

Ash Road North, Wrexham

Proposed New Building

Geo-environmental Report

Ipsen Ltd



GroundSolve Ltd

Consulting Geotechnical, Engineering Geology and Environmental Engineers

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1.0 INTRODUCTION

Ipsen Ltd (IL) propose to construct a new extension onto Building 2 (previously Building 12) at their existing facility in Wrexham Industrial Estate, Wrexham.

Lovelock Mitchell Ltd (LML) are the architects for the scheme and they have appointed GroundSolve Ltd (GSL) on behalf of IL to undertake a combined Phase 1 desk study and Phase II site investigation at the site in order to assist with the planning application and to inform the design team.

A geo-environmental report for an adjacent building on site (replacement for Building 55) was undertaken by GSL in June 2017, Reference 1, with the desk study information collected for Reference 1 used for this report. This building adjoins Building 12 to the south east. In addition, an environmental audit for the entire Ipsen site was carried out by GSL in 2018, Reference 2.

This report presents the findings of the desk study and site investigation and gives firm geotechnical recommendations for the development. In addition, conceptual ground models are presented, along with environmental risk assessments. It should be read in conjunction with References 1 and 2.

2.0 THE SITE

2.1 Site Location and Description

The site is located off Ash Road North on Wrexham Industrial Estate, at National Grid Reference SJ 374 502, see Figure 1.

The Ipsen site is bounded by Ash Road North to the immediate east, with Abenbury Way defining the western site boundary. The wider site area is occupied by a large number of buildings, access roads, and parking areas, with limited areas of landscaping also present, see Figure 2.

The development site is bounded by Building 2 to the north, and a temporary reception/security building to the south. Building 2 is a steel framed structure, with a combination of masonry and industrial cladding. To the west lies a landscaped area, which is at a slightly higher elevation, whilst to the east is the current site entrance and the newly constructed replacement for Building 55 (Building 1), which is currently being used as the reception, see Figure 2.

The development site is generally level, with a tarmac covering, and at an approximate elevation of 37mAOD, with the surrounding land also at a similar elevation, although it does rise slightly towards the west towards the landscaped area.

Photographs of the site are presented in Appendix A.

2.2 Geology and Hydrogeology

The geology plans show the site to be underlain by “Landscaped Ground – Artificially Modified Ground”, with the superficial deposits being glacial till (Clay). Experience in this area shows the glacial till to have a thin weathered surface, typically described as firm, yellow brown clay, quickly becoming a stiff red brown clay with a little gravel. Occasional thin sand horizons are common in this stratum. Reference 3 records the superficial deposits in this area to be in excess of 50m thick in this area.

The underlying bedrock is the Kinnerton Sandstone of Triassic age, which comprises red brown and yellow brown sandstones. A fault trending in a northwest-southeast orientation passes through the southernmost tip of the site, with the bedrock on the southeastern side shown to be the Erbistock Formation, of Carboniferous age, mainly comprising mudstone and siltstone. These deposits in turn are underlain by the Coal Measures at significant depth.

The superficial deposits beneath the site are classified as an unproductive aquifer, whilst the bedrock is classified as a Principal aquifer. The Erbistock Formation to the southeast of the fault is classified as a Secondary A Aquifer.

Groundwater is unlikely to be encountered at shallow depth beneath the site, with any groundwater flow to the north towards the nearest watercourse.

2.3 Abandoned Mining

A Coal Authority mining report was obtained for the site area, the main points are summarised below, with the full report presented in Appendix B.

- The site is not within a surface area that could be affected by past underground mining;
- The site is not within a surface area that could be affected by present underground mining;
- There are no known coal mine entries within, or within 20m of, the site boundary;
- The site lies within an area where a notice to withdraw support was given in 1972;
- The property lies outside the Cheshire Brine Compensation District.

Based on the Coal Authority report and the underlying geology of the area, the site is not considered at risk from coal mining related hazards.

2.4 History

The recent history of the site has been traced using old Ordnance Survey (OS) plans dating from 1879, historic aerial photography from the Welsh Government's Aerial Photography Unit online viewer, and Google Earth.

The 1879 OS at a scale of 1:10,560 plan shows the site to be largely occupied by agricultural fields. A stream runs along the northern boundary flowing from east to west, whilst the development area is underlain by a road leading to two buildings to the north west of the site, with Erlas Lane further to the west.

The 1899 OS plan at a scale of 1:2,500, shows the site as described above. A benchmark on the buildings to the north west record an elevation of 128.4 ft. (39.14 m), see Figure 3a. Several ponds are recorded to the west and south of the site.

No significant changes are evident on the 1912 OS plan, see Figure 3b. However, a spot height on the road beneath the site records an elevation of 124ft OD (37.80mAOD), confirming the site was at a higher elevation than present.

An OS plan dated 1938 at a scale of 1:10,560, failed to show any changes.

The 1954 OS plan (1:10,560 scale) shows no development within the site boundary, although the road crossing the site is no longer shown, and a new road had been constructed to the east of the site, see Figure 3c. However, numerous buildings and access roads are evident across the land to the east and south of the site. These are the remains of buildings from the area's use during WWII as an Ordnance Factory. Development from the Ordnance Factory

extended up to the site's eastern and southern boundaries, with the site area itself remained undeveloped.

This was confirmed by the 1946 aerial photograph from Reference 2, which is presented below.



1946 Aerial Photograph

The area was used for Cordite production during WWII, which was the propellant for shells. Production ceased in 1945, and the Welsh Development Agency started construction of Wrexham Industrial estate in the 1960's.

The 1961 OS plan shows a mineral railway had been constructed through the centre of the Ipsen site, trending north-northeast to south-southwest, see Figure 3d. This railway cuts across the eastern site boundary. A degree of cut is indicated along the western side of the railway line through much of the site, although it is at grade adjacent to the development site. An earthworks mound is present to the west of the Mineral Railway to the south of the development site. The stream is no longer shown to the north and "Sinks" are noted to the west of the railway, suggesting the stream had been culverted, as it continues to the west of the site.

Several large industrial buildings had been constructed immediately to the east of the site, and Ash Road had been partly constructed, see Figure 3d. Only a single building, Green Lane Cottage, is evident in the north western corner of the site.

The 1982 OS Plan shows the Mineral Railway across the site to have been removed and the cottage demolished. The site had been developed with three industrial units, although the current development site remains undeveloped, see Figure 3e. A large works had been constructed to the east of the site, with more industrial units and factories/warehouses to the west. Ash Road had been completed and linked to Abenbury Way to the south of the site.

The 1988 OS plan shows a similar layout within the site boundary, although some of the existing buildings had been extended, and Building 55 had been constructed to the north east of the site, see Figure 3f. Some of the buildings to the east of the site had been demolished, with other minor changes to the layout of the industrial estate also evident.

The 1990 OS plan again shows minor changes to the footprints of the main buildings on-site, but not in the vicinity of the current development site, see Figure 3g. A new industrial building had been constructed to the east of the site.

No significant changes are visible on the 1995 OS plan, see Figure 3h.

A 2003 aerial photograph shows the site in a similar layout to the 1995 OS plan, with Building 55 to the north east of the site, see Figure 3i. Building 2 had not been constructed by this time, and trees were present to the west of Building 55.

3.0 ENVIRONMENTAL SEARCHES

An Envirocheck report from Reference 1 has been used for this report, the main points are summarised below, with the report presented in full in Appendix C.

Agency & Hydrological

- The closest active discharge consent is located 236m to the northeast of the site,
- An Integrated Pollution Prevention and Control is recorded on site for Ipsen Biopharm Ltd, for the production of plant health products/biocides,
- The nearest surface water feature is recorded within the site boundary,
- The nearest pollution incident to controlled waters is 117m to the north of the site, recorded in 1998, where light oil caused a Category 3 – Minor incident,
- The nearest water abstraction is 228m to the north east of the site, where water is abstracted for non-evaporative cooling,
- The site is located within a Zone 3 source protection zone,
- The site is not at risk of flooding from rivers or seas,
- It is recorded that the site lies within an area with the potential for groundwater flooding to property situated below ground level. The south westernmost part of the site area recorded as having limited potential for groundwater flooding.

Waste

- There is an historical landfill site 595m to the north west of the site, operational between 1953 and 1983, where deposited waste included industrial waste and liquid sludge,
- The nearest licensed waste management facility is 806m to the north of the site, at Clays Farm Golf Centre.

Geological

The BGS have provided the following general soil contamination values for the site.

- Arsenic <15 mg/kg,
- Cadmium < 1.8 mg/kg,
- Chromium 60 – 90 mg/kg,
- Lead < 100 mg/kg,
- Nickel 15-30 mg/kg.

In addition, the following geological information has been provided.

- The site is in an area, which may be affected by coal mining,

- The site is within a lower probability radon area since 1 to 3% of homes are estimated to be at or above the Action Level,
- Consequently, no radon protective measures are necessary.

Industrial Land Use

- The nearest industrial land use is recorded on-site, being for pharmaceutical manufacture and distribution,
- Numerous other industrial land uses surrounding the site on Wrexham Industrial Estate.

Sensitive Land Use

- Ancient woodland is recorded 147m to the southeast of the site.

4.0 PROPOSED DEVELOPMENT

The proposed extension is to comprise a single storey, steel portal frame building, with ground floor and internal 1st floor mezzanine. The proposed development layout is presented on Figure 4.

The structure is anticipated to be of similar construction to Building 2, with a steel frame and composite cladding. The structural engineer has indicated maximum column loads of around 2,000kN, however, they are anticipated to be generally between 250kN and 750kN. Floor slab loads have been indicated to be a UDL of 25kN/m², with a MHE point load of 60kN.

The recommendations given in this report are based on the above assumption, therefore they will need to be reviewed, and if necessary revised during the detailed design process.

5.0 THE INVESTIGATIONS

5.1 Previous Investigation

The investigation for the works on the adjacent Building 1 (replacement for Building 55), Reference 1, was undertaken on the 3rd May 2017, and comprised:

- Three window sample boreholes, with SPT's carried out at 1.00m intervals to a maximum depth of 5.00m;
- Two dynamic probes to 10.00m at the base of WS01 and WS03;
- A hand-dug trial pit and hand auger to 2.50m depth,
- Chemical Testing,
- Physical Testing.

The window sample and hand auger logs are presented in Appendix D, along with the dynamic probes and physical/chemical test results. The location of the boreholes and hand auger holes are presented on Figure 2.

The investigation encountered a thin veneer of made ground, generally comprising hardcore overlying glacial till, which was generally described as soft, quickly becoming very stiff, brown, locally mottled grey clay, with frequent silt laminations.

SPT "N" values were generally between 5 and 26, with the lower values encountered near surface. The clay typically became stiff at depths of around 2.0m.

Atterberg limit testing recorded Liquid limits between 44 and 48%, Plastic limits between 19 and 23%, with plasticity indices of 21 to 29%, indicating clay of intermediate plasticity. Natural moisture contents were between 26.7 and 29.9%.

pH values between 7.28 and 7.78 were recorded, with water soluble sulphate values, when measured as 2:1 water extract, between 0.04 and 0.08g/l.

Groundwater was encountered in borehole WS01, standing at a depth of 2.85m below ground level upon completion of the borehole. Groundwater inflows were not recorded in any of the remaining boreholes, although the glacial till was noted to be damp or wet below 1.3m depth in borehole WS03.

The chemical testing failed to reveal any values above the commercial guidance values, and no asbestos was encountered.

5.2 This Investigation

The investigation was undertaken on the 8th February 2021 and comprised:

- Three window sample boreholes, with SPT's carried out at 1.00m intervals, to a maximum depth of 5.45,

- Three dynamic probes to 10.00m extended from the base of the window sample boreholes.

The window samples were supervised and logged by an engineer from GSL in general accordance with BS 5930, Reference 4. The locations of the boreholes were limited by numerous services on site and the tarmac hardstandings.

The window sample locations are shown on Figure 2, and borehole logs and dynamic probes presented in Appendix E.

5.3 Laboratory Work

Soil samples were taken from the window samples for the following physical and chemical testing:

Physical Testing

- Moisture Content,
- Atterberg limit,
- pH and water-soluble Sulphate.

The testing was carried out in accordance with BS1377, Reference 5, with the results presented in full in Appendix F. The testing was undertaken by Geotechnics laboratories in Chester.

Chemical Testing

Samples for chemical testing were taken from the Made Ground encountered within the boreholes, placed in the appropriate containers and a cool box, and taken immediately to the laboratories of Derwentside Environmental Testing (DET's) in Doncaster for the following testing:

Metals & Non-metals - Arsenic (As), Boron (B), Cadmium (Cd), Chromium (hexavalent), Chromium (Trivalent), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), Phenol, Selenium (Se), and Zinc (Zn).

Petroleum Hydrocarbons - Benzene, Toluene, Ethylbenzene, o-xylene, m-xylene, p-xylene, Aliphatics >C5 – C44, Aromatics >EC5 – EC44.

Polyaromatic Hydrocarbons (PAH) – Acenaphthene, Acenaphthylene, Anthracene, Benz (a) anthracene, Benzo (a) pyrene, Benzo (b) fluoranthene, Benzo (g, h, i) perylene, Benzo (k) fluoranthene, Chrysene, Dibenzo (a, h) anthracene, Fluorene, Fluoranthene, Indeno (1,2,3-cd) pyrene, Naphthalene, Phenanthrene, Pyrene.

Other Contaminants – Sulphide (easily liberated), Water soluble Sulphate (2:1 extract), Cyanide, pH, Soil Organic Matter (SOM).

In addition, asbestos screening was carried out on all samples.

The results are summarised in Section 7.0, with the results presented in full in Appendix G.

6.0 GROUND CONDITIONS

6.1 General Stratigraphy

The following general stratigraphy was encountered within the boreholes.

BH Ref.	Stratigraphy		
	Topsoil (m)	Made Ground (m)	Glacial Till (m)
WS301	0.00 – 0.40	0.40 – 0.60	0.60 – 5.45
WS302	0.00* – 0.30	0.30 – 0.70	0.70 – 5.45
WS303	0.00* – 0.30	0.30 – 0.70	0.70 – 5.45

* WS302 & 303 recorded 0.05m of gravel and geotextile used for weed suppression over the topsoil layer

6.2 Topsoil

Topsoil was encountered in all of the boreholes, and was generally described as medium dense, dark brown, sandy, slightly gravelly, silt with rootlets, with the gravel being angular to sub angular, fine to coarse of limestone.

6.3 Made Ground

Underlying the topsoil made ground was encountered, up to a maximum depth of 0.70m, and was described in WS301, in the landscaped area, as firm, dark greyish brown, sandy, gravelly, clay, with the gravel being angular to sub angular, fine to coarse of limestone.

In WS302 and WS303 a granular material (Hardcore) was encountered, described as a dense, dark greyish brown, clayey, sandy, angular to sub angular, fine to coarse gravel of limestone, with a medium cobble content of angular limestone.

pH and sulphate tests recorded pH values between 8 and 9, with water soluble sulphate values, when measured as a 2:1 water extract of 15 to 91 mg/l (0.015 to 0.091g/l).

6.4 Glacial Till

Glacial till was encountered in all of the boreholes from 0.60m, and proven to a depth of 5.45m. It was described as firm to stiff, brown, slightly sandy, clay, with sandy laminations.

SPT “N” values were between 7 and 18, confirming a firm to stiff consistency, see Figure 5. No obvious trend with depth was recorded. The lower values were typically at 3m depth and were at the horizon of a water strike in all boreholes.

pH and sulphate tests were undertaken on the glacial till to allow concrete classification. Tests recorded pH values of 8.3, with water soluble sulphate values, when measured as a 2:1 water extract between 20 to 25mg/l (0.02 to 0.025g/l)

A sample of the glacial till was taken from WS301 at 1.50m for Atterberg limit testing to determine if the shrinkage potential of the clay is an issue. It recorded a liquid limit of 44%, a plastic limit of 22%, and a plasticity index of 22%, indicating a clay of intermediate plasticity. The recorded natural moisture content was 20.6%.

6.5 Dynamic Probing

To assess the ground's consistency up to 10.00m, dynamic probe tests were carried out at the base of each borehole.

The table below presents the borehole depth against the minimum to maximum value of blows over 300mm of penetration. Equivalent SPT "N" value has then been derived from the correlation presented by Card, G.B. & Roche, D.P. *The Use of continuous dynamic probing in ground investigation. Penetration Testing in the UK*, Thomas Telford, London, UK (1988):

WS301	Depth (m)	Blows/300mm	SPT "N" Value
	5.4 – 6.0	8 - 11	5 - 7
	6.0 – 7.0	15 – 24	10 - 16
	7.0 – 8.0	21 – 29	14 – 19
	8.0 – 9.0	29 – 33	19 – 22
	9.0 – 10.0	36 – 50	24 - 33

WS302	Depth (m)	Blows/300mm	SPT "N" Value
	5.4 – 6.0	1 – 4	1 – 3
	6.0 – 7.0	5 – 8	3 – 5
	7.0 – 8.0	9 – 12	6 – 8
	8.0 – 9.0	14 – 22	9 – 15
	9.0 – 10.0	21 – 25	15 - 17

WS303	Depth (m)	Blows/300mm	SPT "N" Value
	5.5 – 6.0	2 – 3	2 – 3
	6.0 – 7.0	6 – 8	4 – 5
	7.0 – 8.0	11 – 14	7 – 9
	8.0 – 9.0	14 – 19	9 – 13
	9.0 – 10.0	18 – 21	12 - 15

6.6 Groundwater

Slight groundwater seepages were observed in all of the boreholes, at depths of around 3m.

7.0 RESULTS OF CHEMICAL TESTING

Soil samples were taken from the made ground, with the sample depths presented in the table below.

BH No	Depth (m)
WS301	0.50
WS303	0.50

The results of the soil analyses are presented below, where they have been compared to suitable generic assessment criteria (GACs), in order to allow a generic quantitative risk assessment (GQRA) to be carried out for the site and the proposed development.

The Category 4 Screening Levels (C4SLs) published by DEFRA (2014) have been adopted in the first instance, which have been published for six substances to date. Where a C4SL is unavailable, the “Suitable 4 Use Levels” (S4ULs) published by LQM/CIEH (2015) have been adopted.

These criteria have been derived using the CLEA model for a range of standard end-use scenarios and a range of soil organic matter (SOM) contents. It should be noted that the C4SL values are derived on the basis of a “low level of toxicological concern”, while the S4UL values are based on a “tolerable” or “minimal” level of risk. As such, the S4ULs describe a lower level of risk than the C4SLs, and are equivalent to the former Soil Guideline Values (SGVs, published by the Environment Agency) and the previous editions of the LQM/CIEH GAC values.

A “Commercial” end-use has been adopted for this analysis, based on the most conservative SOM content of 1%, and the results of the laboratory testing.

Note: the S4UL values presented below are Copyright Land Quality Management Limited, reproduced with permission; Publication Number S4UL3668. All rights reserved.

	WS301	WS301				
Metals & Non-Metals	0.50	0.20	Count	Adopted Guideline (mg/kg)	Source	Exceedances
Arsenic	8.7	6.30	2	640	C4SL	0
Boron, Water Soluble	0.2	0.50	2	240000	S4UL	0
Cadmium	0.3	0.40	2	410	C4SL	0
Chromium III	14	7.90	2	8600	S4UL	0
Chromium, Hexavalent	< 1.0	< 1.0	2	49	C4SL	0
Copper	15	51	2	68000	S4UL	0
Lead	33	48	2	2300	C4SL	0
Mercury	< 0.05	< 0.05	2	58	S4UL	0
Nickel	13	10	2	980	S4UL	0
Phenol - Monohydric	< 0.3	< 0.3	2	440	S4UL	0
Selenium	0.8	0.60	2	12000	S4UL	0
Zinc	56	58	2	730000	S4UL	0

None of the above values exceed the relevant guidelines for a commercial end use.

	WS301	WS301				
Petroleum Hydrocarbons	0.50	0.20	Count	Adopted Guideline (mg/kg)	Source	Exceedances
Aliphatic C5-C6	< 0.01	< 0.01	2	3200	S4UL	0
Aliphatic C6-C8	< 0.01	< 0.01	2	7800	S4UL	0
Aliphatic C8-C10	< 0.01	< 0.01	2	2000	S4UL	0
Aliphatic C10-C12	< 1.5	< 1.5	2	9700	S4UL	0
Aliphatic C12-C16	< 1.2	< 1.2	2	59000	S4UL	0
Aliphatic C16-C21	< 1.5	< 1.5	2	1600000	S4UL	0
Aliphatic C21-C35	< 3.4	< 3.4	2	1600000	S4UL	0
Aliphatic C35-C40	< 3.4	< 3.4	2	26000	S4UL	0
Aromatic C5-C7	< 0.01	< 0.01	2	56000	S4UL	0
Aromatic C7-C8	< 0.01	< 0.01	2	3500	S4UL	0
Aromatic C8-C10	< 0.01	< 0.01	2	16000	S4UL	0
Aromatic C10-C12	< 0.9	< 0.9	2	36000	S4UL	0
Aromatic C12-C16	< 0.5	< 0.5	2	28000	S4UL	0
Aromatic C16-C21	< 0.6	< 0.6	2	28000	S4UL	0
Aromatic C21-C35	< 1.4	< 1.4	2	28000	S4UL	0

None of the above values exceed the relevant guidelines for a commercial end use.

Polyaromatic Hydrocarbons (PAH)	WS301	WS301	Count	Adopted Guideline (mg/kg)	Source	Exceedances
	0.50	0.20				
Acenaphthene	< 0.03	< 0.03	2	84000	S4UL	0
Acenaphthylene	< 0.03	< 0.03	2	83000	S4UL	0
Anthracene	< 0.03	< 0.03	2	520000	S4UL	0
Benzo(a)anthracene	< 0.03	0.03	2	170	S4UL	0
Benzo(a)pyrene	< 0.03	< 0.03	2	77	C4SL	0
Benzo(b)fluoranthene	< 0.03	< 0.03	2	44	S4UL	0
Benzo(g,h,i)perylene	< 0.03	< 0.03	2	3900	S4UL	0
Benzo(k)fluoranthene	< 0.03	< 0.03	2	1200	S4UL	0
Chrysene	< 0.03	0.03	2	350	S4UL	0
Dibenzo(a,h)anthracene	< 0.03	< 0.03	2	3.5	S4UL	0
Fluoranthene	< 0.03	0.06	2	23000	S4UL	0
Fluorene	< 0.03	< 0.03	2	63000	S4UL	0
Indeno(1,2,3-c,d)pyrene	< 0.03	< 0.03	2	500	S4UL	0
Naphthalene	< 0.03	< 0.03	2	190	S4UL	0
Phenanthrene	< 0.03	0.07	2	22000	S4UL	0
Pyrene	< 0.03	0.06	2	54000	S4UL	0

None of the above values exceed the relevant guidelines for a commercial end use.

Other Contaminants / Testing	WS301	WS301	Count	Adopted Guideline (mg/kg)	Source	Exceedances
	0.50	0.20				
Organic matter	1.20	1.20	2	-	-	-
pH	8	9	2	-	-	-
Sulphide	< 10	32.00	2	-	-	-
Cyanide, Total	0.2	< 0.1	2	-	-	-
Sulphur (free)	< 0.75	< 0.75	2	-	-	-
Sulphate Aqueous Extract as SO4	15	91.00	2	-	-	-

None of the above values give cause for concern.

In addition, there were no exceedances when compared to the most conservative end use of residential gardens.

Furthermore, no asbestos was detected in any of the samples.

8.0 CONCEPTUAL MODEL AND RISK ASSESSMENT

8.1 General

According to the Contaminated Land Regulations, to determine whether there is a significant possibility of significant harm, the following should be taken into account:

“The nature and degree of harm, the susceptibility of the receptors and the timescale within which the harm might occur”.

Current good practice therefore requires that the findings from the desk study or site investigation be evaluated for contamination on a site-specific basis using a risk-based approach. Risk assessment involves identification of the hazards and evaluation of the risks associated with these hazards. Risk assessment requires an evaluation of a conceptual “source – pathway – receptor” linkage model and can be qualitative or quantitative.

The basis of an environmental risk assessment involves identifying a ‘source’ of contamination, a ‘pathway’ along which the contamination may migrate and a ‘receptor’ at risk from the contamination.

Current legislation defines the various elements of the pollution linkage as:

- A contaminant ‘source’ is a substance, which is in or under the ground and which has the potential to cause harm or to cause pollution of controlled waters.
- A ‘pathway’ is one or more routes through which a receptor is being exposed to, or affected by, a contaminant, or could be so affected.
- A ‘receptor’ is either a living organism, an ecological system, a piece of land or property, or controlled water.

A pollutant linkage indicates that all three elements have been identified. The site can only be defined as ‘Contaminated Land’ if a pollutant linkage exists and the contamination meets the criteria above.

8.2 Hazard Identification

On Site

The desk study has revealed that the site has historically been agricultural land, before entering industrial use and forming part of a large industrial estate following WWII. However, the site was on the perimeter of a wartime ordnance factory, although the historical plans and aerial photographs indicate that the site was not developed as part of the munitions manufacture. It being only developed later as part of the WDA development of Wrexham Industrial estate. Therefore, contamination resulting from ordnance manufacture is not considered a significant risk at the site.

A mineral railway line ran through the centre of the site area prior to its development for industrial use, which has included battery and pharmaceutical manufacture.

As part of the development, which comprised building and hardstanding construction, any made ground and soft materials will have been removed and taken off site. Therefore, any potential contamination would have been removed as part of the site works. This has largely been proved by the site investigation, which confirmed the made ground to be imported material, sat directly on top of the glacial till. In addition, a spot height on the 1912 OS plan confirms that the site elevation used to be some 0.70m above existing levels, confirming that material has been removed from site.

In addition, the boreholes failed to reveal any visual or olfactory evidence of contamination and no exceedances of any contaminants were detected during this or the previous site investigation. In addition, the chemical testing failed to record any exceedances of the guidance values for residential use with gardens.

Off Site

The site is located on a large industrial estate, with numerous industrial processes carried out in the vicinity of the site. Historically, an ordnance factory was located immediately to the south and west of the site area.

However, no significantly contaminative industrial processes have been identified as occurring near to the site. In addition, the underlying glacial till will be highly impermeable, and this will act to prevent migration of off-site contaminants into the site area.

8.3 Summary of Conceptual Ground Model

Potential Contamination Sources	Potential Contaminants of Concern	Potential Pathways	Receptor Group
Made Ground	Heavy metals	Dermal contact	Construction
Industrial Manufacturing Processes	PAH	Inhalation of contaminated dust	Workers
Hydrocarbon Spills – Railway and Industrial Land Use	Petroleum Hydrocarbons	Ingestion of soil or home-grown vegetables	End users
Ordnance Factory	Asbestos	Lateral Migration and Infiltration	End Users
	Explosives		Groundwater

8.4 Pathways

In relation to any on site contamination reaching potential site users, the following pathways are generally considered:

- Ingestion and skin contact with soils on site,
- Inhalation from wind-blown dust,
- Leaching of contaminated materials that may affect controlled waters,
- Direct contact with contaminated material during construction,
- Infiltration and accumulation of ground gas.

8.5 Receptors

The potential impact of a hazard must be assessed with regard to the following target groups:

- Future site users,
- Construction workers,
- Surface and groundwater, both on and off the site,
- Nearby vegetation,
- Building materials and buried services.

8.6 Future Site Users

The site is to be developed with a new commercial unit, with no change to the end-use or site activities proposed.

The desk study has failed to reveal any past contaminated land uses, and site investigation did not encounter any made ground or visual or olfactory evidence of contamination.

No exceedances of any contaminants have been recorded in the two samples of made ground tested, based on a commercial land end-use, or as a residential use with gardens. The site area was not developed as part of the ordnance factory, and therefore the pathways associated with this contamination source are not considered active.

Therefore, the risk to future site users from the proposed development is considered to be negligible.

However, in accordance with current good practice, a watching brief should be undertaken on all excavations, any contamination encountered should be excavated, stored safely on site, tested, and then disposed of at a suitably licensed landfill facility.

8.7 Controlled Waters

No exceedances of any contaminants have been recorded in the two samples of made ground tested, based on a commercial land end-use.

In addition, the proposed development involves the like-for-like replacement of existing hardstandings, and the construction of a new commercial unit. No landscaping is proposed as part of the development.

Therefore, the underlying made ground will either remain covered by building floor slabs or tarmac/concrete hardstandings, reducing the potential for rainfall infiltrations; or it will be removed from site, removing the contamination source. The underlying glacial till is considered to be impermeable, and will prevent the downward migration of any contaminants to the underlying aquifer.

Therefore, the risk to controlled waters is considered to be negligible.

8.8 Construction Workers

The risk to construction workers is considered to be very low; and can be catered for by appropriate PPE and washing facilities in accordance with current good practice.

However, in accordance with current good practice, it would be prudent to undertake a watching brief during shallow excavations. Any contaminated material encountered should be excavated, stored safely on site, tested, and then disposed of at a suitably licensed landfill facility.

8.9 Ground Gases

The desk study has failed to reveal any potential sources of landfill or radon gas close to the site.

Therefore, no gas protection measures are required for the development.

8.10 Building Materials

The investigation has not revealed any contamination that could adversely affect building materials or services, although this should be checked with the statutory suppliers, who should be supplied with the laboratory test results.

8.11 Vegetation

No landscaped areas are proposed as part of the development works. Therefore, the site will pose no risks to vegetation.

It can therefore be concluded that the site is uncontaminated and fit for its intended end use.

9.0 GEOTECHNICAL RECOMMENDATIONS

9.1 Excavations and Site Preparation

The site is predominantly currently covered by the tarmac and hardstandings, which will need to be excavated, and taken off site to a suitably licensed landfill facility.

The tarmac is underlain by granular hardcore, which will also have to be removed to provide space for the floor slab construction. However, following inspection this material may be suitable for re-use.

Excavations will be in made ground and glacial till, and will be possible using conventional earth moving equipment. Excavation sides are likely to be stable in the short-term, although should not be left open if unsupported. Any excavations deeper than 1.2m that are to be entered will need to be shored or battered back for safety reasons.

Care will need to be taken when excavating next to the adjacent building to ensure the existing foundations are supported at all times. However, it is understood that no new foundations are proposed adjacent to Building 2.

Numerous services were observed crossing the site, mainly drainage runs, and these will either need to be diverted, or strengthened beneath the new floor slab. At this stage, it has been assumed they will be diverted, in which case, service runs should either be grubbed out and replaced with well compacted granular materials, or alternatively they should be grouted.

Based on the results of this investigation, no significant inflows of groundwater are anticipated in the foundation excavations. However, deeper excavations for services may encounter slight seepages, which should be easily catered for by pumping from sumps cut within the excavation.

9.2 Foundations and Floor Slabs

Traditional spread foundations, pads/strips are recommended, located within the firm to stiff clays, and designed assuming an allowable bearing pressure of 125kN/m². However, based on the maximum loads given by the structural engineer, this could lead to pad sizes of 4m by 4m, which is on the upper side of what is considered economic. This would reduce to pad sizes of 2.5m by 2.5m for 750kN column loads.

If the size of pad foundations becomes an issue then consideration should be given to piling the development.

It is also assumed that the existing columns on Building 2 will be used, in which case, this will add an additional load onto the existing foundations. This could result in additional minor settlement, which should be checked during the detailed design.

Regarding floor slabs construction all surface materials should be stripped and excavated to the top of the glacial till. The formation should then be proof rolled, any soft spots excavated typically an additional 300mm and backfilled with suitable well compacted granular material to proposed formation level.

Floor slabs can then be designed assuming a Modulus of sub grade reaction of 0.27N/mm³, Reference 6.

9.3 Protection of Buried Concrete

Chemical testing revealed chemical attack of buried concrete is not an issue.

Therefore, in accordance with Reference 7, assuming mobile groundwater, the buried concrete can be classified as:

- DS-1,
- AC-1.

9.4 Landfill and Radon Gas

No sources of radon or ground gas that may affect the site has been identified by the desk study or site investigation, therefore no gas protection measures are considered necessary.

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