

Technical Note

Project:	P18-669 Llanwern – Phase 5A & 5B		
Subject:	Phase 5A & 5B Controlled Waters Detailed Quantitative Risk Assessment Addendum		
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1 Introduction

1.1 General

Rodgers Leask Ltd (RLL) has been commissioned by Brighton STM Developments Limited (BSTMDL) to develop a phase specific addendum Controlled Waters Detailed Quantitative Risk Assessment (CWDQRA) to assess the potential risk to Controlled Waters for Phase 5A & 5B of the Glan Llyn development at Llanwern, Newport (herein referred to as the Site).

In July 2024 the Client, St Modwen Developments was rebranded to be called Brighton STM Developments Limited. Any reference to the previous company name in this report should be referred to accordingly.

1.2 Purpose

This report has been prepared to support the discharge of Planning Condition 27 of the Outline Planning Permission Reference 06/0471 for the proposed development of residential development Phase 5A & 5B as part of a wider mixed-use development at Llanwern, Newport.

Planning Condition 27 states the following.

“(27) Prior to the commencement of each phase of development as defined by Condition 03 (or at such other date or stage in development or for such specified activities or works as may be agreed in writing with the Local Planning Authority), the following components of a scheme to deal with the risks associated with contamination relating to that phase or activity shall each be submitted to and approved, in writing, by the Local Planning Authority:

- (1) A preliminary risk assessment which has identified:
 - (a) all previous uses;*
 - (b) potential contaminants associated with those uses;*
 - (c) a conceptual model of the site indicating sources, pathways and receptors;*
 - (d) potentially unacceptable risks arising from contamination at the site.**
- (2) A site investigation scheme, based on (1) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.*
- (3) The site investigation results and the detailed risk assessment (2) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.*
- (4) A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in (3) are complete and identifying any requirements for longer term monitoring of pollutant linkages, maintenance and arrangements for contingency action. Any changes to these components require the express consent of the Local Planning Authority.*

Reason: To ensure that the proposed development will not cause pollution of the environment or harm to human health."

1.3 Objectives and Scope

The objectives and scope of this report are to assess the soil chemical testing results obtained during previous ground investigations, within the Site, against the soil re-use criteria presented in H F Consulting's Soils Validation Strategy and to discuss the suitability of the soils for retention as part of the proposed remedial works.

1.4 Sources of Information

The following documents have been reviewed in preparation of this technical note, and should be read in conjunction with it:

- RLL, Updated Controlled Waters Detailed Quantitative Risk Assessment, Glan Llyn, ref. 18669-RLE-19-RP-O-0006, dated June 2022
- H F Consulting, Glan Llyn: Soils validation strategy for protection of controlled waters (30937 R2), dated December 2024
- RLL, Phase 5A & 5B Desk Study & Phase 2 Geo-Environmental Report, ref. 18669-RLL-25-XX-RP-O-0781-P01, dated November 2025

2 Site Information

2.1 Site Setting

The Site is located within the Glan Llyn development at the former Llanwern Steelworks, approximately 5.5 km to the east of Newport City Centre, at approximate National Grid Reference 336490E, 187114N. The wider Glan Llyn development extends over approximately 250 hectares and is undergoing phased redevelopment for residential, commercial, and open space use.

The Site is irregular in shape, covering an area of approximately 12ha and is situated in the northeastern part of the wider Glan Llyn development. Historical mapping and land use records indicate that the Site formerly comprised part of the former Llanwern steelworks complex, including part of the sinter plant, areas of unspecified commercial/ industrial use, industrial buildings, railway sidings, surface drains, conveyors, tank infrastructure and an electricity substation. Drain 4, a historical below ground box culvert, was located on the eastern side of the Site orientated north-south. The Site was partially demolished by 2004 and fully demolished by 2021.

The Site boundary is shown on RLL Drawing 18669-RLL-25-XX-DR-O-0787-P01, the site illustrative masterplan is presented on Drawing ref. 8111-08-A011, both presented in **Appendix A**.

2.2 Geology

Information pertaining to the underlying ground conditions at the Site has been obtained via the BGS Onshore Geoindex¹. The published geological information shows the Site to be void of Made Ground. However, due to the Site's history, Made Ground is likely to be present associated with the previous development and subsequent demolition.

Superficial deposits are shown to comprise Tidal Flat Deposits.

Tidal Flat Deposits are described by the BGS as *'unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit. Normally a consolidated soft silty clay, with layers of sand, gravel and peat.'*

The underlying bedrock is primarily shown to be the Mercia Mudstone Group with a narrow band of the Penarth Group – Mudstone mapped in the north-western section of the Site.

The Mercia Mudstone Group is described by the BGS as comprising 'predominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite

¹ <http://mapapps2.bgs.ac.uk/geoindex/home.html>

bearing units in some basinal areas. Thin beds of gypsum/ anhydrite are widespread; sandstones are also present’.

The Penarth Group is described by the BGS as ‘grey to black mudstones with subordinate limestones and sandstones; predominantly marine in origin’.

There is an inferred fault approximately 58m northeast of the Site which trends roughly north to south and extends northwards away from Site.

2.3 Encountered Ground Conditions

Two previous ground investigations have been undertaken across the wider Glan Llyn development which included the site:

- IFA (2016) drilled 4 boreholes (2 cable percussion and 2 dynamic sample).
- RLL (2020-2021) excavated 103 trial pits.

Detailed information is available in the RLL Phase 5A & 5B Desk Study and Ground Investigation Report (**Appendix C**).

The following table provides a summary of the exploratory holes that were situated within the Site boundary.

Summary of Historical Exploratory Holes within the Site Boundary	
Report	Exploratory Holes
IFA (2016)	2 Dynamic Sample Boreholes (CWWS10 and CWWS20) and 2 Cable Percussion Boreholes (CWCP10, CWCP32).
RLL (2020-2021)	103 Trial Pits (AT6-1, AT6-2, AJ4-1, AJ4-2, AL2-1, AL2-2, AM1-1, AM1-2, AM2-1, AM2-2, AN1-1, AN1-2, AO1-1, AO1-2, AP1-1, AP1-2, AQ1-1, AR2-1, AR4-1, AR4-2, AS3-1, AS4-1, AS4-2, AS6-1, AS6-2, AS7-1, AS7-2, AT4-1, AT4-2, AT4-3, AG1-1, AH1-1, AH1-2, AI1-1, AJ1-1, AJ1-2, AJ6-1, AJ6-2, AK1-1, AK1-2, AK2-1, AK2-2, AK3-1, AK5-1, AK5-2, AL1-1, AL1-2, AR10-1, AR10-2, AR11-1, AR11-2, AS9-1, AS9-1, AN10-1, AN10-2, AN11-1, AN11-2, AN12-1, AN12-2, AN12-3, AP10-1, AP10-2, AQ10-1, AQ10-2, AN13-1, AN13-2, AN14-1, AN14-2, AN14-3, AN15-1, AN15-2, AL12-1, AL12-2, AL12-3, AL13-1, AL13-2, AL14-1, AL14-2, AM15-1, AM15-2, AM16-1, AM16-2, AL10-1, AL10-2, AL11-1, AL11-2, AM10-1, AM10-2, AM11-1, AM11-2, AM12-1, AM12-2, AM13-1, AM13-2, AM14-1, AM14-2, AM14-3, AG7-1, AH6-1, AH6-2, AH7-1, AH7-2, AI6-1, AI6-2, AI7-1, AI7-2, AI8-1, AI8-2, AK10-1, AF2-1, AF2-2, AF4-1, AF4-2, AF5-1, AF5-2, AG2-1, AG6-1, AG6-2, AH2-1, AH2-2, AL15-1, AL15-2, AL16-1, AL16-2, AL16-3, AD1-1, AD1-2, AE1-1, AE1-2, AF1-1, AF1-2, AG3-1, AG3-2, AH3-1, AH3-2, AI2-1, AI3-1, AI3-2, AJ2-1, AJ2-2, AJ3-1, AJ3-2, AN6-1, AJ5-1, AS5-1, AS5-2, AT5-1, AT5-2, AU5-1, AU5-2, AU5-3, AU6-1, AU6-2, AG8-1, AG8-2, AH8-1, AH8-2, AH8-3, AH8-4, AI8-1, AI8-2, AJ8-1, AJ8-2, AL3-1, AU7-1, AV6-1, AV6-2, AV6-3, AV7-1)

RLL Drawing 18669-RLL-25-XX-DR-O-0788-P01 presented in **Appendix A** shows the location of the exploratory holes.

The ground investigations found the Site to be underlain by Made Ground overlying Tidal Flat Deposits, encountered from ground level to a maximum depth of 4.20m bgl.

Made Ground of Topsoil was encountered in one location from ground level to 0.10m and surfacing of tarmac or recycled 6F2 gravel overlying terram base layer was encountered in two locations from ground level to 0.30m.

The general Made Ground typically comprised brown/ black/ grey sandy or gravelly clays, sandy gravels, gravelly sands, and cobbly gravelly clays. Composition varied but commonly included various slags (fused in places), burnt shales, ash, clinker, bricks, concrete and other anthropogenic debris with occasional gravel inclusions of mudstone, sandstone, and other mixed lithologies. Particle sizes ranged from fine to coarse, with angular to subrounded particle shapes. Man-made inclusions such as timber, plastics, clay pipe fragments, and metal were recorded in numerous locations.

Tidal Flat Deposits were generally described as soft to firm blue/ grey silty clay with occasional fine sand, shell fragments and organic material of soft to firm bluish grey to brownish grey CLAY were encountered. Additionally, lenses of black organic or brown fibrous PEAT were encountered.

The Mercia Mudstone Group was encountered in 2 locations (CWCP31 and CWCP32). The top of the bedrock was recorded from 9.60mbgl and 10.00mbgl, and the base of the bedrock was not encountered but was recorded to a maximum depth of 10.50mbgl. The Mercia Mudstone Group was described as:

- Extremely weak red brown MUDSTONE (Grade II); and
- Very stiff reddish brown mottled grey silty CLAY (Grade IVa).

2.4 Post-construction ground conditions

The following table provides an anticipated post-construction ground model.

Post-Development Ground Conditions		
Unit	Approximate Thickness	Description
- Impermeable Construction Materials; or Housing Sub-base - Permeable cover system (imported topsoil and subsoil)	0.6m	Imported clean topsoil/ construction materials
Piling Mat*	0.5m	Imported 6F2 (*may be included within 600mm of construction materials)
Made Ground	1.5 – 2.0m	Excavated and re-compacted Made

		Ground
Tidal Flat Deposits	7.0 – 10.0m	No change from current conditions
Bedrock (Mercia Mudstone Group)	>1,350m	No change from current conditions

In accordance with the assumptions of the 2019 RLL CWDQRA, further mitigation to promote lateral flow is recommended, this will be in the form of a drainage blanket installation to cap the reengineered Made Ground (including piling mat) which will increase the levels fall from the centre of a plot to periphery.

2.5 Historical Groundwater Monitoring and Wider Site Hydrogeology

A summary of pre-reclamation groundwater levels is presented in the Phase 5A & 5B Desk Study & Phase 2 Geo-Environmental Report. Groundwater levels recorded during the pre-reclamation ground investigations across the development suggest that the groundwater is present beneath the wider Glan Llyn development as follows:

- Shallow/ perched water within the Made Ground (shallow boreholes); and
- Groundwater within the Tidal Flat Deposits (confined to the basal sand layers) and Mercia Mudstone (deep boreholes).

The shallow perched water described above was recorded during pre-reclamation conditions. The earthworks for this phase include the reengineering of the Made Ground, this shallow perched water shall no longer be present due to the engineering and compaction of Made Ground reducing the permeability.

Groundwater monitoring within the deep boreholes was in the solid geology, and hydraulic continuity between the upper perched shallow groundwater and 'regional' groundwater was considered likely to be limited, due to low permeability strata (natural clay). Post-development, the excavation and re-compaction of the Made Ground was recognised as likely to reduce its permeability, lowering still further, the hydraulic continuity.

3 Controlled Waters Detailed Quantitative Risk Assessment

3.1 Introduction

In 2019 RLL was commissioned by St Modwen to prepare a Controlled Waters Detailed Quantitative Risk Assessment (CWDQRA) for the wider Glan Llyn development, report reference 18669-RLE-19-RP-O-0006, dated June 2022. This assessment was considered to be an update to and further development of Atkins Limited (Atkins), CWDQRA, Document Reference: 5111373-LLA-OUT-0257, Version: 3, dated February 2017.

The principal objective of the 2019 RLL CWDQRA, was to provide compliant future surface water flow contributions from private drainage system on the wider Glan Llyn development (following the redevelopment for mixed residential and commercial end use) upon entry into the Monks Ditch. An important consideration in developing the CWDQRA was to improve sustainability and further limit the amount of material which requires off-site removal by improving soil chemical conditions to a degree that it would be suitable for reuse on site.

With the aim of generating a streamlined and consistent process for the Phase-by-Phase reporting process, in 2024 H Fraser Consulting Ltd were commissioned to build on the findings of the CWDQRA and produce a Soils Validation Strategy for the Protection of Controlled Waters (30937 R2).

A summary of the reporting relating to controlled waters on the development are presented in the following sections.

The development area this assessment covers is known as Phase 5a and 5b, the site area is presented on RLL drawing reference 18669-RLE-19-XX-DR-O-0004 in **Appendix A**.

3.2 RLL CWDQRA Summary

In 2019 RLL prepared a Controlled Waters Detailed Quantitative Risk Assessment (CWDQRA) for the wider Glan Llyn development site. This assessment incorporated a comprehensive dataset of concentrations of contamination recorded in soils across the development. Screening analysis of soil, soil leachate, groundwater and surface water data revealed potential moderate to low levels of inorganic and organic contamination present across the wider site in line with contaminants associated with former steelworks sites.

The Made Ground generally comprises clayey sandy gravels with local slag, burnt shale, tarmac, concrete, brick and mudstone, and was identified to be a source of contamination. Calculation of representative re-use criteria for a residential with plant

uptake end use was undertaken using a dilution assessment methodology based on the site-wide water balance, incorporating site specific permeability and infiltration parameters. No allowance was made for dilution of discharged waters within Monks Ditch itself as part of this calculation as, this being the receptor, it is proposed that the water quality in this Controlled Water be maintained (as far as possible) at EQS values.

Comparison of re-use criteria against available soil chemical testing established that a significant volume of the Made Ground was likely to be suitable for re-use onsite, however, localised source materials existed containing higher concentrations of contamination (particularly elevated concentrations of iron, manganese and vanadium), and ammoniacal and cyanide components, may require remediation, or offsite disposal.

Further modelling of these contaminants was undertaken using Remedial Target Methodology (RTM) to assess the potential extent of attenuation of these specific determinands within the ground where these soils may be placed, with the receiving surface waters being assumed to be existing Blueways (reens), which were considered as the Compliance Points. The compliance point for the Residential Development has been assigned to the point of discharge into the receptor Monks' Ditch and will require an enacted permit for discharge to occur.

Initial modelling was carried out by Atkins (Glan Llyn, Llanwern Controlled Waters Detailed Quantitative Risk Assessment dated February 2017), with this approach being adopted within later revisions of this Report in the Rodgers Leask, Controlled Waters Detailed Quantitative Risk Assessment, Glan Llyn (sitewide) Update (2019), using the Equation presented in the EA Table 5.2 – soil-water partitioning of the EA Remedial Targets Methodology Guidance (2006) where a pore-water concentration (C_p) was determined from soil concentration analyses to derive soil reuse criteria at the site as a whole. Subsequently, and purely to gauge the potential distance that re-engineered Made Ground could be placed from the respective Compliance Point(s), further modelling was carried out for specific determinands using the EA RT Excel Worksheets, based on maximum and average soils concentrations determined within samples of re-engineered Made Ground and available site derived data.

Further modelling was carried out for specific determinands (including specific PAHs) using the EA Remedial Target Excel Worksheets, based on maximum and average soils concentrations did indicate that there was little attenuation of the initial porewater PAH concentrations on migration within the re-engineered Made Ground toward the nearest reen Receptors. However, the presence of elevated porewater PAH concentrations was only theoretical and based on calculated values derived using the Equation presented in the EA Table 5.2 – soil-water partitioning of the EA Remedial Targets Methodology Guidance (2006). Actual PAH concentrations determined more recently in groundwater samples recovered (where sufficient groundwater was available for sampling purposes), were generally lower, and potentially significantly lower, than the calculated values which were derived using soils analyses data. Additionally, as previously mentioned, there was little evidence obtained of hydraulically continuous groundwater horizon(s) within the re-

engineered Made Ground beneath areas proposed for residential and commercial development. Therefore, there has been no proven PAH (or other contaminant) migration pathways towards the reens.

As the data used within the CWDQRA has utilised ground investigation data taken from within the Site, it is therefore considered that the findings of this assessment are representative of the Site and therefore adoption of the calculated re-use criteria and recommendations presented within the CWQRA are appropriate.

3.3 HFCL Glan Llyn: Soils Validation Strategy for Protection of Controlled Waters

Following queries from Natural Resources Wales (NRW), H Fraser Consulting Limited (HFCL) were commissioned by RLL to assist with NRW liaison and reporting pursuant to the discharge of PC28. Following discussion with NRW, RLL and the developer, HFCL prepared a revised methodology for the validation of soils in relation to the protection of controlled waters.

The assessment does not rely on groundwater analysis, being dependent rather on soil re-use values. It included distance specific remedial targets that model the attenuation of contaminants in the saturated zone allowing for advection, dispersion, retardation and decay during transport. In addition to the inclusion of distance specific remedial targets, further statistical and spatial analysis was carried out on contaminants of concern.

More detail is provided in the HFC Glan Llyn: Soils Validation Strategy for the Protection of Controlled Waters (30937 R2).

4 Comparison of Phase 5A & 5B and CWDQRA Dataset

The dataset utilised in the RLL CWDQRA was taken from soil samples from the wider Glan Llyn development site which included the Site area. A comparison of the residential CWDQRA dataset with the soil samples taken from within the Site has been undertaken.

The purpose of this comparison is to establish if the residential dataset used in the CWDQRA is representative of concentrations of contamination present within Site and therefore whether the derived re-use criteria and recommendations of this assessment are applicable to the Site or whether further assessment is required.

4.1 Phase 5A & 5B Sampling

169 soil samples were collected from the Site during the 2020-2021 RLL ground investigation for contamination testing, taken from the Made Ground. The works comprised trial pitting to collect soil samples for chemical analysis.

The samples were analysed for heavy metals, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbon (TPH), gasoline range organics (GROs), BTEX, pH, soil organic matter (SOM), cyanide, phenols, ammoniacal nitrogen and select samples were also tested for asbestos.

4.2 Comparison of Results

The chemical soil results for the Made Ground analysed from Phase 5A & 5B have been compared to the sitewide dataset presented in the RLL CWDQRA, as shown in the following table. The table compares the maximum, average and 95th percentile concentrations for each determinand within Phase 4E against the sitewide dataset.

The Phase 5A & 5B data has been considered comparable with the sitewide dataset where the maximum, average and 95th percentile concentrations are less than or equal to the sitewide dataset. In limited cases where the Phase 5A/5B dataset concentrations are greater than the sitewide dataset, these exceedances have been reviewed in the context of overall distribution to determine whether the dataset is broadly consistent with the sitewide dataset.

Determinand	Samples from Phase 5A & 5B – Residential Area			Samples from CWDQRA - Residential Area			Considered Representative of CWDQRA data (Yes/No)
	Maximum Soil Sample Value* (mg/kg)	Average Soil Sample Value* (mg/kg)	95 th Percentile Soil Sample Value* (mg/kg)	Maximum Soil Sample Value (mg/kg)	Average Soil Sample Value* (mg/kg)	95 th Percentile Soil Sample Value* (mg/kg)	
Inorganic Metals and Metalloids							
Arsenic	52.60	8.76	18.72	397.00	12.18	21.89	Y
Cadmium	24.00	1.56	9.01	31.30	0.65	2.37	N
Chromium	1200.00	148.34	580.20	3090.00	138.89	590.80	Y
Copper	259.00	25.05	63.66	1790.00	25.19	52.07	Y
Iron	256200	90676	256200	2390000	103039	277000	Y
Lead	2070.00	158.99	1058.00	4220.00	91.58	231.85	N
Manganese	53700	10219	33300	408000	9574	33520	Y
Mercury	22.90	0.86	1.40	6.24	0.68	1.40	Y
Nickel	65.10	18.93	45.18	313.00	25.73	44.90	Y
Selenium	33.80	6.86	15.26	51.70	6.09	16.67	Y
Vanadium	2050.00	221.40	710.50	2880.00	206.93	693.10	Y
Zinc	10600	626.99	5018.00	13300.00	291.45	784.75	N
Other Inorganics							
Ammoniacal Nitrogen	123.00	14.67	25.40	1590.00	60.97	263.00	Y
Cyanide	213.00	5.39	12.86	272.00	2.32	4.05	N
Organics							
Benzene	1.80	0.22	0.28	0.12	0.04	0.04	N
Toluene	4.51	0.18	0.14	0.07	0.01	0.02	N
Ethylbenzene	0.84	0.09	0.08	0.02	0.01	0.01	N
Xylene	19.00	0.29	0.20	0.11	0.01	0.01	N
Phenol	0.31	0.01	0.02	1.21	0.02	0.03	Y
TPH Criteria Working Group							
Aliphatics >C5-C6	0.35	0.02	0.04	0.92	0.03	0.04	Y
Aliphatics >C6-C8	0.18	0.04	0.17	3.32	0.04	0.09	Y
Aliphatics >C8-C10	20.30	0.19	0.21	74.20	0.20	0.12	Y
Aliphatics >C10-C12	10.00	1.17	1.20	987.00	2.55	0.35	Y
Aliphatics >C12-C16	133.00	4.59	14.30	514.00	5.26	16.47	Y
Aliphatics >C16-C21	1590.00	44.41	130.60	3530.00	26.92	83.07	N
Aliphatics >C21-C35	1450.00	50.04	129.80	2980.00	64.53	174.70	Y
Aliphatics >C35-C44	337.00	13.28	46.38	913.00	20.37	68.99	Y
Aromatics >EC5-EC7	0.65	0.03	0.13	5.26	0.03	0.04	Y
Aromatics >EC7-EC8	1.85	0.03	0.03	20.30	0.05	0.04	Y
Aromatics >EC8-EC10	13.50	0.13	0.14	49.50	0.14	0.10	Y
Aromatics >EC10-EC12	169.00	4.03	10.30	658.00	1.71	0.24	N
Aromatics >EC12-EC16	239.00	6.74	38.82	5280.00	13.62	24.72	Y
Aromatics >EC16-EC21	966.00	35.53	167.80	9800.00	56.85	165.55	Y
Aromatics >EC21-EC35	2610.00	101.26	398.00	9010.00	122.76	440.85	Y
Aromatics >EC35-EC44	476.00	20.87	99.24	1580.00	40.69	150.00	Y
Polyaromatic Hydrocarbons							
Acenaphthylene	35.30	0.85	3.73	2100.00	3.08	3.18	Y
Acenaphthene	28.60	0.31	0.77	193.00	0.47	0.41	Y
Anthracene	46.80	1.26	5.12	1860.00	3.61	5.48	Y
Benz(a)anthracene	99.00	2.96	8.42	1150.00	4.64	1.61	Y
Benzo(a)pyrene	87.60	2.61	12.04	714.00	3.73	10.58	Y
Benzo(b)fluoranthene	136.00	3.96	17.40	1110.00	5.28	15.87	Y
Benzo(k)fluoranthene	43.40	1.31	4.89	373.00	2.08	5.96	Y
Benzo(g,h,i)perylene	55.00	1.94	8.35	333.00	2.51	7.27	Y

Determinand	Samples from Phase 5A & 5B - Residential Area			Samples from CWDQRA - Residential Area			Considered Representative of CWDQRA data (Yes/No)
	Maximum Soil Sample Value* (mg/kg)	Average Soil Sample Value* (mg/kg)	95 th Percentile Soil Sample Value* (mg/kg)	Maximum Soil Sample Value (mg/kg)	Average Soil Sample Value* (mg/kg)	95 th Percentile Soil Sample Value* (mg/kg)	
Chrysene	82.90	2.59	7.53	1090.00	4.22	11.47	Y
Dibenzo(a,h)anthracene	11.70	0.47	2.33	177.00	0.74	1.86	Y
Indeno(1,2,3-cd)pyrene	69.30	2.18	9.84	374.00	2.61	7.46	Y
Fluoranthene	216.00	6.82	25.18	2940.00	11.59	29.56	Y
Fluorene	49.70	1.07	4.15	1890.00	2.81	2.72	Y
Naphthalene	102.00	2.23	7.49	4680.00	10.98	5.66	Y
Phenanthrene	191.00	5.30	25.06	3810.00	9.79	18.03	Y
Pyrene	149.00	4.89	17.08	1.95	0.01	0.03	N

A review of the datasets has shown that the contaminants largely show similar or lower concentration ranges for the Site and for the wider Glan Llyn development site utilised within the CWDQRA. The results are therefore considered to be representative of the levels of contamination present within the Site and therefore adoption of the calculated re-use criteria and recommendations presented within the CWDQRA are appropriate for the Site.

Cadmium, lead, zinc, cyanide, Aliphatics >C16-C21, Aromatics >EC10-EC12 and pyrene have higher 95th percentile concentrations within the Site when compared to the DQRA dataset, however given the marginal difference this is not considered to affect the conclusions of the CWDQRA. With the exception of pyrene (where only 3 marginal exceedances were recorded), laboratory concentrations of these determinands were below the residential soil re-use criteria for controlled waters.

Contaminants benzene, toluene, ethylbenzene and xylene (sum) for the Site are shown to have higher maximum, average and 95th percentile concentrations when compared to the DQRA dataset. The detection limits for the tested determinands listed by the laboratory were higher than the respective values presented in the DQRA dataset, as summarised in the table below, and as a result caused a significant skew in the results.

Determinand	Laboratory Detection Limit (mg/kg)
Benzene	<0.18, <1.80
Toulene	<0.14, <1.40
Ethylbenzene	<0.08, <0.80
M & p-Xylene	<0.20, <2.00
o-Xylene	<0.20, <2.00

Where samples are reported at the detection limit, for screening purposes, it has been conservatively assumed that the value is that of the detection limit. If the true concentration is taken into consideration, the 95th percentile and average concentrations are likely to be significantly lower than this value. In addition, given the values were lower

than the relevant reuse criteria, their relatively low mobility and the distance of the Site from existing and future surface waters then it is considered that this shouldn't have a detrimental impact on the conclusions of the CWDQRA.

4.3 Comparison to RLL CWDQRA Reuse Criteria for 40% Infiltration Rainfall

The samples collected for the Site, as part of the RLL ground investigation, have subsequently been assessed against the RLL CWDQRA Reuse Criteria for 40% Infiltration Rainfall values for a residential end use as outlined in the RLL CWDQRA. A summary of exceedances is presented in the table below, and the chemical screening results are presented in full in **Appendix B**.

Summary of Exceedances of RLL CWDQRA Reuse Criteria for 40% Infiltration Rainfall for Residential End Use:				
Contaminant	No. of Exceedances	Location of Exceedances	Exceedance Concentration Range (mg/kg)	Screening Value (mg/kg)
Cyanide (total)	41 of 169 (24.26%)	AT6-1, AR2-1, AR4-1, AS3-1, AS7-2, AT4-1, AT4-2, AN12-2, AN13-2, AM15-2, AH6-1, AH6-2, AI8-2, AF2-2, AF5-2, AG2-1, AG6-2, AH2-1, AF1-2, AG3-1, AG3-2, AH3-1, AH3-2, AI2-1, AI3-1, AI3-2, AJ2-1, AJ2-2, AJ3-1, AS5-2, AT5-2, AU5-2, AU5-3, AU6-2, AG8-2, AU7-1, AV6-1, AV6-2, AV6-3, AV7-1	2.63 – 213.00	2.313
Iron (Total)	2 of 169 (1.18%)	AV6-2, AV6-3	327000.00 – 467000.00	349148.010
Manganese	5 of 169 (2.96%)	AT6-2, AS6-2, AT4-3, AG3-2, AH3-2	38300.00 – 53700.00	38175.690
Vanadium	1 of 169 (0.59%)	AS6-2	2050.00	1840.198
Naphthalene	2 of 169 (1.18%)	AH7-2, AG3-1	80.60 – 102.00	31.450
Acenaphthylene	1 of 169 (0.60%)	AG3-1	35.30	19.170
Fluorene	2 of 169 (1.18%)	AH7-2, AG3-1	34.00 – 49.70	31.080
Phenanthrene	7 of 169 (4.14%)	AM15-1, AM15-2, AH7-2, AG2-1, AG3-1, AH3-1, AJ2-2	34.50 – 191.00	31.080
Anthracene	1 of 169 (0.60%)	AG3-1	46.80	39.120
Fluoranthene	22 of 169 (13.02%)	AP1-2, AN12-3, AN14-1, AN14-2, AL12-2, AL12-3, AM15-1, AM15-2, AM11-2, AH7-2,	8.26 – 216.00	7.610

Summary of Exceedances of RLL CWDQRA Reuse Criteria for 40% Infiltration Rainfall for Residential End Use:				
Contaminant	No. of Exceedances	Location of Exceedances	Exceedance Concentration Range (mg/kg)	Screening Value (mg/kg)
		AG2-1, AL15-2, AG3-1, AG3-2, AH3-1, AI2-1, AI3-1, AJ2-1, AJ2-2, AH8-2, AH8-3, AH8-4		
Pyrene	3 of 169 (1.78%)	AH7-2, AG3-1, AJ2-2	88.30 – 149.00	87.560
Benzo[b]fluoranthene	25 of 169 (14.79%)	AP1-2, AN12-2, AN12-3, AN14-1, AN14-2, AL12-2, AL12-3, AM15-1, AM15-2, AM11-2, AH7-2, AF5-1, AG2-1, AG3-1, AG3-2, AH3-1, AI2-1, AI3-1, AJ2-1, AJ2-2, AG8-1, AH8-1, AH8-2, AH8-3, AH8-4	4.58 – 136.00	3.910
Benzo[k]fluoranthene	9 of 169 (5.33%)	AP1-2, AM15-1, AM15-2, AH7-2, AG2-1, AG3-1, AH3-1, AI3-1, AJ2-2	5.83 – 43.40	5.790
Benzo[a]pyrene	3 of 169 (1.78%)	AM15-1, AH7-2, AG3-1	39.60 – 87.60	39.490
Indeno(1,2,3-c,d)Pyrene	3 of 169 (1.78%)	AM15-1, AH7-2, AG3-1	31.10 – 69.30	29.020
Benzo[g,h,i]perylene	6 of 169 (3.55%)	AP1-2, AM15-1, AM15-2, AH7-2, AG3-1, AJ2-2	19.40 – 55.00	15.230

The results show exceedances of cyanide (total), iron (total), manganese, vanadium, naphthalene, acenaphthylene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene and benzo[g,h,i]perylene of the RLL re-use criteria during the 2020-2021 ground investigation. The location of exceedances are shown on RLL Drawing 18669-RLL-25-XX-DR-O-0830-P01, **Appendix A**.

Following this assessment, recorded exceedances shall be managed, via the earthworks operation, in accordance with the HFC Glan Llyn: Soils Validation Strategy for the Protection of Controlled Waters; and where unsuitable material is identified, this shall be removed from Site and disposed at a suitable waste facility.

Soil chemical testing certificates are presented within Appendix G of the RLL Phase 5A & 5B Desk Study and Ground Investigation Report (18669-RLL-25-XX-RP-O-0781-P01).

5 Conclusion

In 2021 RLL submitted a CWDQRA for the wider Glan Llyn development site. This assessment incorporated a comprehensive dataset of concentrations of contamination recorded in soils across the development. Further assessment has been undertaken comparing soil concentrations recorded within the Site area with those of the wider residential Glan Llyn development site used in the CWDQRA.

This assessment has concluded that the dataset used in the CWDQRA is largely representative of the levels of contamination present within the Site and therefore adoption of the calculated re-use criteria and recommendations presented within the CWDQRA are appropriate for the Site.

Determinands benzene, toluene, ethylbenzene and xylenes were found to not be representative of the calculated re-use criteria due to the laboratory listed detection limits causing a significant skew in the results. If the true concentration is taken into consideration, the 95th percentile and average concentrations are likely to be significantly lower than this value. The concentrations were lower than the relevant reuse criteria.

Following an assessment of soil chemical testing data from within the Site, exceedances of the reuse criteria for cyanide (total), iron (total), manganese, vanadium, naphthalene, acenaphthylene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene and benzo[g,h,i]perylene have been identified that may represent a risk to Controlled Waters.

The soil reuse criteria have been conservatively calculated considering only dilution of contamination by intercepted surface water from the finished development. In reality subsurface degradation and attenuation will occur as these contaminants migrate laterally through the ground, further reducing the concentrations prior to dilution within the on-site private drainage system.

It is recommended that further delineation and assessment of the identified exceedances of cyanide (total), iron (total), manganese, vanadium, naphthalene, acenaphthylene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene and benzo[g,h,i]perylene (as shown on RLL Drawing 18669-RLL-25-XX-DR-O-0818-P01) are undertaken as part of the remediation works, with unsuitable material being removed or re-located as necessary, in order to ensure that they do not present a risk to controlled waters.

A Remediation Strategy has been prepared for Phase 5A & 5B (18669-RLL-25-XX-RP-O-0816-P01) outlining required remedial measures for the Site.

Appendix A: Drawings

GENERAL NOTES

NO DIMENSIONS TO BE SCALED OFF THIS DRAWING.

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS.

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.

ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEY:



P01	20/08/2025	First Issue	DM	CW
Rev	Date	Amendments	By	Chk



Client

BSTMDL

Project

P18-669 Llanwern Reclamation

Drawing Title

Phase 5a & 5b
Site Location Plan

INFORMATION

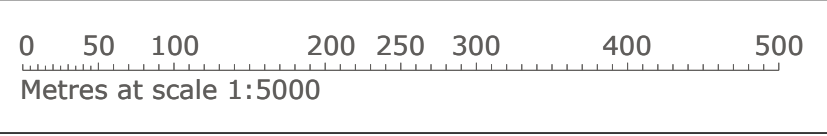
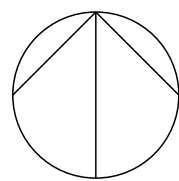
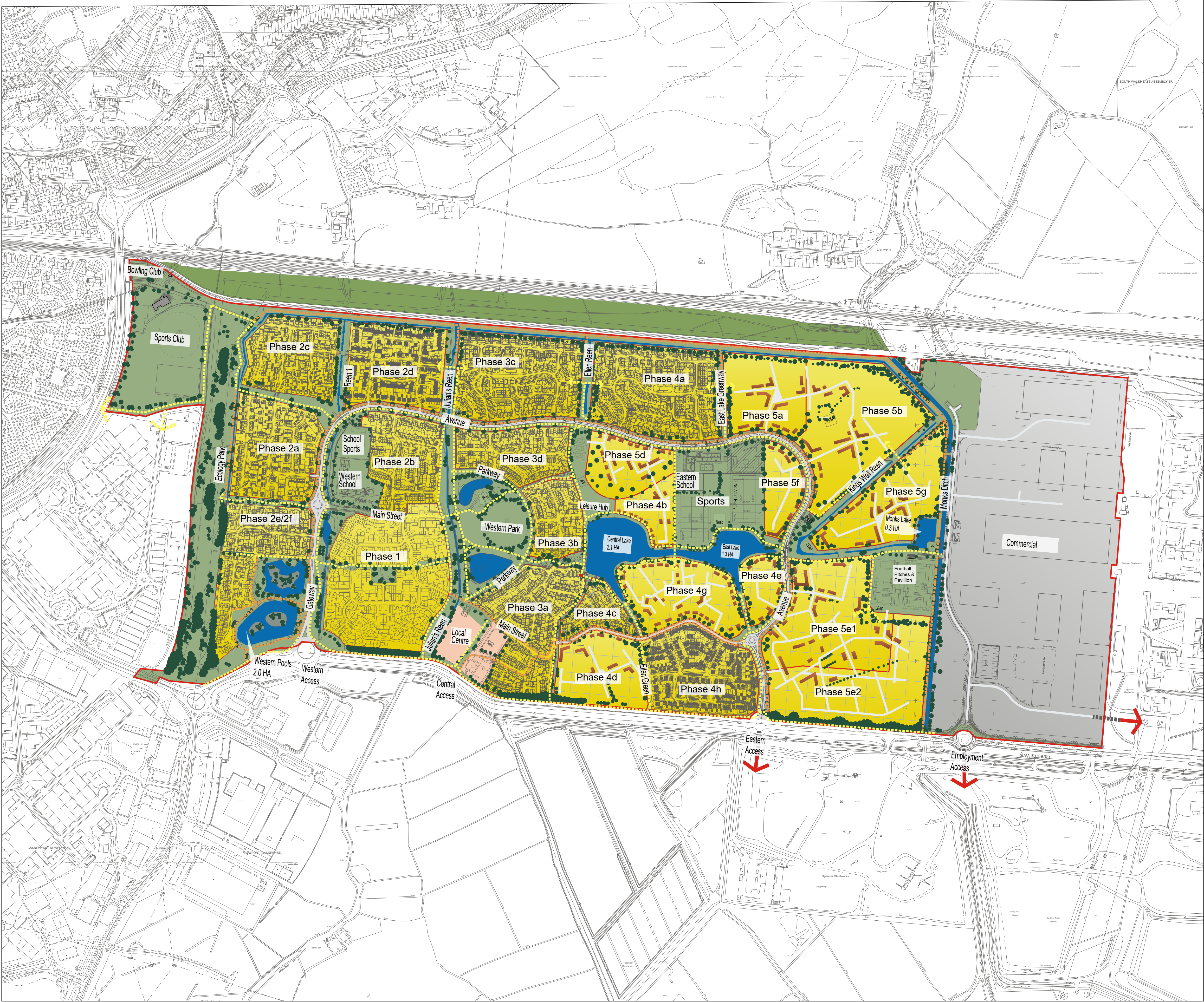
	Drawn	Checked	Date
NTS	DM	CW	20/08/25

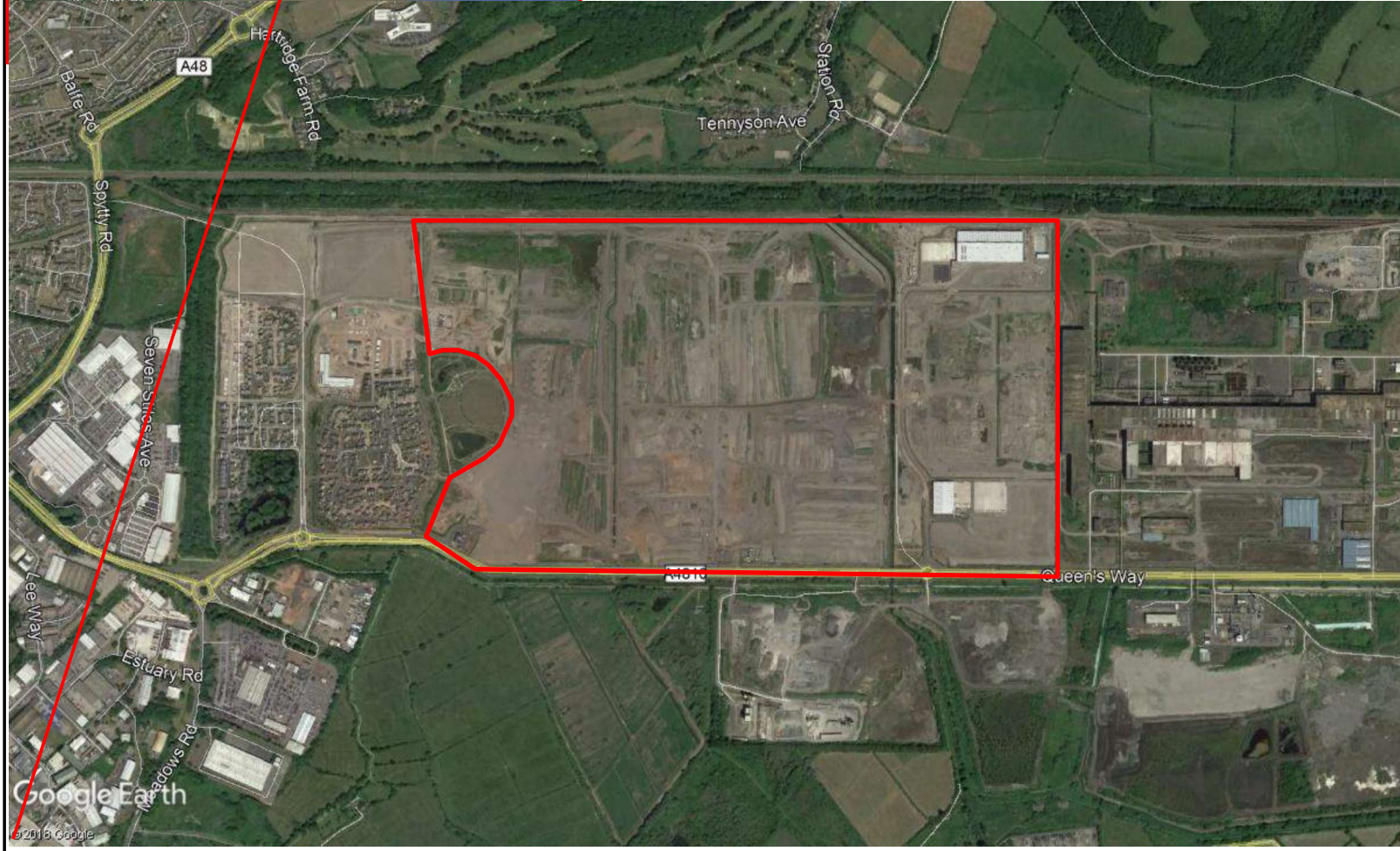
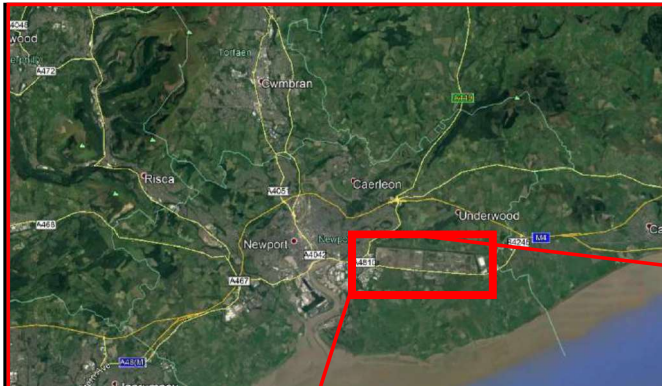
Drawing No. Rev.

18669-RLL-25-XX-DR-O-0787 P01

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Glan Llyn -ESAMP Indicative Masterplan





GENERAL NOTES

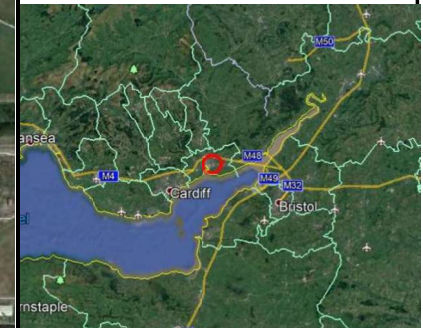
NO DIMENSIONS TO BE SCALED OFF THIS DRAWING

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Key

 Redline boundary



CLIENT

ST. MODWEN DEVELOPMENTS

PROJECT

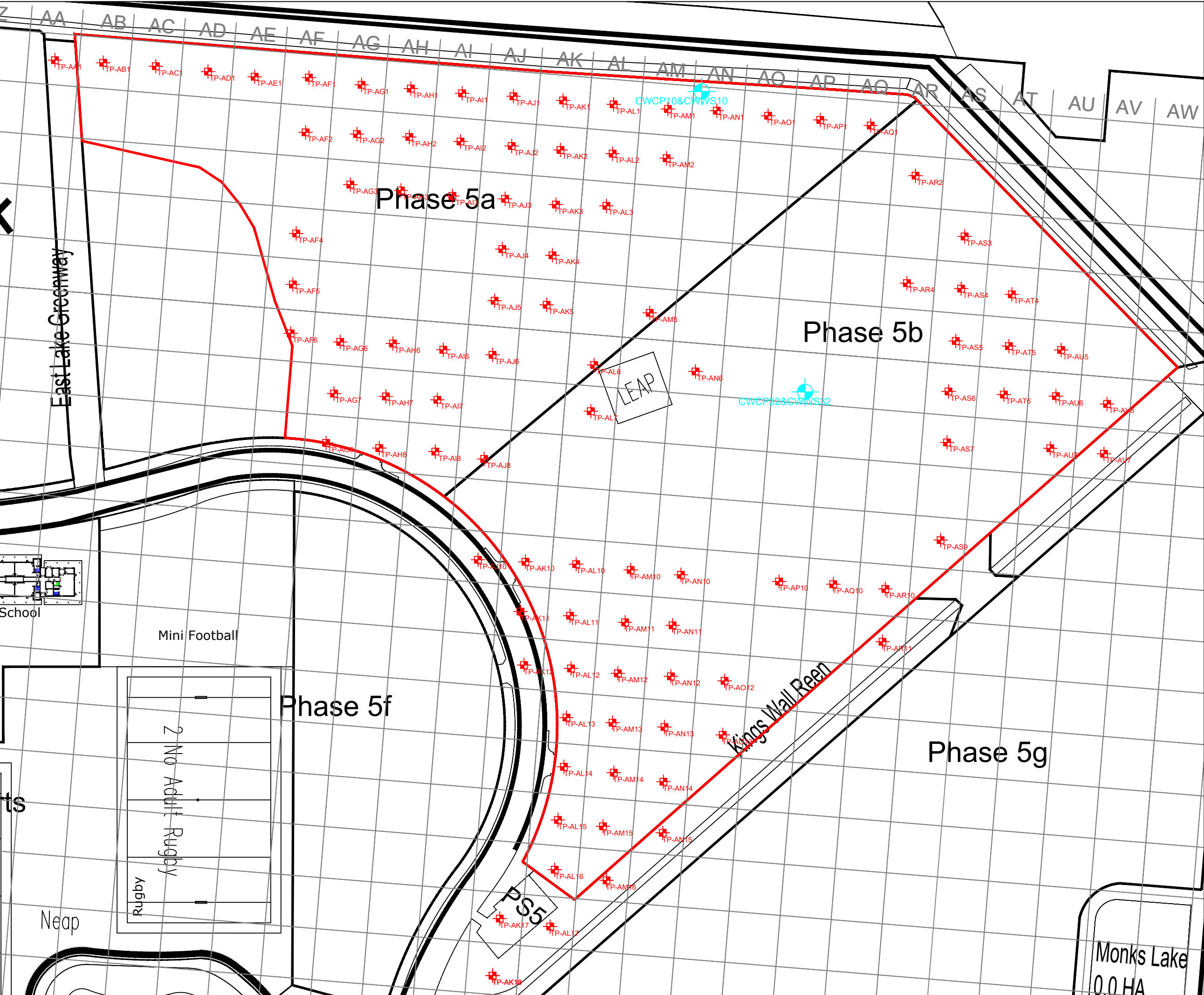
LLANWERN SITE LOCATION PLAN

STATUS

FOR INFORMATION

DRAWN	CHECKED	DATE
ET	CW	19/08/2019

PROJECT NUMBER	DRAWING NUMBER	REV
P18-669	18669-RL-19-XX-DR-O-0004	



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ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEY:

- TP-AG6 RLL (2020/21) TRIAL PIT LOCATION
- ATKINS (2016) EXPLORATORY HOLE LOCATION

P01	26/05/2026	Atkin Exploratory Holes Added	AMS	CW
Rev	Date	Amendments	By	Chk



Client
BSTMDL
Project
P18-669 Llanwern Reclamation

Drawing Title
Phase 5A & 5B Trial Pit Location Plan

INFORMATION

	Drawn	Checked	Date
NTS	DM	CW	15/08/25
Drawing No.	Rev.		

18669-RLL-25-XX-DR-O-0788 P01

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ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEY:

- TP-AG6 TRIAL PIT LOCATION
- SITE BOUNDARY
- CYANIDE (TOTAL)
- IRON (TOTAL)
- MANGANESE
- VANADIUM
- NAPHTHALENE
- ACENAPHTHYLENE
- FLUORENE
- PHENANTHRENE
- ANTHRACENE
- FLUORANTHENE
- PYRENE
- BENZO[B]FLUORANTHENE
- BENZO[K]FLUORANTHENE
- BENZO(A)PYRENE
- INDENO(1,2,3-C,D)PYRENE
- BENZO[G,H,I]PERYLENE

P01	05/12/2025	First Issue	AMS	CW
Rev	Date	Amendments	By	Chk



Client
BSTMDL
Project
P18-669 Llanwern Reclamation
Drawing Title
Phase 5A & 5B RLL Re-Use Criteria
Exceedances Location Plan

INFORMATION

	Drawn	Checked	Date
NTS	AMS	CW	05/12/25
Drawing No.	Rev.		
18669-RLL-25-XX-DR-O-0830	P01		

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Appendix B: Chemical Screening

P18-669 Llanwern Phase 5A 5B Soil Chemical Screening Results

Project: P18-669					RLL Grid Ref:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
Client: Rodgers Leask Environmental		Job No.:		CWDORA Reuse Criteria for 40% Infiltration Rainfall (Residential)	Number of Exceedances	Maximum Concentration Check	Minimum Exceedance Concentration	95th Percentile Concentration	95th Percentile Check	Maximum Concentration	Average Concentration	Minimum Concentration	201217-34	201217-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218-34	201218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P18-669 Llanwern Phase 5A 5B Soil Chemical Screening Results

[illegible]

P18-669 Llanwern Phase 5A 5B Soil Chemical Screening Results

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P18-669 Llanwern Phase 5A 5B Soil Chemical Screening Results

Project: P18-669																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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P18-669 Llanwern Phase 5A 5B Soil Chemical Screening Results

Client: Rodgers Leask Environmental

Quotation No.: Q21-24056

Order No.:

Job No.:

Sample ID.:

Client Sample Ref.:

Sample Type:

Top Depth (m):

Bottom Depth (m):

Date Sampled:

Asbestos Lab:

CWQDRA

Reuse Criteria for 40% Infiltration (Residential)

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P18-669 Llanwern Phase 5A 5B Soil Chemical Screening Results

Project: P18-669																															
Client: Rodgers Leask Environmental		Job No.:		CWDORA Reuse Criteria for 40% Infiltration Rainfall (Residential)	210211-154	210211-154	210211-154	210211-154	210211-154	210211-154	210211-154	210210-68	210210-68	210210-68	210210-68	210210-68	210210-68	210210-68	210210-68	210219-57	210219-57	210213-50	210217-34	210211-154	210211-154	210211-154	210211-154	210217-34			
Sample ID.:		23709365	23709370		23709347	23709357	23709361	23709332	23709339																						
Client Sample Ref.:		AT5-1	AT5-2		AU5-1	AU5-2	AU5-3	AU6-1	AU6-2	AG8-1	AG8-2	AH8-1	AH8-2	AH8-3	AH8-4	AH8-1	AH8-2	AJ8-1	AJ8-2	AL3-1	AU7-1	AV6-1	AV6-2	AV6-3	AV7-1						
Sample Type:		SOLID	SOLID		SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID		
Top Depth (m):										0.40-0.40	1.50-1.50	0.10-0.10	1.00-1.00	2.00-2.00	3.90-3.90	0.40-4.00	2.00-2.00	0.40-0.40	1.00-1.00	0.30-0.30	0.50-0.50	0.50-0.50	1.20-1.20	2.00-2.00	0.30-0.30						
Bottom Depth (m):		0.40-0.40	1.30-1.30		0.70-0.70	1.60-1.60	2.30-2.30	0.50-0.50	1.70-1.70																						
Date Sampled:		10/02/2021	10/02/2021		10/02/2021	10/02/2021	10/02/2021	10/02/2021	10/02/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	18/01/2021	17/12/2020	17/12/2020	22/01/2021	16/12/2020	10/02/2021	10/02/2021	10/02/2021	10/02/2021	16/12/2020				
Asbestos Lab:																															
Determinand	Accred.	SOP	Units	LOD																											
ACM Type	U	2192		N/A			Chrysotile (White) Asbestos													Chrysotile (White Asbestos)											
Asbestos Identification	U	2192		N/A		Not Detected	Detected		Not Detected	Not Detected		Not Detected		Not Detected		Not Detected				Trace					Not Detected			Not Detected			
Asbestos by Gravimetry	U	2192	%	0.001			<0.001													<0.001											
Total Asbestos	U	2192	%	0.001		-	-	<0.001	-	-	-	-																			
Moisture	N	2030	%	0.020		14	14	16	23	24	25	22		9.5	15	13	9.7	11	13		6.8	7.1		11	13		13		6.9	31	20
Soil Colour	N	2040		N/A		Light Brown	Red	Light Brown	Dark Brown	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Light Brown	Light Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown			
Other Material	N	2040		N/A		Sandy Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Sandy Loam	Sandy Clay Loam	Loamy Sand	Loamy Sand	Oil/Petroleum	None	Vegetation	None	Stones	None	Stones	None	Stones	Stones	Stones	Vegetation	Stones	Stones	Stones	Stones			
Soil Texture	N	2040		N/A		Stones	Stones	Stones	Stones	Stones	Stones	Stones								Loamy Sand	Loamy Sand		Loamy Sand					Loamy Sand			
pH	M	2010		4.0		10.4	10.7	10.6	10.7	9.18	7.7	11.4	11.1	10.5	8.89	9.17	11.3	11	12	9.27	8.32	8.57	11.5	11.4	12.5	11.4	9.84	11.6			
Cyanide (Total)	M	2300	mg/kg	0.5	2.313	<1	6.9	<1	23.1	37.2	1.11	9.79	1.41	2.63	<1	<1	<1	<1	<1	4.42	<1	<1	<1	8.68	4.42	6.99	184	10.8			
Ammoniacal Nitrogen	M	2425	mg/kg	0.5	176.983	<12	<12	<12	<12	<12	123	<12	<12	24.8	93.4	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12	<12			
Iron (Total)	N	2430	mg/kg	100	349148.01	45100	47100	104000	349000	261000	22100	254000	114000	54600	62800	112000	85300	97400	112000	39800	11500	11400	67200	255000	192000	467000	417000	327000			
Arsenic	M	2450	mg/kg	1	2902.688	7.08	9.76	10.2	19.7	17.7	13.7	5.08	6.09	5.96	16	4.3	6.32	<6	6.52	3.94	4.77	6.59	16.3	<6	16.9	22.2	17.2				
Cadmium	M	2450	mg/kg	0.1	83.661	0.95	3.38	2.12	21.9	16.5	0.913	12.6	0.371	<0.02	0.215	<0.2	0.164	<0.2	<0.2	0.231	0.177	0.118	0.493	9.82	6.38	7.44	24	10.4			
Chromium	M	2450	mg/kg	1	10806.907	138	39.6	588	267	115	17.2	551	215	108	148	448	127	288	589	8.3	9.37	11.7	163	273	430	172	104	91.7			
Manganese	M	2450	mg/kg	5	38175.69	5900	1940	12700	23600	13400	624	26300	17000	12300	10400	3340	17400	25000	32400	2010	585	784	16300	23300	33500	14600	14400	16700			
Copper	M	2450	mg/kg	0.5	516.883	34.6	88.3	64.7	85.3	63.7	52.8	55.3	22.1	13.8	21.9	29.2	19.3	22.1	<14	6.31	9.19	11.8	<14	56.5	38	117	82	60			
Mercury	M	2450	mg/kg	0.1	150.809	<1	1.97	<1	<1	<1	<1	<1	<0.14	<0.14	<0.14	<1.4	<0.14	<1.4	<1.4	<0.14	<0.14	<0.14	<1.4	<1	1.39	1.34	<1.4				
Nickel	M	2450	mg/kg	0.5	13188.601	22.7	29.4	26.1	52.3	44	21.2	28.5	9.95	13.6	13.1	33.6	10	11.1	5.7	5.96	8.94	9.98	14.4	45.5	39.2	40.1	59.2	60.2			
Lead	M	2450	mg/kg	0.5	18032.071	56.4	255	135	1920	1370	564	1070	28.1	18.1	31.2	182	32.3	18.7	10.1	11.8	14.7	9.07	18.3	1320	494	447	2070	1270			
Selenium	M	2450	mg/kg	0.2	804.305	<10	<10	<10	<10	<10	<10	<10	6.3	5.37	4.29	<10	5.72	10.2	17.2	1.03	<1	<1	13	<10	11.8	<10	<10	<10			
Vanadium	U	2450	mg/kg	5	1840.198	107	56.9	490	945	460	23.6	485	157	110	181	74.1	165	199	478	15.7	12	17.1	256	1180	1490	472	379	691			
Zinc	M	2450	mg/kg	0.5	157599.516	208	1260	559	9230	6550	187	5520	75.7	77.1	154	283	82.3	71.5	59.9	50.8	35.6	86.2	5510	2100	1920	10600	5830				
Organic Matter	M	2625	%	0.4		4.43	10.3	6.55	9.28	6.62	39.1	18.3	2.26	2.26	7.6	6.71	13	30.7	3.79	0.619	1.42	0.902	<0.35	6.5	2.79	2.72	8.83	8.96			
Aliphatic TPH >C5-C6	N	2680	mg/kg	1	84	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0122	0.0401	<0.01	<0.01	0.0426	0.0441	<0.01	0.028	<0.01	<0.01	<0.01	<0.01	<0.01	0.0107	<0.01	<0.01			
Aliphatic TPH >C6-C8	N	2680	mg/kg	1	412								0.0389	0.092	<0.01	<0.01	0.162	0.176	<0.01	0.0506	<0.01	<0.01	<0.01	0.0242	<0.01	0.0311	0.0115	0.0175			
Aliphatic TPH >C8-C10	M	2680	mg/kg	1	3255	<0.01	<0.01	0.051	<0.01	<0.01	<0.01	<0.01	0.091	0.373	<0.01	<0.01	1.88	1.16	<0.01	0.0958	<0.01	<0.01	<0.01	0.0311	<0.01	0.0634	0.0158	0.025			
Aliphatic TPH >C10-C12	M	2680	mg/kg	1	25838	<1	<1	<1	<1	1.99	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1			
Aliphatic TPH >C12-C16	M	2680	mg/kg	1	515489	<1	1.79	1.12	1.74	1.09	1.26	1.32	49.4	79.4	<1	<1	27.9	30.8	<1	1.82	<1	<1	<1	3.37	10.8	6.03	6.34	1.52			
Aliphatic TPH >C16-C21	M	2680	mg/kg	1	64895263.78	3.46	5.67	5.8	11.1	5.43	5.18	7.11	672	1190	27.9	20.3	213	251	11.3	73.9	<1	1.13	1.03	19.4	31	20.7	20.6	6.04			
Aliphatic TPH >C21-C35	M	2680	mg/kg	1	64895263.78	19.8	28.1	80.1	45.8																						

Appendix C – Phase 5A & 5B DS GIR

Glan Llyn
Phase 5A & 5B

Desk Study & Phase 2 Geo-
Environmental Interpretative
Report

Glan Llyn, Newport

Phase 5A & 5B

Desk Study & Phase 2 Geo-Environmental Report

For

Brighton STM Developments Limited

DATE: May 2026

REV: P01

18669-RLL-26-XX-RP-O-0781-P01

Document Reference & Control

Project Name: Glan Llyn, Phase 5A & 5B

Project Reference: P18-669

Report Title: Desk Study & Phase 2 Geo-Environmental Report

Client: Brighton STM Developments Limited

Document Reference: 18669-RLL-25-XX-RP-O-0781

Report Status: FINAL

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Revision Status	Date	Summary of Revision
P01	May 2026	First Issue

Executive Summary

This presents the salient points of the report and should not be referred to in isolation.

Summary	Rodgers Leask Ltd (RLL) were commissioned by Brighton STM Developments Limited (BSTMDL) to prepare a combined Desk Study and Phase 2 Geo-Environmental Interpretative Report for Phase 5A & 5B of the Glan Llyn development on the former Llanwern steelworks (hereafter referred to as the 'Site'). The Site is proposed to be re-developed for residential with gardens and public open spaces end-use.
Site Location and Description	The Site is irregular in shape and covers approximately 12 hectares, located within the Glan Llyn development at the former Llanwern Steelworks, approximately 5.5km to the east of Newport at National Grid Reference 336490E, 187114N. Prior to the recent earthworks, the site comprised an area used for the storage of excavated Made Ground originating from the wider Llanwern Site.
History	The Site historically comprised agricultural land until the 1960s, when it was developed as part of the Llanwern Steelworks (sinter plant, lagoons and associated infrastructure). Operations ceased in 2001, with the Site being partially demolished by 2006 and above ground structures were completely demolished to slab level by 2009..
Geology / Ground Conditions	The Site is understood to be underlain by Made Ground overlying Tidal Flat Deposits, underlain by bedrock from the Mercia Mudstone Group. The 2020-2021 RLL ground investigation comprised 103 trial pits within Phase 5A & 5B. General Made Ground was encountered within all 103 exploratory holes from ground level or underlying asphalt surfacing to a maximum encountered depth of 4.20m. Tidal Flat Deposits were encountered beneath the Made Ground in 74 locations from depths of between 0.80m and 4.20m; base of the formation was not encountered, but the strata was recorded to a maximum depth of 4.30m. The Mercia Mudstone Group was not encountered. The Mercia Mudstone Group or the Penarth Group was not encountered during the RLL 2020-2021 ground investigation.
Hydrology and Hydrogeology	The Mercia Mudstone Group is classified as a Secondary B Aquifer. The Penarth Group is a Secondary (Undifferentiated) Aquifer. The Tidal Flat Deposits are classified as Secondary (Undifferentiated) Aquifer. The nearest surface water feature is Kings Wall Reen and Northern Reen which bound the site to the north and east. Monks' Ditch, which is hydrologically separate to Kings Wall Reen and Northern Reen is approximately 28m to the north-east. These form part of the private reen network. The overall flood risk is mapped as low (tidal/ sea) by Natural Resources Wales. The Site lies within an area shown as having a Low Flood Risk from Sea according to Natural Resources Wales Flood Risk mapping.
Controlled Waters	With regard to controlled waters, the following pathways are considered applicable to the Site, following completion of the

	development and once relevant approvals have been granted to allow discharge into Monks' Ditch: - Leaching of soil-borne contamination in Made Ground and subsequent lateral migration through permeable pathways in Made Ground to Monks' Ditch via onsite reens; and - Newly created preferential pathways associated with the redevelopment of the Site e.g. foundations and infrastructure. As such, it is recommended that this report is read in conjunction with the Phase Specific Controlled Waters Risk Assessment. .
Contamination	169 soil samples were collected during the ground investigation for contamination testing, all of which were taken from the Made Ground. The samples collected were conservatively assessed against LQM/ CIEH 2015 S4ULs (Suitable for Use Levels) for a residential end use with plant uptake (1% SOM). Chemical testing has identified some exceedances of S4ULs for metals (lead, zinc, arsenic and vanadium) and hydrocarbons (TPH, PAHs and BTEX compounds). Asbestos was detected in 12 of 89 soil samples analysed, at concentrations of <0.001% to 0.0022%. The presence of asbestos and elevated contaminants identified on site are a risk to human health and will be managed through the remedial works and succeeding housebuilder requirements.
Ground Gas and Radon	No gas monitoring has been undertaken within Phase 5A & 5B. A programme of shallow gas monitoring is required following turnover and earthworks reengineering. The Site is located within a radon affected area, with 1-3% of properties being above the action level on its southern side and 10-30% of properties are above the action level across the majority of the Site. As such, the Site is in a radon affected area with and full protective measures are likely to be required in the construction of the new development.
Recommendations	Following the completion of the RLL ground investigation, the following recommendations are made: - Removal of identified hotspot contamination on a grid square basis, and subsequent validation testing and reporting. - Turnover of the Made Ground to natural geology, to variable depths up to approximately 4.20mAOD, with removal of obstructions. - reengineering of materials in accordance with the approved Remediation Strategy and earthworks specification. - Chemical validation of the placement of material following turnover. - A programme of shallow gas monitoring and assessment is required following the turnover and reengineering of the earthworks. - Concrete classification testing should be undertaken in accordance with BRE Special Digest 1.

	▪ Phase-specific geotechnical assessments and validation relating to the proposed development. ▪ Construction of buildings and hardstanding with suitable construction materials to break the pathway with underlying Made Ground, to intercept rainwater and to reduce infiltration. ▪ Installation of a 600mm clean cover system, suitable for a residential with plant uptake end use, will be required in areas of residential gardens and landscaping. ▪ Consultation with the water supply company in relation to the potential use of barrier pipe. ▪ Preparation of a Piling Risk Assessment. ▪ Preparation of a Detailed Quantitative Controlled Waters Risk Assessment to assess the risk posed to controlled waters within the future development and inform the Remediation Strategy. ▪ Preparation of an MMP to facilitate the reuse of excavated materials and import of soil for use in the cover system.
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Appendices

- Appendix A:** Drawings and Plans
- Appendix B:** Site Walkover Photographs
- Appendix C:** Historical Aerials
- Appendix D:** Groundsure Insight Report
- Appendix E:** UXO Map
- Appendix F:** EH Logs
- Appendix G:** Chemical Screening and Testing Certification
- Appendix H:** Geotechnical Testing Summary and Certification

1.0 Introduction

1.1. Terms of Reference

Rodgers Leask Ltd (RLL) was commissioned by Brighton STM Developments Limited (BSTMDL) to prepare a combined Desk Study and Phase 2 Geo-Environmental Interpretative Report for Phase 5A & 5B of the Glan Llyn development in Newport (hereafter referred to as the 'Site').

The Site is situated within the ongoing wider redevelopment of the former Llanwern Steelworks. The Site location plan is shown on Drawing 18669-RLL-25-XX-DR-O-0787, included in **Appendix A**.

In July 2024 the Client, St Modwen Developments, were rebranded to be called Brighton STM Developments Limited (BSTMDL). Any reference to the previous company names in this report should be referred to accordingly.

1.2. Proposed Development

It is understood that the Site is proposed to be redeveloped for a residential end use with gardens and public open space areas. An illustrative masterplan (ref. 8111-08-A011, Rev P19, dated April 2019) is available in **Appendix A**.

The development will form part of the wider Glan Llyn development.

1.3. Purpose

This report has been prepared to support the discharge of Planning Condition 27 of the Outline Planning Permission Reference 06/0471 for the proposed development of residential development Phase 5A & 5B as part of a wider mixed-use development at Llanwern, Newport.

Planning Condition 27 states the following.

“(27) Prior to the commencement of each phase of development as defined by Condition 03 (or at such other date or stage in development or for such specified activities or works as may be agreed in writing with the Local Planning Authority), the following components of a scheme to deal with the risks associated with contamination relating to that phase or activity shall each be submitted to and approved, in writing, by the Local Planning Authority:

- (1) A preliminary risk assessment which has identified:*
 - (a) all previous uses;*
 - (b) potential contaminants associated with those uses;*
 - (c) a conceptual model of the site indicating sources, pathways and receptors;*
 - (d) potentially unacceptable risks arising from contamination at the site.*

(2) A site investigation scheme, based on (1) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.

(3) The site investigation results and the detailed risk assessment (2) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.

(4) A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in (3) are complete and identifying any requirements for longer term monitoring of pollutant linkages, maintenance and arrangements for contingency action. Any changes to these components require the express consent of the Local Planning Authority.

Reason: To ensure that the proposed development will not cause pollution of the environment or harm to human health."

The scope of this report is detailed in Section 1.4 below. It is considered that this report addresses the requirements of Condition 27 part 1 and 2. Part 3 and part 4 will be addressed in future reporting including a Remediation Strategy and Validation Report.

1.4. Objectives

The objectives of this report are to:

- Obtain desktop information to assist in the assessment of potential environmental and ground related issues that may have implications for the proposed development.
- Review the available information to determine the anticipated ground conditions and identify the potential for contamination to be present within the Site boundary, including formulation of an initial Conceptual Site Model.
- Present the findings of the ground investigations and produce an updated Ground Model,
- Present contamination data and undertake risk assessment to establish the nature and extent of any contamination within the Site.
- Produce a refined Conceptual Site Model for the site using the findings of the desktop study and ground investigation works, including identification of Source Pathway Receptor Linkages that require mitigation.
- Make outline recommendations for remedial actions, where required, to mitigate unacceptable risks.

1.5. Scope

In order to achieve the outlined objectives, the scope of the study includes:

- A review of existing geo-environmental data for the Site including a review of historical maps and existing ground investigation data.
- A site visit/ walkover survey.
- Undertake an intrusive ground investigation, including chemical and geotechnical laboratory testing.

- An assessment of the levels of contamination present within the soils on Site against generic screening criteria based on the results of laboratory testing of samples collected during the investigation.

1.6. Sources of Information

The following documents and data sources have been reviewed in preparation of this Desk Study & Phase 2 Geo-Environmental Interpretative Report and should be read in conjunction with this document:

Groundsure Report

- Groundsure Enviro+Geo Insight Historical Map Pack (ref. GS-FWC-52V-7SW-PC7), dated August 2025 (**Appendix C**); and
- Groundsure Enviro+Geo Insight Report (ref. GS-BO6-PBF-9D2-2IX), dated August 2025 (**Appendix D**).

The following reports have been prepared to be read in conjunction with this report:

- IOM, Assessment of asbestos contamination at former Llanwern Steelworks Site, Newport, Wales, ref. 610-34464 Rev 1, dated March 2024; and
- RLL, Phase 5A & 5B Controlled Waters Detailed Quantitative Risk Assessment Addendum, ref. 18669-RLL-26-XX-RP-O-0822-P01 dated May 2026.

1.7. Limitations and Confidentiality

All conclusions and recommendations made within this report are based upon and limited to the factual information obtained as part of this investigation. No responsibility can be taken by RLL for information obtained by third parties and it has been assumed that all third-party information provided is true and correct.

No liability can be accepted for conditions not revealed within the exploratory holes or pits undertaken by this investigation. The exploratory points cover only a small proportion of the total site area. RLL has where necessary undertaken extrapolation between locations and no responsibility can be taken for different conditions which may occur between locations.

RLL has undertaken the work in accordance with our understanding of current best practice at the time of undertaking the report. Further assessment and revision of the report may be required should new information come to light or legislation/ changes to best practice be introduced after the date of issue of the report.

RLL has prepared the report for the sole use and reliance of the Client. The report may not be used or relied upon by any unauthorised third party without the explicit written agreement of RLL.

The interpretive work undertaken within this report remains the intellectual property of RLL and must not be divulged to any commercial third party without prior written agreement of RLL.

At the time of writing, detailed information on the proposed structures, such as detailed layout, loadings and serviceability limits, was not available. Accordingly, where geotechnical design advice is provided it is for information only and should be reassessed by a competent specialist once the development layout and structural loadings are known.

2.0 Site Location and Description

2.1. Site Location

The Site is located within the Glan Llyn development at the former Llanwern Steelworks, approximately 5.5 km to the east of Newport City Centre, at approximate National Grid Reference 336490E, 187114N. The wider Glan Llyn development covers approximately 250 hectares and is undergoing phased redevelopment for residential, commercial, and open space use. The Site location plan is shown on RLL Drawing 18669-RLL-25-XX-DR-O-0787-P01, provided in **Appendix A**.

The Site is irregular in shape, covering an area of approximately 12ha and is situated in the northeastern part of the wider Glan Llyn development. The Site historically housed part of a sinter plant alongside other steelworks infrastructure. Drain 4, a historical below ground box culvert, was located on the eastern side of the Site orientated north-south. The Site currently comprises an area used for the stockpiling of excavated Made Ground generated from the wider Glan Llyn Site

The Site boundary is shown on drawing 18669-RLL-22-XX-DR-O-0787-P01, **Appendix A**.

2.2. Site Boundaries and Surrounding Area

The Site is bounded on all sides by the wider Glan Llyn development. Boundaries are not defined by permanent physical features but are identifiable on plan by the limits of current groundworks, hardstanding, and stockpile areas.

- North: the Site boundary runs broadly east–west and is bounded to the north by a surface water reën known as Northern East-West Ditch, which forms part of the private Glan Llyn drainage network.
- East: the eastern boundary is formed by a surface water reën known as Kings Wall Reën. Beyond which is Phase 5G, which is currently undeveloped.
- South: the southern boundary adjoins the proposed highway known as Avenue Road, beyond which is Phase 5F, also comprising undeveloped land.
- West: the western boundary is formed by Phase 4A, which comprises land used for the stockpiling of Made Ground generated from the wider Glan Llyn development.

2.3. Site Walkover

Numerous site walkovers were conducted between 2020-2022 by an RLL Engineer. The purpose of the site walkovers was to provide a general description of the Site. Copies of relevant photographs are included in **Appendix B**.

At the time of the walkovers, the Site had been demolished to slab level and housed approximately twenty mostly vegetated stockpiles of material originating from the wider Llanwern site. A temporary site compound was present for earthworks contractors working on the adjacent Phase 4A and contained a few buildings/

structures, open storage areas and stacked materials or containers. Numerous tracks and temporary haul routes traversed the Site.

Vegetation cover was sporadic, with notable areas of dense scrub, particularly in the northeastern areas. Boundaries were open in most locations, with no continuous fencing visible and the Site was directly accessible from adjoining areas within the wider Glan Llyn development.

2.4. Site History - Ordnance Survey Maps

Historical Ordnance Survey maps have been assessed to identify former land uses at the Site and the surrounding area. Records have been obtained from a Groundsure Insight Report commissioned for the Site in 2025 (**Appendix C**).

Map Date	Site Feature	Adjacent Features
1882 OS	The Site predominantly comprised undeveloped land: forming part of six fields segregated by drains. Monks Ditch, part of the collective reen network known as Black Wall, is shown on the eastern side of the Site. An unnamed reen diverges west of Monks Ditch, orientated east-west in the southern half of the Site. The unnamed reen appears again on the western Site boundary, where the reen diverted northwards offsite. A footpath traverses from the south of the Site to the north. Two small features, possibly drain overflows, are located in the northeast corner of the Site.	Surrounding land is characterised by open agricultural fields segregated by reens, drains, trees and the Great Western Railway line which runs approximately east to west approximately 100m to the north of the Site. Two reens are shown running parallel to each other 500m to the west and southwest of the Site. The western most watercourse, Ellen Reen, flows to the south with connected field drains to the east and west, including Middle Reen. Collectively this system is labelled Kings Wall. The Brassgout Reen/ Decoypool Walk runs east to west approximately 350m south-east of the Site. Decoypool Farm and the associated Decoy Pool (marshy pond) are located approximately 250m west of the Site. A footpath with various foot bridges runs from Decoypool Farm in a northeasterly direction towards Llanwern Station which is approximately 100m northeast of the Site. The main railway (Great Western Railway), orientated east to west, runs approximately 100m north of Site at its closest point. Various farms and residential properties are shown within 1km (Monkspill Cottage approximately 250m north-east, Pwll-pan approximately 800m north-east, Tatton Farm 1km southwest, New House 1km south-east).

Map Date	Site Feature	Adjacent Features
1900 OS	Trees have been removed from the field boundaries. The small structure on the northeast corner of the Site is now absent from the map. Black Wall Reen is now labelled as Barn Reen and the unnamed reen crossing the southern section of the Site is shown to flow in a westerly direction.	Decoy Pool is renamed Old Decoy Pool. Little significant change is observed within 1km.
1920 –1922 OS	Little significant change is observed. A footpath encroaches on the northwestern corner of the Site.	Llanwern Lime Works is indicated 450m north of the Site and the associated Goods Shed and railway siding is located 100m north. Ellens Reen and Middle Reen are indicated to have south-easterly flow direction.
1938 –1949 OS	Little significant change.	Llanwern Golf Club is shown to the north of the Great Western Railway line alongside new development comprising 13 residences. Lime kiln and associated infrastructure no longer shown. Monkspill Cottage shown 250m northeast.
1963 OS	Little significant change.	Roman Burials (found AD 1925) indicated to the west of Llanwern Golf Club. Little significant change is observed within 1km.
1973 OS	The Site is shown to form part of the Spencer Steelworks (later known as the Llanwern Steelworks). Numerous industrial buildings/structures are recorded within the Site boundary, including part of a sinter plant. A large canteen building is also labelled. Dashed lines on the survey indicate access tracks and roads, as well as boundaries around infrastructure, possibly service areas, yards or plant enclosures. Railway sidings are shown to be present in the east of the site. Much of the northeast of the Site is shown as mud, implying a wet marshy area. Two surface water drainage channels, presumed to be open channels, are shown in the north and east of the Site.	Mapping shows the surrounding area to comprise the Spencer Steelworks. Within the steelworks, land to the west comprised travelling booms, chimneys, hoppers, tanks and other infrastructure associated with the benzole and benzene plant and gas holder. Further to the west was the coal storage dumps and numerous drains. Land to the east includes tanks, slag pits and numerous gasholders associated with the blast furnaces and iron granulating plant. Land to the immediate south comprised infrastructure associated with a sinter plant. Within 500m to the south-west were found a benzole refinery and associated tanks. To the south a lime plant and various conveyors /travelling booms.

Map Date	Site Feature	Adjacent Features
1988 OS	The Site is shown to have changed with the expansion of the steelworks. The eastern side of the Site formerly comprising marshy land is shown as open space with individual trees or small clusters of deciduous trees present at the time of mapping. An additional unlabelled building is shown to the immediate north of the canteen building. One of the railway sidings is shown to have been removed. A conveyor is shown on the southern boundary of the Site.	The railway sidings are no longer shown to the east of the Site, with roads/ tracks marked in their place. Some additional structures are indicated to the south of the Site associated with expansion of the benzole refinery 100m south. Expansion is shown to the benzole plant approximately 150m to the north of the Site with additional tanks and structures shown. Little significant change is evident to the west, south and east of the Site, with some expansion shown in the ore stockyard to the west.
2001 OS	Four large ponds/ lagoons are shown in the western part of the site.	Some infrastructure associated with the steelworks is shown to have been demolished.
2010 OS	All infrastructure associated with the Llanwern Steelworks has been demolished, including the railway sidings previously located in the west, leaving open space.	Infrastructure associated with the Llanwern Steelworks to the west and south of the Site has been demolished, leaving open space in its place.
2022 OS	No significant change.	A residential area associated with the wider Glan Llyn development is shown from ~500m from to the west of the Site. Notable features include Glan Llyn West Primary School, numerous residential houses with private gardens, numerous roads, recreational park areas and an updated surface water drainage network. To the east and southeast of the Site, six new commercial units, a surface water drainage network and access roads are shown within 500m. This infrastructure is associated with the Llanwern Business Park.

2.5. Site History – Aerial Photographs

Historical aerial photography obtained from online sources (**Appendix C**) and historical aerial photography included in the Groundsure Report (**Appendix D**) and other sources¹ provides additional information relating to the Site.

2001: High resolution, colour aerial imagery. Three large settlement lagoons are shown on the western side of the Site. A large building is shown in the approximate centre of the Site. The sinter plant is shown in the central southern area of the Site with associated structures, conveyors and chimney. A surface water drainage channel and vegetated area covers much of the northeastern part of the Site. A hard-surfaced road traverses centre of the site from east to west.

¹ Google Earth Pro, Accessed 11/08/2025, BNG 336490E, 187114N, URL: <https://earth.google.com/>

2004: High resolution, colour aerial imagery shows much of the Site has been demolished to slab level. In the centre of the Site, the chimney, conveyors and factory buildings associated with the historical sinter plant are largely demolished or being demolished. The area stores building has been reduced to slab level. The southern half of the Site and immediate south of the Site is shown to have organised piles of demolition materials. The access road remains in place, as does the large, vegetated area in the north-east of the Site.

2006: High resolution, colour aerial imagery shows there to be only one remaining structure in the south of the Site. Two stockpiles are located to the southeast of the structure. Much of the dense vegetation and trees have been stripped from the open space in the northeast corner of the Site. The access tracks and hardstanding areas remain visible across the Site.

2009: High resolution, colour aerial imagery shows the water in the northwest corner of the Site to be larger. Numerous stockpiles are now observed across the Site, much of which are vegetated.

2014: High resolution, colour aerial imagery shows the last remaining structure to have been demolished along with the remaining foundations and hardstanding that was previously still visible within the Site. Fewer stockpiles are shown to be present on the Site and vegetation has become more dense on the northeast section of the Site.

2016: High resolution, colour aerial imagery shows numerous finger stockpiles neatly arranged on the southern half of the Site and further stockpiles are located on the northern half. A main haul route for ground workers is shown to run from the northwest Site boundary to the eastern boundary.

2018: High resolution, colour aerial imagery shows the stockpiles present on Site to have largely remained in the same positions, with approximately half covered in vegetation. Vegetation has been stripped back from the eastern corner of the Site.

2020: High resolution, colour aerial imagery shows numerous stockpiles across the Site. A temporary compound associated with wider earthworks has been constructed in the north-east of the Site.

2023: High resolution, colour aerial imagery shows numerous additional stockpiles across the Site. A large pump station (PS5) has been constructed in the south of the Site.

2.6. Site History - Available Information

According to the Royal Commission on the Ancient and Historical Monuments of Wales², the Llanwern Steelworks were built between 1958 and 1962 for Richard & Thomas Baldwin, was subsequently owned by British Steel, and is currently owned by Tata Steel Europe (formerly known as Corus Group). Reportedly due to the lack

² <https://coflein.gov.uk/en/site/86821/>

of a deep-water iron ore unloading terminal, the Steelworks struggled and steel making ceased in 2001 with demolition commencing in 2004.

Blueprints and a Historical Site Layout Plan of the wider Llanwern Steelworks site indicates that the Site comprised a sinter plant comprising the fan house and dust extraction unit. Within the sinter plant various infrastructure is shown including conveyors, pipelines and numerous buildings. Surrounding the sinter plant were various accessways and haul routes, a car park, office block and stores and heavy weighing group amenity building. A large lagoon is recorded as being present in the west of the Site. The north-west of the Site is characterised by ponded marshy vegetated ground and two surface water drains.

The routing of Drain 4 (a below ground box culvert) is shown in the western part of the Site.

The historical overlays of the Site are shown on drawings 18669-RLL-22-XX-DR-O-0784-P01, 18669-RLL-22-XX-DR-O-0789-P01 and the original Operational Site Layout drawing (ref. 839181, dated December 1999), included in **Appendix A**.

3.0 Ground Conditions and Mining Review

3.1. Published Geology

Information pertaining to the underlying ground conditions at the Site has been obtained via the BGS Onshore Geoindex³ and the Groundsure Insight Report.

The published geological information shows artificial ground to be absent. However, due to the Site's history, Made Ground is known to be present associated with the previous development and subsequent demolition.

Superficial deposits are shown to comprise Tidal Flat Deposits. Historic or alternative names for the Tidal Flat Deposits include the Estuarine Alluvium, as reported on published geological maps⁴ and historical logs.

Tidal Flat Deposits are described by the BGS as '*unconsolidated sediment, mainly mud and/ or sand. They may form the top surface of a deltaic deposit. Normally a consolidated soft silty clay, with layers of sand, gravel and peat.*'

The underlying bedrock is primarily shown to be the Mercia Mudstone Group with a narrow band of the Penarth Group – Mudstone mapped in the north-western part of the Site. The Mercia Mudstone Group was historically known as the Red Marl and is referenced as such in historic borehole logs.

The Mercia Mudstone Group is described by the BGS as comprising '*predominantly red, less commonly green-grey, mudstones and subordinate siltstones with thick halite bearing units in some basinal areas. Thin beds of gypsum/anhydrite are widespread; sandstones are also present.*'

The Penarth Group is described by the BGS as '*grey to black mudstones with subordinate limestones and sandstones; predominantly marine in origin.*'

There is an inferred fault approximately 58m north-east of the Site which trends roughly north to south and extends northwards away from Site.

3.2. BGS Borehole Records

A water well is shown on the northeast corner of the Site, referenced ST38NE7 and was drilled to approximately 24.4m. Topsoil was encountered to a depth of 0.15m overlying Tidal Flat Deposits comprising alternating beds of soft grey blue CLAY and brown fibrous PEAT to approximately 7.0mbgl. From approximately 7.0mbgl soft brown CLAY lies above a mixture of soft brown CLAY and GRAVEL to approximately 9.67mbgl. Bedrock of the red marl strata was encountered from depths of 9.76mbgl to a maximum encountered depth of 24.4mbgl.

³ <http://mapapps2.bgs.ac.uk/geoindex/home.html>

⁴ [BGS Lexicon of Named Rock Units - Result Details](#) (Accessed 22 May 2026)

3.3. Mining History

The Site does not lie in a coal mining reporting area, as defined by the Coal Authority.

There are no records relating to historical mining or extraction activities within 500m of the Site (**Appendix D**).

An on-site pond mapped in 1973 is recorded as a surface ground working in the northeast of the Site.

3.4. Railway and Tunnel Features

Information presented in the Groundsure Insight report (**Appendix D**) indicates that there are two active railways within 250m of the Site boundary: the South Wales Mainline and the private Tata railway which runs between the steelworks at Llanwern and the South Wales Mainline.

Additionally, it is known that railway sidings were present throughout the wider Llanwern Steelworks during its history including on the Site. Seven instances of these historical railway features are noted on the Groundsure report indicating their land use as railway sidings.

3.5. Radon

Information from the 'UK Maps of Radon'⁵ interactive map indicates that the Site lies within a radon-affected area, with a maximum radon potential of 10–30% across most of the Site and 1-3% potential on the southern part of the Site. Accordingly, full radon protection measures are likely to be required for any new buildings constructed on the Site.

3.6. Potential for Ground Stability Hazards

The Site has been given the following classifications with regards to ground stability hazards (**Appendix D**):

- Potential for Collapsible Ground Stability Hazards: **Negligible**
- Potential for Compressible Ground Stability Hazards: **Moderate**
- Potential for Ground Dissolution Stability Hazards: **Negligible**
- Potential for Landslide Ground Stability Hazards: **Very Low**
- Potential for Running Sand Ground Stability Hazards: **Moderate**
- Potential for Shrinking or Swelling Clay Ground Stability Hazards: **Low**

3.7. Hydrogeology

Information presented in the Groundsure Insight Report (**Appendix D**) indicates that the underlying Mercia Mudstone Group strata is defined as a Secondary B Aquifer.

⁵ <https://check-your-flood-risk.naturalresources.wales/?culture=en-GB>

The Penarth Group is defined as a Secondary (undifferentiated) Aquifer. The superficial Tidal Flat Deposits are defined as Unproductive Strata.

Secondary B Aquifers are classified as comprising '*predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifer*'.

Secondary (undifferentiated) aquifers are assigned where it is not possible to attribute either category A or B to a rock type. In general, these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive Strata classification has been given to cases where '*rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow*'.

There are no records relating to groundwater abstraction licences for the Site.

The Site is not located within a groundwater Source Protection Zone and there are no reported Source Protection Zones within 500m of the Site boundary.

One historical water well, referenced ST38NE7, is located on the northeastern corner of the Site⁶.

3.8. Hydrology

The Site is located within a privately drained system (Glan Llyn Surface Water Network). The nearest surface watercourse, within the private system is the Northern Reen, on the northern Site boundary and Kings Wall Reen, on the southeastern Site boundary.

Information presented in the Groundsure Insight Report (**Appendix D**) indicates that the nearest surface water feature, outside of the Glan Llyn privately drained system, is located 28m northeast of the Site and refers to Monks' Ditch.

There are no active surface water discharge consents within 500m of the Site.

The Site lies within an area shown as having a Low Flood Risk from Sea according to Natural Wales Flood Risk mapping⁷ from Natural Resources Wales. The Flood risk map is presented within the Groundsure Insight report, included in **Appendix D**.

3.9. Unexploded Ordnance (UXO)

Regional Unexploded Bomb Risk maps obtained from Zetica indicates that the Site is in a low-risk area for encountering UXO. The Zetica UXO map is presented in **Appendix E**.

⁶ [GeoIndex - British Geological Survey](#) (Accessed 22 May 2026)

⁷ <https://check-your-flood-risk.naturalresources.wales/?culture=en-GB>

4.0 Regulatory Review

4.1. Authorisations and Consents

Data held by environmental regulatory bodies and Local Authorities regarding authorisations and consents has been obtained for the Site via a Groundsure Insight Report (**Appendix D**) commissioned for Site in August 2025.

The Groundsure Insight Report contains factual information which is produced from a database of records obtained from various sources including; Local Authorities, Environment Agency (Wales Region), Natural Resources Wales and UK Health Security Agency (formerly Public Health England).

4.2. Environmental permits, incidents and registers

There are eleven records of Integrated Pollution Controls within 500m of the Site. The closest of which is located 382m southwest, relating to carbonisation and associated processes for Koppers UK Ltd, in 1999.

There are no records of prosecutions relating to authorised processes in the vicinity of the Site.

There are three records of Control of Major Accident Hazards (COMAH) sites recorded within the Site, two relate to Air Products (BR) Limited which has a “current COMAH Site” operational status. Air Products (BR) Limited is an industrial gas supplier, located 1.25km to the southwest of the site.

The other COMAH record relates to a historical notification of Installations Handling Hazardous Substances (NIHHS) site for B.S.C, Llanwern Works.

There is one licenced discharge to controlled waters within 500m of the Site. The licence, effective since 12/03/2025, is associated with the trade discharge of site drainage from Indurent Park Newport.

4.3. Waste Management and Hazardous Substances

The environmental report indicates one licensed waste sites within the Site, relating to an historical industrial waste landfill site for factory curtilage (Corus Strip Products, licence BRI007), recorded as part of the Llanwern Works, with a permitted capacity exceeding 75,000 tonnes. The license was issued in 1979.

Four licensed waste sites were recorded within 500m of the Site boundary, the nearest of which relates to the Vertase FLI (Former Coking Works) located 135m west of the Site.

One record of a waste exemption is recorded within the Site, relating to Bam Nuttall Ltd (Rail Facilities) and a further four are recorded within 500m of the Site; the nearest of which is located 54m north of the Site for Bam Nuttall Ltd.

No current or recent petrol stations, hazardous substance consents, or licensed explosive sites are recorded within 500m. However, the Site lies adjacent to a COMAH lower-tier site (Air Products, Llanwern), associated with chemical storage and handling risks.

Historical licensed industrial activities include multiple permits for carbonisation and iron/ steel processes at the former Llanwern Works (Koppers UK, Multiserv), most now revoked or superseded. Records also confirm several radioactive substance authorisations for disposal of radioactive waste by Corus UK Ltd, located ~231m west of the Site, with permits granted between 1998 and 2003, now superseded or revoked.

Finally, historical discharges to controlled waters are noted, including expired consents to Monks' Ditch and on-site lagoons, with one current consent (DB3494FH, issued 2025) for trade drainage to Monks' Ditch ~242m southeast.

4.4. Landfills and Other Waste Sites

The Groundsure Insight Report (2025) indicates that there are no active landfill sites recorded within 500m of the Site boundary. One historical industrial waste landfill site for factory curtilage (Corus Strip Products, license BRI007) is recorded onsite as part of the Llanwern Works, with a permitted capacity exceeding 75,000 tonnes. The license was issued in 1979.

Four historical waste sites are recorded within 500m of the Site boundary, the nearest of which refers to a Scrap Metal Dump, dated 1967, located 332m east of the Site.

There are no records of Potentially Infilled Land (Water) located within 500m of the Site.

4.5. Current Land Use: Industrial Data

The environmental report indicates there are seven records of potentially contaminative industrial sites within 250m of the Site, the nearest of which is located 48m north-east and refers to an electrical pylon.

4.6. Designated Environmentally Sensitive Areas

Reference to the Data Map Wales Website⁹ (accessed August 2025) and the Groundsure Insight Report (2025) indicates there is a SSSI located approximately 603m south-west relating to the Gwent Levels - Nash and Goldcliff.

No further designated environmentally sensitive sites are recorded within 1000m of the Site.

⁹ https://datamap.gov.wales/maps/new?layer=inspire-nrw:NRW_SSSI#/

4.7. Archaeology

A preliminary search of the Historic Wales¹⁰ archaeological database (accessed August 2025) indicates no records within the Site boundary.

¹⁰ <https://historic-wales-rcahmw.hub.arcgis.com/> (accessed June 2025)

5.0 Ground Investigation

5.1. Existing Reports

Two ground investigations have been undertaken, by Atkins in 2016 and Rodgers Leask (RLL) between December 2020 and February 2021. As part of the Atkins investigation 2 cable percussion boreholes were excavated and 2 window sample exploratory holes were excavated within the site area. As part of the RLL ground investigation, 103 trial pits were excavated within the Site area.

The following table provides a summary of the exploratory holes that were situated within the Site boundary.

Summary of Historical Exploratory Holes within the Site Boundary	
Report	Exploratory Holes
Atkins (2016)	2 Window Sample and 2 Cable Percussion Boreholes: CWCP10, CWCP32, CWWS10 and CWWS20.
RLL (2020-2021)	79 Trial Pits: AT6-1, AT6-2, AJ4-1, AJ4-2, AL2-1, AL2-2, AM1-1, AM1-2, AM2-1, AM2-2, AN1-1, AN1-2, AO1-1, AO1-2, AP1-1, AP1-2, AQ1-1, AR2-1, AR4-1, AR4-2, AS3-1, AS4-1, AS4-2, AS6-1, AS6-2, AS7-1, AS7-2, AT4-1, AT4-2, AT4-3, AG1-1, AH1-1, AH1-2, AI1-1, AJ1-1, AJ1-2, AJ6-1, AJ6-2, AK1-1, AK1-2, AK2-1, AK2-2, AK3-1, AK5-1, AK5-2, AL1-1, AL1-2, AR10-1, AR10-2, AR11-1, AR11-2, AS9-1, AS9-2, AN10-1, AN10-2, AN11-1, AN11-2, AN12-1, AN12-2, AN12-3, AP10-1, AP10-2, AQ10-1, AQ10-2, AN13-1, AN13-2, AN14-1, AN14-2, AN14-3, AN15-1, AN15-2, AL12-1, AL12-2, AL12-3, AL13-1, AL13-2, AL14-1, AL14-2, AM15-1, AM15-2, AM16-1, AM16-2, AL10-1, AL10-2, AL11-1, AL11-2, AM10-1, AM10-2, AM11-1, AM11-2, AM12-1, AM12-2, AM13-1, AM13-2, AM14-1, AM14-2, AM14-3, AG7-1, AH6-1, AH6-2, AH7-1, AH7-2, AI6-1, AI6-2, AI7-1, AI7-2, AI8-1, AI8-2, AK10-1, AF2-1, AF2-2, AF4-1, AF4-2, AF5-1, AF5-2, AG2-1, AG6-1, AG6-2, AH2-1, AH2-2, AL15-1, AL15-2, AL16-1, AL16-2, AL16-3, AD1-1, AD1-2, AE1-1, AE1-2, AF1-1, AF1-2, AG3-1, AG3-2, AH3-1, AH3-2, AI2-1, AI3-1, AI3-2, AJ2-1, AJ2-2, AJ3-1, AJ3-2, AN6-1, AJ5-1, AS5-1, AS5-2, AT5-1, AT5-2, AU5-1, AU5-2, AU5-3, AU6-1, AU6-2, AG8-1, AG8-2, AH8-1, AH8-2, AH8-3, AH8-4, AI8-1, AI8-2, AJ8-1, AJ8-2, AL3-1, AU7-1, AV6-1, AV6-2, AV6-3 and AV7-1.

RLL Drawing 18669-RLL-25-XX-DR-O-0788-P01, presented in **Appendix A**, shows the location of the exploratory holes; some areas in the central and western sections of the Site were not investigated as part of the ground investigation due to restricted access from stockpiled Made Ground originating from the wider Glan Llyn development.

The historical logs within the Site boundary are presented in **Appendix F**.

5.2. Encountered Ground Conditions

The Site was generally found to be underlain by Made Ground overlying Tidal Flat Deposits.

5.2.1. Made Ground – Topsoil

Topsoil was encountered in two locations (CWWS10 and AL1) from ground level to approximately 0.10m or directly overlying gravelly clay (Made Ground).

5.2.2. Made Ground – Surfacing

Surfacing was encountered in two locations (AH2 & AV6) from ground level to 0.1m and 0.3m respectively. AH2 comprising asphalt, while AV6 comprised recycled 6F2 gravel with a geotextile separator layer.

Localised historical hardstanding was encountered at shallow depths, comprising tarmac, with occasional concrete slab surfacing at near surface also noted. The locations and depth of the surfacing is summarised in the table below:

Trial Pit Location	Depth (m bgl)	Surfacing Type
AL6	0.30-0.40	Asphalt
AK4	0.20-0.30	Concrete Slab
AN6	0.50-0.55	Asphalt

5.2.3. General Made Ground

Made Ground was encountered within all 107 exploratory holes. The Made Ground was encountered from ground level or underlying the surfacing at thicknesses of between 0.15m and 4.20m, and was described as:

- Dark brown/ brown/ blue/ red/ black/ orange/ light grey clayey sandy GRAVEL with occasional boulders and rare silt;
- Dark brown/ brown/ blue/ red sandy clayey GRAVEL;
- Black gravelly occasionally ashy SAND with cobbles;
- Hard grey/ light grey/ orange/ brown/ yellow sandy GRAVEL with occasional cobbles and boulders of slag;
- Light brown loamy CLAY with angular gravel of brick;
- Dark grey slightly clayey gravelly SAND;
- Dark brown sandy GRAVEL;
- Dark grey to black clayey gravelly fine to coarse SAND;
- Dark brown slightly sandy silty gravelly CLAY;
- Dark red/ brown slightly sandy slightly gravelly CLAY with frequent rootlets; and
- Light yellow/grey sandy SILT.

Gravel and cobble components varied but commonly included various slags (fused in places), burnt shales, ash, clinker, bricks, concrete and other anthropogenic debris with occasional gravel inclusions of mudstone, sandstone, and other mixed lithologies.

16 locations (AF6, AG7, AH7, AJ5, AK3, AK4, AK11, AK12, AK18, AM13, AM15, AN6, AR11, AS5, AU5, AU6, AK4 and AV6) refused at depths between 0.3mbgl and 2.60mbgl.

5.2.4. Superficial Deposits

The Tidal Flat Deposits were encountered underlying the Made Ground in 77 of the exploratory holes. The top of the strata was recorded from depths of between 0.60mbgl and 4.20mbgl and the base of the formation was encountered in two locations at 9.60mbgl and 10.00mbgl.

The Tidal Flat Deposits were described as:

- Firm blue/ grey/ brown silty CLAY with occasional fine sand, shell fragments
- Soft to firm bluish grey to brownish grey CLAY
- Very soft to soft dark brown to brown fibrous PEAT;
- Black slightly silty clayey amorphous PEAT;
- Very soft grey SILT;
- Loose grey slightly gravelly fine to medium SAND sometimes with frequent bands of weak, coarse sandstone with carbonate shells; and
- Soft to firm blue/brown peaty silty CLAY.

5.2.5. Bedrock

The Mercia Mudstone Group was encountered in 2 locations (CWCP31 and CWCP32). The top of the bedrock was recorded from 9.60mbgl and 10.00mbgl, and the base of the bedrock was not encountered but was recorded to a maximum depth of 10.50mbgl.

The Mercia Mudstone Group was described as:

- Extremely weak red brown MUDSTONE (Grade II); and
- Very stiff reddish brown mottled grey silty CLAY (Grade IVa).

5.2.6. Perched Water

Perched water was recorded in 90 locations, generally within the Made Ground or at the boundary with the Tidal Flat Deposits. Water strikes were typically encountered between 0.15mbgl and 0.9mbgl, with occasional deeper strikes to 2.8mbgl.

5.2.7. Groundwater

Groundwater was recorded in 2 locations at the boundary between the lower loose gravelly sands and upper very soft silts. Water strikes were encountered at 9.50mbgl (CWCP31) and 8.00mbgl rising to 3.00mbgl (CWCP32).

5.2.8. Encountered Buried Obstructions or Services

Buried obstructions or services were encountered in 34 exploratory locations as detailed in the following table.

Encountered Buried Obstructions			
Trial Pit Ref.	Depth (m)	Strata	Remarks
AF6	0.70	MG	Concrete slab.
AG6	1.90	MG	Unknown pipe.
AG7	0.80	MG	Black fused slag.
AH3	0.00–1.30	MG	Black fused slag/ sand.
AI2	0.90	MG	Plastic water pipe.
AJ5	0.90–1.00	MG	Concrete slab.
AK1	0.80–1.10	MG	Fused slag.
AK2	1.40	MG	Metal pipe inside of pit.
AK4	0.30	MG	Concrete slab.
AK5	1.60	MG	Large pipe.
AK11	0.20–0.50	MG	Fused slag.
AL6	0.80–1.00	MG	Fused slag.
AL12	1.20–3.00	MG	Boulders of concrete.
AL15	0.90 + 1.50	MG	Concrete piles.
AL16	0.00–0.60	MG	Fused slag.
AM5	0.30	MG	Numerous piles.
AM10	0.20–0.50	MG	300 mm thick concrete slab.
AM16	0.50	MG	Concrete structure.
AN12	1.00–3.40	MG	Fused slag recovered as gravel.
AP10	0.80–0.85	MG	Fused slag.
AQ10	0.00–0.70	MG	Fused slag/mixed lithologies recovered as clay.
AR4	0.30–1.20	MG	Fused slag recovered as sandy gravel.
AR10	1.00–1.70	MG	Fused slag/mixed lithologies.
AR11	0.00–0.20, 0.45–2.00	MG	Fused slag.
AS4	1.30–1.80	MG	Fused slag.
AS5	2.40–2.50	MG	Fused slag.
AS6	0.70–1.20	MG	Fused slag recovered as gravelly sand.
AS7	0.90–1.70	MG	Fused slag recovered as gravel.
AT6	2.20–2.40	MG	Fused slag recovered as gravel.
AU5	2.40–2.50	MG	Fused slag.
AU6	1.50–2.20	MG	Concrete.
AK4	0.20*	MG	Concrete
AV6	2.50*	MG	Not Specified.
CWWS20	1.20*	MG	Not Specified.

Notes: MG= Made Ground, *base of obstruction not encountered.

5.2.9. Visual/ Olfactory Evidence of Contamination

During the intrusive investigation, visual or olfactory evidence of contamination was encountered in 15 locations as detailed in the following table.

Visual / Olfactory Evidence of Contamination			
Exploratory Hole	Depth (m)	Strata*	Remarks
AC1	0.20	MG	Hydrocarbon odour and sheen on perched water.
AG3	0.80	MG	Hydrocarbon odour and sheen on perched water.
AG6	0.70	MG	Slight sheen on perched water.
AH6	1.00	MG	Slight sheen on perched water.
AI7	0.30 - 1.20	MG	Slight hydrocarbon odour. Slight sheen on perched water.
AI8	1.10 – 2.40	MG	Slight sheen observed on boulder of slag Material.
AK2	1.20	MG	Strong hydrocarbon odour.
AL16	1.00 – 1.10	MG	Slight sheen and hydrocarbon odour.
AL7	1.15	MG	Strong sulphuric odour.
AM10	1.00 – 1.10	MG	Slight hydrocarbon odour.
AN10	0.7 – 0.8	MG	Slight sheen on perched water.
AP10	0.5 – 0.6	MG	Slight sheen on perched water.
AQ10	1.00 – 1.10	MG	Slight sheen on perched water.
AG8	0.70 – 0.80	MG	Slight sheen on perched water.
AH8	1.30 – 1.40	MG	Slight sheen on perched water.

Notes: *MG= Made Ground

5.2.10. Instability

Evidence of instability in the Made Ground was not noted during the Atkins or RLL intrusive investigation. Variable Made Ground composition, presence of obstructions, and shallow water strikes has the potential for localised instability during excavations.

5.3. Gas Screening

No gas monitoring was undertaken during the RLL ground investigation. A programme of shallow gas monitoring is recommended following turnover and earthworks reengineering.

The classification of the Site will depend on the permeability of the upper clay of the Tidal Flat Deposits following earthworks. A site-specific ground gas assessment is recommended following the completion of the earthworks.

6.0 Chemical Testing

6.1. Risks to Human Health

6.1.1. Methodology

In order to assess the risk posed to the health of site end users, the concentrations of contaminants recorded in soils have been compared to appropriate Site Assessment Criteria (SAC). These have been derived using the Contaminated Land Exposure Assessment Model (CLEA). SACs used in this generic quantitative risk assessment, include:

- Defra Category 4 Screening Levels (C4SLs) (Defra, 2014); and
- Land Quality Management & Chartered Institute of Environmental Health (LQM & CIEH, 2015) Suitable for use levels (S4ULs).

Where C4SL or S4UL are not available for a contaminant or are not considered appropriate for the risk assessment reference has been made to the Environment Agency Soil Guideline Values (SGV), the LQM/ CIEH Generic Assessment Criteria (GAC) and the Environmental Industries Commission GAC (EIC GAC).

The C4SL and EA SGV have been derived based on the CLEA default value for Soil Organic Matter (SOM) content of 6% and a sandy loam soil type. The LQM/CIEH S4UL and GAC and the EIC GAC are based on 1%, 2.5% and 6% SOM content and a sandy loam soil type.

The Site has been assessed based on a residential end use with plant uptake as defined in the Environment Agency (EA) CLEA model v1.071 'Updated technical background to the CLEA model Science Report – SC050021/SR3'.

6.1.2. Results

169 soil samples were collected and tested during the 2020/ 2021 ground investigation taken from the Made Ground.

Samples were tested for heavy metals, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbon (TPH), BTEX, pH, soil organic matter (SOM), cyanide, phenols, ammoniacal nitrogen and selected samples were also screened for asbestos.

The samples collected were conservatively assessed against LQM/ CIEH 2015 S4ULs (Suitable for Use Levels) for a residential end use with plant uptake (1% SOM). A summary of exceedances is presented in the following table, and the chemical analysis results are presented in full in **Appendix G**.

Summary of Exceedances of S4ULs Residential with Plant Uptake Criteria				
Contaminant	Screening Value (mg/kg)	No. of Exceedances	Exceedance Concentration Range (mg/kg)	Location of Exceedances
Arsenic	37.0	2 of 169 (1.18%)	45.2 – 52.6	AN1-2, AM16-1

Summary of Exceedances of S4ULs Residential with Plant Uptake Criteria				
Contaminant	Screening Value (mg/kg)	No. of Exceedances	Exceedance Concentration Range (mg/kg)	Location of Exceedances
Chromium	26.0	1 of 169 (0.59%)	1200.0	AT6-2
Lead	200.00	23 of 169 (13.61%)	220.00 – 2070.00	AT6-1, AR2-1, AR4-1, AS3-1, AT4-1, AT4-2, AS9-1, AS9-1, AL13-1, AL13-2, AL14-1, AM10-1, AS5-2, AT5-2, AU5-2, AU5-3, AU6-1, AU6-2, AU7-1, AV6-1, AV6-2, AV6-3, AV7-1
Vanadium	410.00	27 of 169 (15.98%)	411.00 – 2050.00	AT6-1, AT6-2, AR4-1, AS3-1, AS4-1, AS4-2, AS6-1, AS6-2, AS7-1, AT4-3, AL1-2, AG7-1, AH7-2, AI8-1, AG3-2, AH3-2, AI3-2, AS5-2, AU5-1, AU5-2, AU5-3, AU6-2, AI8-1, AU7-1, AV6-1, AV6-2, AV7-1
Zinc	3700.00	11 of 169 (6.51%)	3910.00 – 10600.00	AR4-1, AS3-1, AT4-1, AT4-2, AS5-2, AU5-2, AU5-3, AU6-2, AU7-1, AV6-3, AV7-1
Aromatic >C16-C21	930.00	1 of 169 (0.59%)	966.00	AG2-1
Aromatic >C21-C35	1700.00	2 of 169 (1.18%)	1730.00 – 2610.00	AG2-1, AG3-1
Benzene	87.00	165 of 169 (97.63%)	<180.00 – 1480.00	All Samples Excluding: AR10-1, AR10-2, AR11-1, AR11-2
Naphthalene	15.00	6 of 169 (3.55%)	19.90 - 102.00	AM15-2, AH7-2, AG3-1, AH3-1, AH8-3, AH8-4
Phenanthrene	95.00	3 of 169 (1.78%)	123.00 – 191.00	AH7-2, AG3-1, AJ2-2
Benzo[a]anthracene	7.20	11 of 169 (6.51%)	7.24 - 99.00	AM15-1, AM15-2, AH7-2, AG2-1, AG3-1, AG3-2, AH3-1, AI3-1, AJ2-2, AH8-3, AH8-4
Chrysene	15.00	8 of 169 (4.73%)	18.50 - 82.90	AM15-1, AM15-2, AH7-2, AG2-1, AG3-1, AH3-1, AI3-1, AJ2-2
Benzo(b)fluoranthene	2.60	30 of 169 (17.75%)	2.92 – 136.00	AP1-2, AN11-1, AN12-2, AN12-3, AN14-1, AN14-2, AL12-2, AL12-3, AM15-1, AM15-2, AM11-2, AH7-2, AF5-1, AG2-1, AG6-1, AH2-1, AL15-2, AG3-1, AG3-2, AH3-1, AI2-1, AI3-1, AJ2-1, AJ2-2, AG8-1, AG8-2, AH8-1, AH8-2, AH8-3, AH8-4
Benzo(a)pyrene	2.20	27 of 169 (15.98%)	2.48 - 87.60	AP1-2, AK2-2, AN12-2, AN12-3, AN14-1, AN14-2, AL12-2, AL12-3, AM15-1, AM15-2, AM11-2, AH7-2, AF5-1, AG2-1, AL15-2, AG3-1, AG3-2, AH3-1, AI2-1, AI3-1, AJ2-1, AJ2-2, AG8-1, AH8-1, AH8-2, AH8-3, AH8-4

Summary of Exceedances of S4ULs Residential with Plant Uptake Criteria				
Contaminant	Screening Value (mg/kg)	No. of Exceedances	Exceedance Concentration Range (mg/kg)	Location of Exceedances
Indeno(1,2,3-c,d)Pyrene	27.00	3 of 169 (1.78%)	31.10 – 69.30	AM15-1, AH7-2, AG3-1
Dibenzo(a,h)anthracene	0.24	37 of 169 (21.89%)	0.24 - 11.70	AL2-1, AM1-1, AM1-2, AM2-1, AM2-2, AP1-1, AP1-2, AJ1-1, AK2-2, AK3-1, AN11-1, AN11-2, AN12-2, AN12-3, AN14-1, AN14-2, AL12-2, AL12-3, AM15-1, AM15-2, AM11-2, AM14-1, AH6-1, AH7-2, AF5-1, AG2-1, AG6-1, AH2-1, AL15-2, AG3-1, AG3-2, AH3-1, AH3-2, AI2-1, AI3-1, AJ2-1, AJ2-2, AJ3-1, AG8-1, AG8-2, AH8-1, AH8-2, AH8-3, AH8-4

165 of 169 samples were shown to exceed the screening criteria for benzene. It should be noted that 11 samples had concentrations above the limit of detection for benzene ranging between 214µg/kg and 1480µg/kg. The detection limit for benzene tested listed by the laboratory as 180µg/kg for 154 samples, this is greater than the screening value of 87µg/kg (0.087mg/kg) and causes a significant skew in the results. Where samples are reported at the detection limit, for screening purposes, it has been conservatively assumed that the value is 180µg/kg. The true concentration is likely to be significantly lower than this value.

6.1.3. Asbestos

Asbestos was detected in 12 of the 89 samples analysed. A summary of the identified asbestos occurrences is presented in the table below

Summary of Asbestos Identified within the Site		
Location (Depth in m)	Asbestos Type	Quantification (%)
AM1-2 (1.00)	Chrysotile	<0.001
AN1-2 (1.50)	Trace Chrysotile	<0.001
AP1-2 (1.80)	Amosite	0.0022
AT4-3 (2.60)	Chrysotile	<0.001
AR10-1 (0.50)	Trace Chrysotile	<0.001
AM16-1 (0.20)	Chrysotile	<0.001
AG2-1 (0.30)	Amosite	<0.001
AH3-1 (0.50)	Trace Chrysotile	<0.001
AL14-1 (0.30)	Chrysotile	0.0190
AI2-1 (0.50)	Chrysotile	<0.001
AU5-1 (0.70)	Chrysotile	<0.001
AJ8-1 (0.40)	Chrysotile	<0.001

Asbestos was identified in twelve samples; positive samples were quantified to ascertain the weight for weight concentration of asbestos in soil and returned results ranging between <0.001% to 0.0190%. The Institute of Occupational Medicine (IOM) risk assessment report for the reuse of soils containing asbestos at Llanwern (Ref. 401134-IOM-14-XX-RP-Z-0001) and has been agreed with Natural Resources Wales, states the following:

- Within the clean cover system a minimum of 0.6m of clean soil (asbestos content <0.001%) will be placed across the Llanwern site.
- Beneath the cover system, soil will be screened and, if asbestos contamination is less than 0.02% (200PPM) in the soil, that soil may be used in residential areas.

6.1.4. Groundwater

No samples of perched groundwater were taken during the RLL intrusive investigation.

Historical investigations undertaken by Atkins across the wider development have identified elevated concentration of contaminants associated with the Site's former usage that may present a risk to Controlled Waters. Further assessment of the risk posed by the Site as part of the wider development has been completed via preparation of a Controlled Waters Detailed Quantitative Risk Assessment (Ref. 18669-RLE-19-RP-O-0006) for the wider development and a phase specific addendum to this (Ref. 18669-RLL-25-XX-RP-O-0822-P01).

Due to the history of the Site, it is anticipated that further remedial works including turnover of the Made Ground will be undertaken with post remedial monitoring of water and gas following the completion of the earthworks.

7.0 Conceptual Site Model (CSM)

This section provides a qualitative assessment of the risk posed from potential on and off-site contamination sources identified from the information presented in the previous sections. The CSM considers the findings of all ground investigations that have been undertaken at the Site.

The assessment carried out assumes that the Site will be redeveloped for a residential with plant uptake end-use, as the most sensitive of the proposed uses. Should the end use or proposed layout be altered in any way, potential pathways and receptors should be re-assessed.

The conceptual site model below has been developed based on the source-pathway-receptor model as detailed within the Environment Agency Land Contamination Risk Management guidance and the Welsh Government's Contaminated Land Statutory Guidance for Wales 2012, and the Welsh Government, Natural Resources Wales & Welsh Government's Development of Land Affected by Contamination: A Guide for Developers (2017).

7.1. Potential Pollutant Linkages

7.1.1. Sources

The Site makes up part of the former Llanwern Steelworks; the Site historically comprised a sinter plant. Within the sinter plant various infrastructure was present including a fan house, dust extraction unit, conveyors, pipelines, chimney and various other buildings including stores and a canteen. Alongside the sinter plant there were haulage routes and an open space area. In addition, a Benzole and Benzene Plant was located to the west of the Site.

Chemical analysis of soil samples has identified concentrations higher than the selected screening criteria for arsenic, chromium, lead, vanadium, zinc, aromatic TPH >C16-C21, aromatic TPH >C21-C35, benzene, naphthalene, phenanthrene, benzo[a]anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene and dibenzo(a,h)anthracene. Asbestos was identified in twelve of the 89 soil samples tested in the form of bundles and loose fibres detected at concentrations between <0.001% to 0.0190%.

Potential contaminant sources are summarised in the following table.

Summary of Potential on Site Sources of Contamination		
Source	Site Area	Key Contaminants
Deep Made Ground, including slag material	Whole Site	Heavy metals, PAHs, Benzene and ground gas.
Historical Steelworks infrastructure	Whole Site	Heavy metals, PAHs, TPHs, Benzene
Made Ground	Isolated locations across the Site	Low concentrations of asbestos.

Summary of Potential on Site Sources of Contamination		
Source	Site Area	Key Contaminants
Natural Strata	Whole Site	Potential for ground gas from organic materials in the Tidal Flat Deposits Potential for sulphates and pyrites in the underlying Tidal Flat Deposits and Mercia Mudstone Group/Penarth Group.

7.2. Potential Receptors

The following receptors (current and proposed) have been identified at the Site. Given the absence of significant ecological designations in the vicinity of the Site, ecological receptors are not considered below.

Humans:

- Construction workers and maintenance workers; and
- Residents on and off-site (current and future).

Controlled Waters:

- Groundwater within Mercia Mudstone Group (Secondary B Aquifer), Penarth Group Secondary (Undifferentiated Aquifer) and Tidal Flat Deposits (Secondary [Undifferentiated] Aquifer); and
- Private surface water network, including associated lakes within the private system (Central Lake, East Lake, Monks Lake) within 500m.

Property:

- Existing and proposed buildings and services on and immediately surrounding the Site; and
- Proposed infrastructure on the Site.

7.2.1. Potential Pathways

Human Health

There is the potential for exposure of site end users to contaminants in soils via the following pathways, based on a residential with plant uptake end use (Environment Agency CLEA land use scenario):

- Direct soil and dust ingestion;
- Dermal contact with soil directly and indoor dust;
- Plant uptake followed by consumption of homegrown produce;
- Inhalation of vapours;
- Inhalation of dust; and
- Inhalation of gases.

Due to the levels of contamination encountered it is recommended that appropriate risk assessments and method statements are prepared and safety measures (use of PPE/ hygiene rules) implemented in order to provide adequate protection for construction workers.

If materials are required to be imported to Site they will have to be assessed and validated in line with the agreed import criteria detailed in the remediation strategy and site-specific Materials Management Plan (MMP).

Full radon protection measures are likely to be required for any new buildings constructed on the Site.

Controlled Waters

It is considered that due to the low permeability nature of the underlying Tidal Flat Deposits, there is no feasible pathway for vertical migration of contaminants into the underlying Mercia Mudstone Aquifer.

Currently Monks' Ditch crosses the wider development within a concrete channel and no connection with the private drainage system presently exists. It is proposed that the future surface water network of reens and lakes will discharge via a pumping system into Monks' Ditch. This on-site surface water system will discharge, via a permit, into Monks' Ditch once the specified quality criteria are met and the application to connect the system is approved.

Monks' Ditch is not currently a receptor (it is understood to be hydraulically isolated as it flows between the Glan Llyn development and the business park the east, within a concrete channel), although it could potentially be a future receptor if surface water discharge is permitted into the Monks' Ditch.

With regard to Controlled Waters, the following pathways are considered applicable to the Site, following completion of the development and once relevant approvals have been granted to allow discharge into Monks' Ditch:

- Leaching of soil-borne contamination in Made Ground and subsequent lateral migration through permeable pathways in Made Ground to Monks' Ditch via onsite reens.

As such, a Site specific Detailed Controlled Waters Risk Assessment (Ref. 18669-RLL-25-XX-RP-O-0822-P01) has been prepared for the Site and should be read in conjunction with this report.

Structures

Concrete classification testing has not been undertaken. A Design Sulphate (DS) class and Aggressive Chemical Environment for Concrete (ACEC) class should be derived for the Site in accordance with the recommendations given within BRE SD1 and based on pH and sulphate testing.

A site-specific ground gas assessment is recommended following the earthworks. The classification of the Site will depend on the gas generation potential of the Made Ground and permeability of the upper clay of the Tidal Flat Deposits.

7.2.2. Preliminary Remediation Assessment

The Site has undergone one phase of ground investigation and remedial earthworks are proposed.

Based on the outcome of the conceptual site model outline remedial measures are required to break source-pathway-receptor linkages.

Installation of cover system to gardens and POS is required to make the Site suitable for end users.

Some Made Ground will be removed to make the Site suitable in terms of the risks to controlled waters (private reën network). The Made Ground will be tested, re-assessed and where the soil does not meet the reuse criteria it will be excavated, removed, and replaced with suitable fill that meets the criteria. Prior to filling, excavations of unsuitable material shall be validated to demonstrate compliance with the Remediation Strategy.

The installation and validation of gas mitigation measures may be required following completion of the post-earthworks ground gas risk assessment.

7.2.3. Proposed Mitigation

The proposed remedial approach is to remove unsuitable material based on the grid of testing and turnover the Made Ground to natural geology, approximately 2.0mbgl to 4.5mbgl to remove obstructions and reduce the permeability of the Made Ground. Based on the results of chemical testing, the Made Ground is not suitable for reuse at shallow depths within the residential plot but is likely to be suitable for use as part of the reengineered formation beneath 600mm of clean cover.

The introduction of buildings and hardstanding with suitable construction materials along with a clean cover system in landscaped areas is expected break the pathway with underlying Made Ground, to intercept rainwater and to reduce infiltration through to Controlled Waters (private reën network).

To break the identified contamination linkages, the following mitigation measures are required:

- Excavation of Made Ground to natural clay and removal of unsuitable material and buried obstructions to facilitate reengineering and reuse of Made Ground;
- Identify, remove and validate the removal of gross contamination and known and potential obstructions on a grid square basis, followed by subsequent validation testing and reporting;
- Treatment or off-site disposal of impacted soils (where required);
- Reengineering of materials in accordance with the approved Remediation Strategy and Earthworks Specification to an appropriate specification to achieve the required formation level;
- Chemical and geotechnical validation of the placement of material following turnover;
- Site-specific geotechnical assessment relating to the proposed development;

- Installation of a 600mm clean cover system, suitable for a residential with plant uptake end use, will be required in areas of residential gardens and landscaping;
- Consultation with the water supply company in relation to the potential use of barrier pipe;
- Preparation of a Piling Risk Assessment;
- With respect to asbestos, a minimum of 600mm of clean soil (in accordance with Llanwern Asbestos Risk Assessment prepared by IOM) will be placed across the Llanwern site. Made Ground material will be screened and, if asbestos contamination is less than 0.02% (200PPM) then it may be used in residential areas below the clean cover. The materials used in the preparation of the Site will be recorded in a validation report assessing compliance with the approved criteria;
- A Design Sulphate (DS) class and Aggressive Chemical Environment for Concrete (ACEC) class should be derived for the Site in accordance with the recommendations given within BRE SD1 and based on pH and sulphate testing; and
- A programme of shallow gas monitoring is recommended following the turnover and reengineering of the Made Ground to determine whether protective measures are needed with proposed buildings.

The risk to Controlled Waters has been assessed in both the sitewide CWRA (ref. 18669-RLE-19-RP-O-0006) and phase specific CWRA (ref. 18669-RLL-25-XX-RP-O-0822-P01) to further determine whether additional works are required to protect Controlled Waters receptors post-development. This, along with a formal Remediation Strategy should be agreed with Natural Resources Wales (NRW) and Local Authority (LA).

8.0 Geotechnical Testing

8.1. Sampling and Testing

Geotechnical sampling was undertaken by a RLL Engineer during the 2020-2021 ground investigation.

Samples collected on Site were sent for geotechnical laboratory testing, which were undertaken in accordance with BS1377:1990. Laboratory testing was undertaken by Celtest and included the following:

Summary of Geotechnical Testing Undertaken on Samples	
Test	Number of Samples Tested
Moisture Content	131
Particle Size Distribution by Wet Sieve	131
Compaction Using 4.5kg rammer	131
Total Expansion BRE Tests	73

The above testing provided results to show the principal geotechnical properties of the major geological units identified during the ground investigation. A summary of the geotechnical laboratory results is presented in the following sections and the laboratory data is included within **Appendix H**.

8.2. Classification Testing

8.2.1. Natural Moisture Content

131 compaction tests (4.5kg rammer) were undertaken on samples of Made Ground and recorded an optimum moisture content for the Made Ground of between 5.2% and 18.0%.

Moisture content tests were undertaken on 131 samples and recorded water content between 4.8% and 38%.

8.2.2. Material Grading and Classification

Particle size distribution (PSD) testing was undertaken on 131 samples of the Made Ground. The results indicate that the material can generally be described as a slightly clayey sandy gravel with occasional cobbles, falling into Class 1A/1B – General Granular Fill¹¹ or Class 2 - General Cohesive Fill. This grading of material, when compacted/ reengineered, is likely to have limited permeability (approximately 10^{-7}), classed as poor draining soils and therefore inhibiting the downward migration of infiltrated rainwater into the Made Ground.

¹¹ Series 600 Earthworks, Manual of Contract Documents for Highway Works - Volume 1, Specification for Highway Works, Amendment February 2017.

8.2.3. BRE Total Expansion Tests

73 samples were scheduled for testing in accordance with BRE 481 Part B - Appendix B to determine the expansion of steel slag (over 28 days at 80°C) and recorded a total expansion of -1.58% to 10.1%. It is worth noting that the BRE test is a conservative test crushing material >20mm and placing it in a bath of water at 80°C for 28 days.

According to the RLL Technical Note (ref. 17480-RLE-18-XX-RP-O-001, dated March 2018) Geotechnical Guidance for Reuse of Made Ground Containing Slag, the guideline average expansion value considered to be acceptable is 2.5%.

Of the 73 samples tested, the mean value recorded was 1.17%; and only 14 samples produced results over 2.5%, with expansion values of 2.7% to 10.10%.

A full copy of the results are included in **Appendix H**.

9.0 Conclusions and Recommendations

9.1. Conclusion

The Site is located within the Glan Llyn development at the former Llanwern Steelworks, approximately 5.5km to the east of Newport City Centre, at approximate National Grid Reference 336490E, 187114N. The Site is irregular in shape, covering an area of approximately 12ha, and is situated in the northeastern part of the wider Glan Llyn development. It is understood that the Site is proposed to be redeveloped for a residential end use.

Historical mapping and aerial photography indicate that the Site was in agricultural use until the late 1950s, after which it was developed as part of the Llanwern Steelworks, specifically accommodating a sinter plant with associated buildings, conveyors, lagoons, haul routes and ancillary infrastructure. Steelmaking operations ceased in 2001, with large-scale demolition works commencing in 2004, leaving much of the Site reduced to slab level. Since demolition, the Site has remained largely open ground with stockpiling, compounds and limited infrastructure, and more recently forms part of wider redevelopment associated with the Glan Llyn regeneration scheme.

The 2020-2021 RLL ground investigation comprised 103 trial pits within Phase 5A & 5B.

General Made Ground was encountered within all 103 exploratory holes from ground level or underlying surfacing to a maximum encountered depth of 4.20m. Superficial Tidal Flat Deposits were encountered beneath the Made Ground in 74 locations from depths between 0.80m and 4.20m bgl; the base of this formation was not encountered, but the strata was recorded to depths of up to 4.20m. The Mercia Mudstone Group was not encountered.

Perched water was encountered within the Made Ground in 90 locations.

Regional groundwater was not encountered in the exploratory holes within Phase 5A & 5B. Investigations across the wider development have identified perched water within the Made Ground or groundwater within the Tidal Flat Deposits (confined to the basal sand layers) and Mercia Mudstone.

Hydrocarbon odours/ oily sheens were encountered in fifteen locations in the Made Ground and on perched water from depths ranging from 0.20m to 2.40m. Given the slight sheen or mild odour that was observed in these locations, the presence of gross contamination, unsuitable for retention within the development is considered unlikely. This is further supported by only limited elevated speciated hydrocarbons within soils samples.

Buried obstructions such as piles, concrete, asphalt or fused slag were encountered in thirty-three locations between 0.00m to at least 3.00m.

169 soil samples of the Made Ground were analysed for a range pre-determined contaminants. The samples collected were conservatively assessed against LQM/ CIEH 2015 S4ULs (Suitable for Use Levels) for a residential end use with plant

uptake (1% SOM). Chemical analysis has identified some exceedances of arsenic, chromium, lead, vanadium, zinc, aromatic TPH >C16-C21, aromatic TPH >C21-C35, benzene, naphthalene, phenanthrene, benzo[a]anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, Indeno(1,2,3-c,d)Pyrene and dibenzo(a,h)anthracene.

Asbestos was identified in twelve soil samples at concentrations of <0.001% to 0.0190%. In accordance with the IOM report soils with these concentrations are considered suitable for reuse beneath the clean cover system.

No water sampling has been undertaken within the Site as part of the 2020-2021 RLL investigation. Ground investigations undertaken across the wider development have identified elevated concentrations of contaminants that may potentially present a risk to Controlled Waters, this has been assessed in the DQRA.

A Site-specific ground gas assessment is required following the earthworks, comprising a programme of shallow ground gas monitoring following the turnover of the Made Ground to natural geology and reengineering of the site won Made Ground to formation levels. The classification of the Site will depend on the permeability of the upper clay of the Tidal Flat Deposits. Radon protection measures are expected with a small portion of the Site lies within a radon-affected area, with a maximum radon potential of 10–30%.

9.2. Recommendations

Following the completion of the ground investigation the following recommendations have been made:

- Removal of identified hotspot contamination on a grid square basis, and subsequent validation testing and reporting.
- Turnover of the Made Ground to natural geology with removal of obstructions.
- Reengineering of materials in accordance with the approved Remediation Strategy and Earthworks Specification to an appropriate specification to achieve the required formation level.
- Chemical and geotechnical validation of the placement of material following turnover.
- A programme of shallow gas assessment is recommended following the earthworks to turnover and reengineer the Site.
- Concrete classification testing should be undertaken in accordance with BRE Special Digest 1.
- Phase-specific geotechnical assessments relating to the proposed development.
- Construction of buildings and hardstanding with suitable construction materials to break the pathway with underlying Made Ground, to intercept rainwater and to reduce infiltration.
- A 600mm clean cover system, suitable for a residential with plant uptake end use, will be required in areas of residential gardens and landscaping.

- Preparation of a Detailed Controlled Waters Risk Assessment to assess the risk posed to controlled waters within the future development and inform the Remediation Strategy.
- Preparation of a Piling Risk Assessment.
- Preparation of a Detailed Quantitative Controlled Waters Risk Assessment to assess the risk posed to controlled waters within the future development and inform the Remediation Strategy.
- Preparation of an MMP to facilitate the reuse of excavated materials and import of soil for use in the cover system.

Appendix A

Drawings and Plans

GENERAL NOTES

NO DIMENSIONS TO BE SCALED OFF THIS DRAWING.

THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS.

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.

ANY DISCREPANCIES NOTED ON SITE ARE TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

KEY:



P01	20/08/2025	First Issue	DM	CW
Rev	Date	Amendments	By	Chk



Client

BSTMDL

Project

P18-669 Llanwern Reclamation

Drawing Title

Phase 5a & 5b
Site Location Plan

INFORMATION

	Drawn	Checked	Date
NTS	DM	CW	20/08/25

Drawing No. Rev.

18669-RLL-25-XX-DR-O-0787 P01

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