely to pose an unacceptable risk to future residents. It notes that the cadmium concentrations are generally low and within the range of values covered by the SGV value applicable at the time. It also notes that the assessment process did not consider the impact of soil pH on the risk assessment process which is considered to be pertinent for this site due to relatively low pH within washed colliery spoil material.

The report does not provide any further assessment of the risk or offer an opinion of the requirement for remedial measures.

4.10 CONTAMINATED LAND RISK ASSESSMENT – SCRAP YARD HYDROCARBON ASSESSMENT. SES (NOVEMBER 2004)

This report was produced to provide additional information regarding the vehicle scrap yard (dismantlers) located in the east of the site following a request for more information from the Environment Agency.

Two trial pits were excavated in the vicinity of the scrap yard to a maximum depth of 3m. Shallow perched groundwater was noted in one location at a depth of 0.75m bgl.

The report states that laboratory testing of the samples indicate *"very low concentrations of diesel range organics"* in both soils and leachates and *"concentrations only marginally above the laboratory limit of detection"*.

4.11 CONTAMINATED LAND RISK ASSESSMENT – WASTE MANAGEMENT UPDATE. SES (NOVEMBER 2004)

This document provides information on the Rolling Mill Sludge and Silica waste material with regards to options for disposal / reuse.

Both the Rolling Mill Sludge and Silica Waste were classified as Non Hazardous. It is noted that the silica waste was being removed from the site for off site disposal at the time the report was produced.

Three options are provided for the Rolling Mill Sludge:

1. Recycling into brick making
2. Removal to landfill
3. Remediation on site and then used on site as topsoil.

The report states that the material was being removed from the site at the time of writing, however discussions were on going for the use of the material on another site for brick making.

A methodology (Dew Remediation Limited, 9th November 2004) was also presented for the on-site remediation of this material through windrows for use in topsoil in order to reduce the hydrocarbon content so that the material is suitable for reuse on the site.

4.12 CONTAMINATED LAND RISK ASSESSMENT – CADMIUM REASSESSMENT. SES (NOVEMBER 2004)

This report was produced to provide additional information in terms of the risk assessment of concentrations of cadmium within colliery spoil materials across the site, following feedback from the Contaminated Land Specialist at Carmarthenshire County Council.

The report provides a summary of the review undertaken by LQM (2004) and lists the following conclusions.

- Plant uptake of cadmium below pH 6.5 may be over estimated, therefore the assessment presented in SES Addendum 2a report (2004) would be over cautious and unrealistic.
- Background concentrations of cadmium had not been factored into the CLEA model run.
- LQM recommended further assessment of cadmium concentrations and pH values at the site with reference to the generic SGV for soil cadmium. The report states that this has been undertaken and results in only five locations where cadmium exceeds the SGV (four in colliery spoil, one in natural soils in woodland). All other locations are noted to be below the SGV and therefore do not pose a risk to human health for vegetables grown in garden plots.
- LQM report notes that for pH below 6, the SGV values are not applicable and the CLEA model should be used to generate specific screening values on a case by case basis. The SES report presents a table outlining six samples where pH <6. The calculated screening values are also presented and indicate the concentrations of cadmium in all six samples exceed the calculated screening value. SES also note that this assessment assumes the colliery spoil will be used as a growing medium, which was noted to be un-realistic.
- SES notes that with the removal of ingestion of vegetables, the recorded concentrations are all below the screening value for cadmium and the site is no longer considered to pose a risk to human health.
- SES also note that original recommendations were to include a 0.5m thick layer of topsoil across the site to provide a growing medium overlying the colliery spoil with the additional effect of reducing

cadmium concentrations due to the effects of mixing and to amend the pH of the colliery spoil to more neutral levels.

4.13 CONTAMINATED LAND RISK ASSESSMENT – COLLIERY SHALE LEACHATE ASSESSMENT. SES (NOVEMBER 2004)

The report presents the findings of an intrusive investigation consisting of twelve machine excavated trial pits to target depths of 4m bgl. Laboratory testing and subsequent analysis indicated that leachates derived from this material did not indicate any water contamination issues from the colliery spoil.

The report also indicates that water sitting within the colliery spoil is perched on top of peat strata and clay based superficial strata draining via spring lines around the northern and western part of the colliery spoil and via drains and streams at the original site surface to the east, north and south west.

The report also notes that boreholes drilled by Esterling Geotechnical (2002) did not encounter groundwater within deep boreholes within areas of known mineshafts.

Data presented from surface water samples from the east of the site indicate marginally elevated concentrations of chromium and low pH (3.1) which is considered to be related to the water draining through coal measures and colliery spoil.

4.14 CONTAMINATED LAND RISK ASSESSMENT, ROLLING MILL SLUDGE AREA RE-ASSESSMENT. SES (AUGUST 2005)

4.14.1 Report Scope

This report provides a Risk Assessment for the soils which may have been affected by the storage of mounds of Rolling Mill Sludge in the north-east of the site. The risk assessment covers both risks to human health and controlled waters (surface water and groundwater).

Samples were obtained from the colliery spoil directly below these areas and analysed for the presence of a suite of contaminants including heavy metals, PCBs, speciated PAH and TPH, pH and BTEX. Leachability testing was also undertaken. The assessment was based on the comparison with generic values, relevant at the time of the assessment, as well as modelling using RISC 4 software assuming a 1m cover of colliery spoil and a 20cm building slab thickness.

Appended to the report is a letter, dated 11th July 1996, from Alcan Rolled Products (metal works) to Castle Brick (based on the site) discussing the arrangements for Effluent Plant Sludge Cake to be imported for use on site which is assumed to be in relation to the brick works. It also covers the potential for waste oil to be imported to the site for use as a supplementary fuel on the site.

The filter cake material is described as *"an iron hydroxide floc, obtained by the intermixing of an aqueous lime dispersion with ferrous chloride, [the] solution is used to treat our oil in water emulsion wastes on site. The extracted oil is bound by the floc and this bottom separates in a clarifier…… it is noted the oil content of the cakes arises from the emulsified lubricants used in our plant."*

4.14.2 Conclusions

The report concludes that the concentrations recorded in the samples obtained from the site did not pose a significant risk to human health or the wider environment, although exceedances of the generic values were recorded.

The report states that the shale is not contaminated and no further remedial action is required other than a 1m cover and 20cm building slab thickness.

4.15 GEOTECHNICAL REPORT – WYG (AUGUST 2005)

4.15.1 Report Scope

To present full factual records of the site work carried out, the ground conditions encountered in the exploratory holes, the in-situ and laboratory test results and the results of any monitoring of ground installations. All information collected was used to provide an interpretation of the ground conditions, with recommendations on geotechnical design. Ground contamination risks were not part of the scope.

Geotechnical aspects are considered in relation to the proposed end use of the site. An earthworks plateau level is proposed, and this will require large-scale cut and fill operations.

4.15.2 Conclusions & Recommendations

Most of the earthworks operations are noted to involve re-grading of the colliery spoil that covers most of the site. Moisture contents indicate that about half of this material was significantly wet of optimum moisture content at the time of the site investigation and would therefore be difficult to compact.

However, the majority of the colliery spoil is non-plastic, so that the moisture content is likely to change fairly rapidly depending on conditions, especially when it is excavated. The proportion of material that can be well-compacted will therefore depend critically on weather conditions at the time of excavation, placement and compaction, and on management of the earthworks and any stockpiling. It was therefore not possible to give precise proportions of usable materials, although it is noted that the majority of the colliery spoil should be suitable for compacted earthworks with proper handling at suitable times of the year, with particular regard to minimising moisture content. it was recommended that earthworks field trials be undertaken to determine the best methods of handling and compacting the colliery spoil and the field densities that can be achieved in practice.

Other materials, such as brick rubble and soft deposits of clay, peat and lagoon material would need to be removed prior to the main earthworks operation and treated separately, as described in the report. Material infested with Japanese knotweed would also require special treatment.

Groundwater are not considered to present a major problem during earthworks operations, but perched groundwater pockets are likely to be present and where these are breached then fast inflows are to be expected.

Gas monitoring indicates that ground gas in the form of carbon dioxide was likely to be released during excavation of the colliery spoil. This was not considered to present a hazard during working in open areas but could be hazardous in confined excavations, where air monitoring should be considered.

4.16 MINING SUMMARY REPORT – WYG (SEPTEMBER 2005)

4.16.1 Report Scope

A summary of known mining activities across the site, collating all the various previous investigations, mining records, Coal Authority reports and recent investigation work.

4.16.2 Report Conclusions & Recommendations

Further investigations should probably take the form of trial pits & trenches in the suggested areas outlined in Figures 2 & 2a. A long reach swing shovel excavator with a reach of at least 6.00m should be deployed to maximise the extent of the investigation. Investigations should be extensive enough as to prove or disprove the

presence of any shafts, adits or mine entries in the areas outlined in figures 2 & 2a. A Coal Authority license will be required for further investigations and for any treatment required.

The area of the site identified in the A.M. Johnson report (1992), along the south-eastern edge of the site, as having shallow mine workings (4m<20m), will need to be investigated further for a specification to be drawn up on how to treat these shallow workings. A Coal Authority report will also be required for the area.

The area identified as having soft lagoon deposits at depth will need excavation with the soft deposits removed to a suitable depth and replaced by a geotechnically suitable material.

The area around shaft 058 and adits 049 & 050 is currently occupied and before further investigations progress this area will need to be vacated by its present occupiers. All other areas are ready for immediate investigation but as ground levels are being reduced on site it would be of benefit to wait until this exercise has been undertaken to again maximise the extent of further investigations. All further investigations and excavations should be supervised by a suitably qualified engineer.

4.17 VALIDATION REPORT FOR EARTHWORKS– WYG (APRIL 2007)

4.17.1 Report Scope

The validation report relates to the phase IA, IB and 2 of the development only which is located in the central and eastern part of the site. WYG has also supervised the mining treatment works that were undertaken during the earthworks phase.

The validation statement provides an overview of the site earthworks, and mine treatment works at the site and a summary of the final conditions. It also presents an overview of the Japanese Knotweed clearance works and resultant deposition area. The report does not comment on environmental aspects. It is noted that Soil Environmental Services undertook all ground contaminations risk assessment work.

4.17.2 Report Conclusions & Recommendations

Overall, the results indicate that the engineered fill in phases IA IB and 2 on the site was placed in accordance with the WYG Specification which was based on the Specification of Highway Works (1990) and British Standard BS6031:1981 which is approved by the NHBC.

Measured properties of samples taken from the earthworks during the course of the work met or exceeded the requirements of the Specification such that the compacted fill has sufficiently high strength and low compressibility to support the structures and pavements proposed for the development at the site, as set out in the designs produced by WYG.

Soft strata such as peat and mine waste tailings are noted to be present below the fill placed and the presence of these materials below the development will need to be considered in the foundation design for each structure proposed. The lateral extent and elevation of these strata have been determined by probe hole drilling on a grid pattern in September 2006.

Near surface soft areas have been excavated and disposed of off-site and unsuitable materials found in cutting were excluded from the fill.

It is noted that where required by the WYG design, geogrid reinforcement and drainage material were incorporated into the fill to ensure long-term stability.

The report notes that the recommendations above are subject to the proviso that any material re-excavated, trafficked or left unprotected would require further checks to ensure that it continued to meet the requirements of the Specification.

Areas susceptible to mining were designated zones requiring further investigation and treatment and kept clear of structures.

Japanese Knotweed was removed from infected areas of the site in accordance with Environment Agency guidance and processed to remove as much Japanese Knotweed as possible. The residual soils and any remaining Japanese Knotweed fragments were buried in the Japanese Knotweed deposition area with sufficient cover (5m) to prevent any future re-growth. The area is marked on the constraints plan (Figure 3) included in this report.

4.18 VALIDATION REPORT – SES (JANUARY 2007)

4.18.1 Report Scope

The report states that the scope of works covered within this report was defined in agreement with representatives from Carmarthenshire County Council and the Environment Agency. It states that the overall aim of the works is to produce a final document covering all current contaminated land issues in the validation report.

The scope included the following.

- Assessment of near surface soils to consider risks to future residential development in terms of garden areas and testing to support an assessment of mobile contamination in terms of WRAS guideline values. Representative samples were obtained from each building area as well as the soil washing area.
- Assessment of stockpiled topsoil in terms of suitability for use in cover systems through the collection of samples from two stockpiles.
- Installation of six ground gas monitoring wells to inform ground gas risk assessment.
- Installation of a water monitoring well in the 'wet' area near the northern boundary and assessment of water quality in the ditch on the northern boundary.
- Gas monitoring well installed in the area of coal washing fill in the east of the site.

4.18.2 Report Conclusions & Recommendations

The report states that on average no contaminants significantly exceed any of the contemporary guideline values, although arsenic is noted to be on average slightly elevated with respect to WRAS guidelines

Stockpiled topsoil was considered suitable for reuse in gardens and landscaped areas.

The report also amends reports relating to the presence of silica waste on the site which was imported during the use of the site as a brick works. It is determined that the material does not pose a risk to human health, surface waters or groundwaters.

4.19 CONTAMINATED LAND RISK ASSESSMENT – VERIFICATION REPORT, SES. (AUGUST 2007).

4.19.1 Report Scope

The objective of this report is to clearly demonstrate that the remediation activities have been completed satisfactorily, no harm has been caused to third parties or the environment and that the remediation criteria have been met.

The report is presented in the form of a Contaminated Land Risk Assessment, demonstrating how the pollutant pathways have been removed.

4.19.2 Report Conclusions & Recommendations

The report covers a number of elements including:

- Laboratory testing of shallow soils did not identify at potential contaminants deemed to pose a risk to human health within the context of the proposed development. It is noted that samples were obtained from 173 trial pits across the site.
- Aliphatic hydrocarbons were noted at depths below 3m within the colliery shale, these were generally in the range C21 to C34 which were considered to be typical of peaty gley soils. However, a risk assessment was undertaken and the recorded concentrations were not deemed to pose a risk to future site users.
- Ground gas monitoring indicated limited ground gas recorded on the site with a maximum recorded carbon dioxide concentration of 0.7%.
- Topsoil was noted to have been stripped and stockpiled on the site, with the report stating that all contaminants are within guideline values.
- With regards to risks to groundwater, laboratory testing of samples from boreholes revealed no significant levels of contamination within the solids or leachates from the site which may be considered to pose a risk to controlled waters.
- The report also details the complexity of the groundwater below the site due to extensive coal mine workings both on site and in the surrounding areas, noting that mine workings below the site have historically been flooded by neighbouring colliery workings. As such it is noted that interpreting groundwater movements below the site are likely to be hard to predict.

The report presents a letter from the Environment Agency dated 11th March 2005, confirming the acceptance of a report which outlined the removal of materials from the site associated with silica waste and rolling mill sludge.

The report presents a summary of results from the trial pits in terms of U95 values for the 8 zoned areas and site as a whole and states marginally elevated concentrations of arsenic in three areas. Elevated concentrations of PAH (total) are noted in TP48 with a value of 310mg/kg stated. This is noted to be associated with the location of a above ground diesel storage tank, which was intended for removal and retesting during site clearance.

Comparison to current screening values for a residential development with plant uptake does not indicate any contaminants at concentrations above the relevant screening value, although it is noted that speciated PAH testing was not undertaken, TPH testing was also not undertaken on soil samples.

The verification report concludes that all remedial works previously scheduled have been completed and that no risk to human health or controlled waters now exists.

4.20 CONTAMINATED LAND RISK ASSESSMENT – SUMMARY REPORT – SES. (NOVEMBER 2007)

4.20.1 Report Scope

The report is intended to provide a summary of the contamination risk assessments undertaken up to the date of the report. It is noted that since the assessments have been undertaken over a number of years, the contaminated land assessment process will have become more refined and as such the earliest assessments may not be in line with the contemporary assessment processes. The report reviews the assessments presented in the following reports by SES.

- July 2004 – Contaminated Land Risk Assessment.