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PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT

Padeswood Cement Mill 5 - Phase 1 Contaminated Land Assessment

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REPORT



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Table of Contents

1.0 INTRODUCTION	1
1.1 The Brief	1
1.2 Methodology	1
1.3 Structure of this Report	1
2.0 SITE SETTING AND OPERATIONS	1
2.1 Site Setting	1
2.2 Proposed Development	2
3.0 ENVIRONMENTAL SETTING	3
3.1 Topography	3
3.2 Geology	3
3.3 Hydrology	3
3.4 Hydrogeology	4
3.5 Historical On-Site and Off-Site (500 m) Activities	4
3.6 Current On-Site Activities	7
3.7 Current Off-Site Activities (500 m)	7
4.0 PREVIOUS PHASE 2 SITE ASSESSMENTS	8
4.1 Ground Investigations Outside of the Proposed Development Boundary	8
4.2 Ground Investigations Within the Proposed Development Boundary	8
4.2.1 Records of Coal Mining Beneath the Site	10
4.3 Previous Remediation Works	10
5.0 SITE OBSERVATIONS AND FINDINGS	11
6.0 CONCEPTUAL SITE MODEL	11
6.1 Sources	12
6.1.1 On-site Sources	12
6.1.2 Off-site	12
6.2 Sensitive Receptors	13
6.3 Pathways	13
6.4 Source-Pathway-Receptor Risk Analysis	13
7.0 CONCLUSIONS AND RECOMMENDATIONS	16
8.0 REFERENCES	16



TABLES

Table 1: Historical Site and Site Surroundings' Use 5

Table 2: Summary of Intrusive Ground Investigations Carried out within the Padeswood Cement Works Main Boundary 8

Table 3: Assessment of Made Ground Environmental Testing Results (mg/kg) Against Current Soil Guideline Values (mg/kg) for an Industrial Site Use 10

Table 4: Source-Pathway-Receptor Linkages 14

APPENDICES

DRAWINGS

APPENDIX A

Envirocheck Landmark Report

APPENDIX B

Site Context Plans



1.0 INTRODUCTION

1.1 The Brief

This Phase 1 Contaminated Land Assessment has been prepared in support of the planning application for the construction of a new cement mill (Cement Mill 5, the 'Site') at the Padeswood Cement Works ('Cement Works'). The Phase 1 Contaminated Land Assessment was undertaken in accordance with the scope set out in the Screening and Scoping Report prepared by Golder Associates in March 2017, reference 1773079.500/A.0 (Golder, 2017) and issued to Flintshire County Council.

1.2 Methodology

The methodology for this assessment comprised:

- An examination and review of information collected and presented in a Landmark Envirocheck report (including historical maps) to ascertain the likelihood and potential significance of historical contamination (included in Appendix A);
- A review of readily available relevant geological, hydrological and hydrogeological information for the Site and its immediate surrounds to ascertain the implications with regard to contaminated ground, groundwater or surface water that may be present;
- A Site walkover;
- A review and summary of potentially sensitive receptors (e.g. aquifers, watercourses, human, etc.); and
- A risk analysis using the identified source-pathway-receptor model to assess the severity of any potential contamination of ground, groundwater or surface water.

1.3 Structure of this Report

The Site setting is presented in Section 2 and the environmental setting is presented in Section 3. Section 4 summarises the Site walkover observations. The conceptual site model is presented in Section 5. This section includes a risk analysis using the identified source-pathway-receptor model to assess the severity of any potential contamination of ground, groundwater or surface water. Section 6 presents the conclusions and recommendations, including advice on mitigation measures.

2.0 SITE SETTING AND OPERATIONS

2.1 Site Setting

The Site lies within the north eastern part of the existing Cement Works and is centred on OS grid reference NGR SJ 29230 62300 (Drawing 1). The application area lies wholly within the existing Padeswood Cement Works and extends to approximately 3.1 ha, including the temporary construction contractor's compound, laydown area and railway track improvements.

The application area currently comprises hardstanding and disturbed ground and is used for vehicle or rail access and general open storage.

The application is bounded to the north by a belt of mature woodland and agricultural land with the residential properties on Padeswood Drive lying approximately 200 m beyond. To the east lies nature woodland and agricultural land bisected by the Liverpool to Wrexham railway line, which runs in a north-south direction. The Cement Works lies to the west (Silo 6 and the cement packing bay and building) and south (the raw material storage hall).

The application area therefore lies within the industrial setting of the Cement Works, which itself lies within open countryside, to the west of the villages of Penyffordd and Penymynydd and to the south of the town of Buckley.



2.2 Proposed Development

The proposed development is described in full in the Screening and Scoping Report (Golder, 2017). In summary, the proposed development will comprise:

- Site profiling to achieve required ground levels;
- Civil foundations, including piling, services and access roadways for Mill 5;
- Demolition of Silos 11 and 12, the existing rail loading facility (including Silos 7, 8, 9 and 10) and a small railway cabin;
- Construction of a new vertical roller mill (VRM) together with ancillary development (comprising mainly belt conveyors and pneumatic pipelines) required to feed clinker and other raw materials to the mill and feed the resulting cement to existing and proposed cement storage silos and rail loading facility;
- Erection of three new steel cement storage silos, each with a storage capacity of 1,000 tonnes, fitted with rail and road loading facilities; and
- Laying of new or realigned railway track to service the proposed rail loading facility.

Drawing P103-48 and Drawing P103-51 in Appendix B illustrate the site context and the layout of the proposed development.

Ground Preparation and Civils Works

The area of proposed development for the new VRM will require the mechanical clearance and levelling of previously disturbed ground to facilitate the construction phase. It is envisaged that no material will need to be exported from the site during the ground preparation work. A temporary contractor's compound and laydown area will be established to the east of the new VRM for the duration of the construction phase.

Built Development – New Rail Loading Facility

The Cement Works has an existing operational private rail connection and sidings, which are currently used for importing coal. The Cement Works also has an existing rail loading facility to export cement; however, it is uneconomic to modify and therefore obsolete. It is therefore proposed to demolish the existing obsolete rail loading facility (including Silos 7, 8, 9, and 10) and erect a new rail loading facility, replacing the existing cement silos with three new 1,000 tonne silos. The new facility will not affect the ability of the Cement Works to import coal.

Sections of the existing private railway will be realigned and the railway track will be extended further into the works. The permitted development works required to the private railway line will involve approximately 445 m of new rail track, which will either renew, realign or extend the existing railway line and will include a realignment of the curve through to the proposed location for the new rail loading facility and proceed towards the main Cement Works site road. The application area includes the length of railway line that will be new or realigned to service the proposed rail loading facility.



3.0 ENVIRONMENTAL SETTING

3.1 Topography

The land in the vicinity of the Site slopes gently from approximately 130 m above Ordnance Datum (aOD) 1 km north of the Site to 85 m aOD by the Black Brook, 750 m south of the Site. The Site is at an elevation of approximately 105 m aOD, comprising a flat built area and an area of raised Made Ground in the northern part of the Site.

3.2 Geology

The British Geological Survey (BGS) website indicates the Site to be underlain by Quaternary, Pleistocene and Holocene deposits consisting of till and stony clay. The solid geology is shown to comprise the Carboniferous Middle Coal Measures consisting of mudstones, siltstones, sandstones and seatearths. The BGS website shows an underground fault running in a north-south direction through the centre of the Cement Works, west of the proposed development. One other unnamed fault is shown to the east of the Cement Works, east of the proposed development, also running in a north-south direction.

The closure report for the Cement works' landfill (Golder, 2006) shows the location of known coal workings with relation to the Site. This is presented in Drawing 2, and is taken from a map of Hollins Coal Workings produced by Padeswood Hall Colliery in 1902. According to coal mining records obtained from the Coal Authority, coal mining ended in 1901. The drawing indicates that recorded coal workings extend beneath the proposed development.

The Envirocheck report indicates the Site to be in an area that may be affected by coal mining activity. There are two BGS Recorded Mineral Sites within a 500 m radius of the Site. Both relate to underground coal extraction from the Pennine Lower Coal Measures Formation and are located to the north of the Site, at a distance of 100 m and 400 m. A number of natural cavities relating to Swallow Holes in the limestone and coal measures is listed in the vicinity of the Site. The nearest of these is located 490 m to the southwest.

According to the Envirocheck report, the site is in an intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level) and no radon protective measures are necessary in the construction of new dwellings or extensions.

3.3 Hydrology

'Foundry Drain', a tributary to Black Brook, flows along the eastern and southern boundary of the Site and is designated a Controlled Water by Natural Resources Wales ('NRW'). Black Brook is the nearest major surface water feature in the vicinity of the Site. It passes at a distance of 750 m south, flowing in a west to southeast direction. The Black Brook converges with the River Alyn to the south. At a distance of 4 km from the Site, the Black Brook is classified by the Environment Agency with a river quality grade of E. In addition, the 1:10 k Raster Mapping (2006) provided by the Envirocheck report, shows a number of tributaries to the Black Brook, land drains and small water features within a 1 km radius of the Site. The nearest features comprise a land drain that flows along the east boundary of the Site flowing southeast and a tributary to the Black Brook, which flows south passing immediately east of the Site.

According to the Envirocheck report, the Site is within an area of potential for groundwater flooding to occur at surface as well as within a high risk (30 year return period) area of flooding from surface water. The Site does not benefit from flood defences.

The Cement Works hold an IPC Authorisation to discharge effluent from the Cement Works' lagoon to the Foundry Drain (tributary to Black Brook). There are four other (now expired) discharge consent entries to a tributary of the Black Brook within a 500 m radius of the proposed development boundary. All have been expired or replaced by IPC authorisation. There is a prosecution relating to controlled waters, located 135 m south of the Site. It relates to a spill of heavy oil by Castle Cement into 'a tributary of the Black Brook' interpreted to also be known as Foundry Drain. The prosecution dates from the year 2000 and Castle Cement was found guilty.



No pollution incidents are recorded for the Site in the Envirocheck report. Within a 500 m radius, two pollution incidents to controlled waters are recorded as having occurred. The nearest incident (Category 2) occurred in 1991, 12 m southeast of the Site, and relates to an accidental spill of mud/clay/soil. The second incident (Category 3) occurred in 1995, approximately 300 m northeast of the Site, and relates to accidental spillage of oils/diesel to the road.

3.4 Hydrogeology

The BGS website and the Envirocheck Landmark report show the Site to be underlain by sequences of shales, seatearths, sandstones, coal and limestone (Middle Coal Measures) which are classified as a Secondary A aquifer. Secondary A aquifers comprise permeable layers capable of supporting water supplies at a local rather than strategic scale and can form an important source of base flow to rivers. The Drift deposits are classified as unproductive strata due to their low permeability which results in negligible significance for water supply or river base flow. There are no Source Protection Zones within a 1 km radius of the Site.

The Environment Agency (EA) has produced a series of maps covering England and Wales which identify the vulnerability of groundwater to contamination. Geological information is used to define major, minor and non-aquifers, and information on soils is used to determine the protection afforded to the underlying geology and characterise its overall vulnerability. The map for this area, Sheet 16, Groundwater Vulnerability for West Cheshire, shows that the Site is located on a minor aquifer which lies beneath soils of low leaching potential. The low leaching potential indicates soils in which pollutants are unlikely to penetrate the soil layer.

The Environment Agency website indicates that the Site is not within a Nitrate Vulnerable Zone. An area of proposed 2017 surface water nitrate vulnerable zone is located 200 m to the southeast of the Site. There are no water abstractions listed for the Site. The only water abstraction within 500 m is held by Miss F Hewitt, 370 m east of the Site. The groundwater is extracted for general farming and domestic use. Fourteen additional water abstraction licences are listed within 2 km of the Site.

3.5 Historical On-Site and Off-Site (500 m) Activities

The history of the Site and its surroundings has been reviewed from the historical maps provided by the Envirocheck report. The review is summarised in Table 1.



PADESWOOD CEMENT MILL 5 - PHASE 1 CONTAMINATED LAND ASSESSMENT

Table 1: Historical Site and Site Surroundings' Use

Map	Site Use	Surrounding Site Use (500 m)
1871, 1:10,560 map of Flintshire	The site is occupied by fields. No buildings.	The area is occupied mainly by fields. The London and North Western Railway (Chester and Mold Branch) runs in a NE-W direction, at a distance of approximately 500 m south of the Site. The Wrexham Mold Connah's Quay Railway runs in a N-S direction, approximately 200 m to the east of the Site. Padeswood Hall is located 250 m to the northwest of the Site.
1872, 1:2,500 map of Flintshire	As above.	Immediately to the north are ' <i>Shafts (coal)</i> ' in an area occupied by coniferous trees.
1881, 1:10,560 map of Flintshire	The Site remains unoccupied.	Immediately to the north is an unidentified colliery and ' <i>Shafts</i> '.
1899, 1:2,500 map of Flintshire	As above.	The area immediately to the north is identified as ' <i>Padeswood Colliery</i> '. A railway line enters the colliery from the north.
1900, 1:10,560 map of Flintshire	As above.	The colliery to the north is identified as ' <i>Padeswood Colliery</i> '. Additional ' <i>Shafts</i> ' are located 450 m to the north of the Site.
1912, 1:2,500 map of Flintshire	As above.	' <i>Old Shafts</i> ' are now identified at the location of the colliery.
1914, 1:10,560 map of Flintshire	As above.	' <i>Old Shafts</i> ' are now identified 450 m to the north.
1938, 1:10,560 map of Flintshire	As above.	The Wrexham Mold Connah's Quay Railway is now identified as the ' <i>London & North Eastern Railway</i> ' and the railway to the south of the Site is now identified as ' <i>L.M.S.R. Mold Branch</i> '
1954, 1:10,560 map of Flintshire	The Site is occupied by a ' <i>Cement Works</i> '. Two small areas in the south and west of the Site are occupied by a ' <i>Cement Works</i> ' with the remainder of the Site unoccupied. A railway line runs along the south boundary of the Site.	The area immediately to the south and west of the Site is occupied by the same ' <i>Cement Works</i> ' as the Site.
1961, 1:2,500 Ordnance Survey Plan	The central part of the Site is occupied by a heap. A ' <i>Drain</i> ' crosses the central part of the Site from WNW to ESE. A railway line runs along the southern boundary of the Site.	The land immediately to the north is occupied by a heap, ' <i>Disused Shafts</i> ' and ' <i>Ponds</i> '.
1964-66, 1:10,000 Ordnance Survey Plan	As above.	The Cement Works are now identified as ' <i>Works</i> ' and have expanded to comprise additional buildings to the south and west of the Site.



PADESWOOD CEMENT MILL 5 - PHASE 1 CONTAMINATED LAND ASSESSMENT

Map	Site Use	Surrounding Site Use (500 m)
		A 'Sports Field', residential properties and a 'Bannel Farm' are located 200 m to the north. Padeswood Hall is no longer identified as such although the buildings remain in place.
1968-69, 1:10,000 Ordnance Survey Plan	As above.	As above.
1974, 1:2,500 Supply of Unpublished Survey Information	Only the northern end of the site is occupied by a heap.	As above.
1975, 1:10,000 Ordnance Survey Plan	As above.	A new building within the 'Cement Works' is shown directly south of the Site.
1977-1989, 1:2,500 Additional SIMs	As above.	As above.
1981-1989, 1:2,500 Additional SIMs	As above.	New building footprints are shown in the 'Cement Works' to the west of the Site.
1991, 1:10,000 Ordnance Survey Plan	As above.	The 'Sports Field' to the north has expanded in area. The buildings formerly occupied by Padeswood Hall are now identified as 'Padeswood Hall Farm'. Two 'Oak Tree' farms are shown, one 500 m to the WNW and another 400 m W of the Site. The railway line to the south is shown as 'Dismantled Railway'.
1993, 1:2,500 Large-Scale National Grid Data	As above.	As above.
1999-2000, 1:10,000 Raster Mapping	Three unidentified circular features (probably silos) are shown in the southern part of the Site.	The area of the former colliery immediately to the north of the Site is identified as 'Workings (dis)'. The 'Works' comprises a new circular building footprint to the south of the Site. An electrical substation is located 300 m SW of the Site.
2001, Historical Aerial Photography	The aerial photograph confirms the circular features to comprise of silos. The majority of the Site remains unoccupied although some areas appear to be used for storage of materials.	The Cement Works surrounds the Site with the exception of east of the Site which is occupied by agricultural fields.
2006, 1:10,000 Raster Mapping	As above.	Additional building footprints are shown within the 'Works' to the south of the Site.
2017, 1:10,000 Vector Map Local	As above.	There is a slight change in the buildings footprints within the 'Works' adjacent to the Site.



3.6 Current On-Site Activities

Current on-site activities have been reviewed from the information supplied in the Envirocheck report.

An active repair and servicing commercial service is located 340 m north of the Site. The Envirocheck report lists four industrial features ('Tanks') on Site. The report does not provide additional information but it is likely these refer to the silos currently present on Site. There are no integrated pollution controls (IPC), no integrated pollution prevention and control (IPPC) and no local authority pollution prevention and control (LAPPC) entries for the Site.

3.7 Current Off-Site Activities (500 m)

The Envirocheck report lists both active and inactive off-site activities, located with a 500 m radius from the Site. A review of the Envirocheck report indicates one active entry in the Contemporary Trade Directory within 500 m of the Site, relating to Hanson's Cement works. Two inactive entries relate to a commercial cleaning services (300 m northwest) and a car dealers (325 m north).

A fuel station, listed as obsolete, was located 340 m north of the Site, where a repair and servicing commercial service is now present.

The Envirocheck report identifies the following manufacturing and production points of interest within 500 m of the Site; three 'unspecified works or factories' (20 m NW, 220 m W and 230 m W), a 'Tank (generic)' (320 m E) and 'Shafts (disused)' (90 m N and 400 m N). In addition, the report lists two 'Spoil Heaps', under class code for waste storage, processing and disposal, at 300 m and 340 m SW.

There are eight entries for Integrated Pollution Controls within 500 m of the Site. Two have not yet been authorised (under Castle Cement, located 10 m west and 130 m NW of the Site) and seven have been superseded.

There are ten Integrated Pollution Prevention and Control entries within 500 m of the Site. Only two are active: one relates to incineration of non-hazardous waste greater than 1 T/hr and is located 175 m northwest of the Site; the second relates to waste landfilling greater than 10 T/day, located 175 m northwest. Both are held by Castle Cement Limited. The Envirocheck report lists one Local Authority Pollution Prevention and Control entry of unknown status, relating to a 4x4 centre, located 325 m north of the Site.

The Envirocheck report lists three prosecutions relating to authorised processes, at distances of 80 m NW, 90 m NW and 120 m NW of the Site. The prosecutions are dated between 1999 and 2010.

The Envirocheck report indicates a historical landfill to be present immediately to the north of the Site and within the extreme northern extent of the proposed planning application area. Deposited waste included industrial and household waste and input started in 1950. The licence holder is Castle Cement. A licensed landfill, the Padeswood Landfill operated by Castle Cement, located in the southern part of the Cement Works, approximately 200 m south of the proposed development, is shown as licensed and not operational since 1987. In addition, the Envirocheck report indicates the presence of potentially infilled land (non-water), comprising of unknown filled ground (pit, quarry, etc.) and potentially infilled land (pond, marsh, river, stream, etc.) within the Site boundary.



4.0 PREVIOUS PHASE 2 SITE ASSESSMENTS

4.1 Ground Investigations Outside of the Proposed Development Boundary

Several phases of site investigation have been carried out in the Cement Works in order to determine the local geological setting and for the installation of monitoring wells in the Cement Works' landfill (Padeswood Works' landfill located to the south of the proposed development). The investigation locations were centred in the south of the Cements Works' site, outside of the proposed development boundary. The findings of the investigations are discussed in the Padeswood Landfill Closure Report (Golder, 2006). The investigations carried out are listed in Table 2.

Table 2: Summary of Intrusive Ground Investigations Carried out within the Padeswood Cement Works Main Boundary

Date	Contractor	Ground Investigation
1995	Gibb Environmental	Excavation of trial pits concentrated on the landfill area south of the current works and in an area to the east of the works used for coal stockpiling.
1998	Kennedy & Donkin	Excavation of trial pits.
1998	Castle Cement	Drilling of 6 boreholes.
1998/1999	Exploration Services	Drilling of 13 boreholes in the area of Kiln 4, and towards the northern end of the landfill.
January 2001	Foundation and Exploration Services Ltd	Drilling of 11 boreholes around the existing landfill.
September 2004	Ground Restoration Ltd	Drilling of 5 boreholes around the proposed new development area for a landfill to the west of the existing landfill.

The ground investigations confirmed the presence of Glacial Till deposits, comprising stiff orange brown sand gravelly clay with layers and lenses of sands and gravels (Golder, 2006). Made Ground was encountered in all of the boreholes during the Exploration Associates site investigation of 1999, and in most of the trial pits in the Gibb Environmental site investigation of 1995, overlying the Glacial Till (Golder, 2006). The Made Ground comprised cement kiln dust, silty sand and clayey silt with gravel, brick, plastic, wood and concrete and fine to medium gravel sized particles of coal and shale. Borehole information from the 2001 ground investigation indicated the geology to consist of mudstones and sandstones of the Middle Carboniferous Coal Measures overlain by a sequence of Glacial Till and interbedded glacial sand and gravel lenses with a total thickness ranging between 10 to 14 m thick (Golder, 2006).

4.2 Ground Investigations within the Proposed Development Boundary

Soil Mechanics carried out a ground investigation within the planning application area in 2007 in order to provide geotechnical and geoenvironmental information to inform the proposed development. The investigation locations are shown on Drawing 3.

The ground investigation comprised the drilling of four boreholes (drilled by cable percussion boring and extended with rotary core drilling methods) in the centre of the Site. Boreholes BH1, BH2, BH3 and BH4A were drilled to final depths of between 40.1 and 42.1 m. The inspection pit for borehole BH4 was terminated at 1.0 m depth due to encountering a drain in the east side of the pit.



Ground Conditions

The investigation encountered Made Ground thicknesses of between 1.3 m (BH4A) and 3.3 m (BH1). The Made Ground comprised of shallow layers of cobbles, sand and gravel of concrete and limestone, overlying a deeper layer of soft to firm clay. Concrete, brick, ash, timber and plastic were encountered in the Made Ground, as well as layers of organic matter at depth.

The Made Ground was found to overlie the Glacial Deposits of stiff to very stiff brown slightly sandy gravelly clay. A deeper bed of medium dense grey brown sandy fine to coarse gravel was encountered in BH4A. The thickness of the Glacial Deposits ranged from 8.9 m (in BH4A) to 10.5 m (in BH1). Glacial Deposits were proven to an average maximum depth of between 10.2 m and 13.8 m (between 93.2 m and 95.3 m aOD) before encountering the bedrock of the Middle Coal Measures (Sandstone, Mudstone and Siltstone). The bedrock was proven to a maximum depth of 42.1 m (63.4 m aOD). A coal layer of up to 2.5 m thickness was encountered in boreholes BH1, BH2 and BH3 at approximately 20 m depth (80 m aOD).

Groundwater Conditions

Groundwater monitoring standpipes were installed in boreholes BH1, BH3 and BH4A with response zones within the Middle Coal Measures. Soil Mechanics carried out three groundwater levelling exercises in May 2007. Depth to groundwater of between 10.3 m and 12.7 m below ground level were recorded in boreholes BH4A and BH3, respectively, with groundwater depth in BH1 between the two extremes. Groundwater quality testing was not undertaken.

Environmental Testing

The investigation included geotechnical and geoenvironmental testing. Environmental analysis included testing of eight samples of Made Ground collected from the top 1.0 m depth for pH, metals (arsenic, cadmium, total chromium, lead, mercury, nickel and selenium), phenol index, total cyanide, polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH). The samples were also screened for asbestos.

The pH values of the samples were found to range between 10.8 and 12.6 (except in BH4A where the pH ranged from 7.5 to 8.1) denoting an impact of the surface soils by the Cement Works activity. The asbestos screen did not detect asbestos.

Soil Mechanics provide an assessment of the concentrations of contaminants in the environmental analysis against Soil Guideline Values (SGV), based on the CLEA model, and Generic Soil Screening Levels (SSL), based on the Risk-Based Corrective Action (RBCA) Tool Kit. Soil Mechanics conclude that the mean concentrations (to the 95% upper confidence limit) of the contaminants which have SGVs or Generic SSLs did not exceed their respective guideline values for a commercial/industrial site use. In addition, none of the maximum concentrations exceeded the guidelines and the contaminants were not considered to pose a risk to Site users.

Soil Guideline Values published before 2009 have been withdrawn and replaced by the Suitable for Use Levels (S4UL), introduced in 2004 by Land Quality Management (LQM), and Category 4 Screening Levels (C4SL), introduced by Defra in 20014. An assessment of the analytical results obtained by Soil Mechanics against the current Soil Guideline Values is presented in Table 3. The table shows that there are no exceedances of the Soil Values and the contaminants are not considered to pose a risk to Site users.



Table 3: Assessment of Made Ground Environmental Testing Results (mg/kg) Against Current Soil Guideline Values (mg/kg) for an Industrial Site Use

Determinand	Number of Analysis	Measured Concentrations			Soil Guideline Value		Number of Exceedances
		Min	Max	Arithmetic Mean	Value	Source	
Arsenic	8	4	8.9	7.6	640	C4SL ¹	0
Cadmium	8	0.1	0.5	0.3	220	C4SL ¹	0
Copper	8	2.9	27.3	20.1	68,000	S4UL ²	0
Chromium (total)	8	11	34.9	27.3	8,600	S4UL ²	0
Lead	8	18.6	51.4	40.5*	1,100	C4SL ¹	0
Mercury	8	0.1	0.14	0.1	1,100	S4UL ²	0
Nickel	8	8.4	42.4	26.9	980	S4UL ²	0
Selenium	8	1.04	3.51	26	12,000	S4UL ²	0
Zinc	8	17.9	94.5	79.8	730,000	S4UL ²	0
Phenol Index	8	0.5	0.6	0.5	3,200	SGV ³	0
PAH (total)	8	10	28	N/R	N/A		-
TPH	8	15	314	N/R	N/A		-
Cyanide	8	1	6	2.8	N/A		-

*Geometric Mean; ¹C4SL (Defra, 2014); ²Suitable for Use Levels (S4UL) (LQM, 2014); ³Soil Guideline Values (Environment Agency, 2009); N/R-Not Relevant; N/A – Not Applicable

Gas Monitoring

Gas monitoring was carried out by Soil Mechanics on three occasions in May 2007 from boreholes BH1, BH3 and BH4A (Soil Mechanics, 2007a). No hydrogen sulphide was detected during the monitoring exercises. Methane was detected on two occasions, both in BH3, at concentrations of 0.5 % vol (08/05/2007) and 0.3 % vol (17/05/2007), both values below the lower explosive limit (LEL) of 5%. The presence of methane in BH3 may arise from the Coal Measures (2.5 m thick) which are intersected by the borehole response zone at approximately 25 m depth. Carbon dioxide concentrations varied between 0.0 and 0.2 % vol at the three locations.

4.2.1 Records of Coal Mining Beneath the Site

A Coal Authority Mining report was obtained during the 2007 Soil Mechanics investigation (Soil Mechanics, 2007a). The report indicated that the site is within the likely zone of influence on the surface from workings in one seam the last date of which being 1901. According to Soil Mechanics (2007a) report, the 1999 investigation indicated the recording of an unnamed shallow coal seam at 27 m depth on the Padeswood Section, and also “Old Workings” shown in the area of the proposed limestone storage shed may suggest the presence of shallow coal workings which should not be discounted. The 1999 ground investigation report recorded one mine entry in the area north of the limestone storage shed.

Soil Mechanics report encountering an un-worked coal seam at depths between 26.1 m and 29.6 m in boreholes BH1, BH2 and BH3 but not in BH4A. They present an interpretation that the fault indicated on the geological map possibly dissects the area of the proposed development in a north-south trend. Soil Mechanics highlight that it is not uncommon to, in mining areas, for only the coal from one side of a fault to be mined, leaving the other un-mined and that, shallow workings would only be likely to be found beneath the western half of the Site with the coal below the eastern half being un-worked.

4.3 Previous Remediation Works

The Site representative reported that there have been no remediation works at the Site.



5.0 SITE OBSERVATIONS AND FINDINGS

A walkover of the Site was carried out on the 2 March 2017. The Site walkover included the part of the Padeswood Site within the redline boundary of the proposed development. The weather conditions at the time of the Site visit were sunny and dry, mild and windy. According to the Site Representative, the Padeswood site has been operational as a Cement Works since 1949. A description of the potential sources of contamination is given below. Drawing 3 shows selected photographs of the potential sources and their location.

Part of the Site is currently used as general open storage. In the northern part of the Site, in an area of raised Made Ground, open storage of bags of cement was observed to take place. A disused vertical mill structure was also found in this area. No visual evidence of contamination was observed on the surface although the raised Made Ground itself is likely to comprise of construction waste and waste arising from the Cement Works' workshop. This area extends further north outside the boundary of the proposed development. Metal bars (to the east) and cabin containers containing open drums of fuel and grease (to the north) are located in the area. The stored fuel and grease were thought to have been used in the servicing of Cement Works vehicles (a disused vehicle was parked in the vicinity). This activity is thought to have been ceased. No visual evidence of contamination was observed in the surrounding soil. Additionally, wood pellets, tyres and plastic sheeting were observed to be stored in the area.

Two waste containers, one asbestos container and one plastic covered pallet containing asbestos are stored on hard-standing in the centre of the Site. It was unclear what waste was contained in the containers. The asbestos container was closed and properly labelled. The plastic covered pallet with asbestos was properly labelled and contained asbestos ceiling sheets covered with plastic sheeting.

In the western side of the Site, a small electrical sub-station was located adjacent to the limestone crusher building, a boiler was located by the disused railway line and truck loading of cement was observed to take place beneath Silo number 6. All activities were on hard-standing. No visual evidence of contamination, such as staining, was observed.

To the east of the Site is the existing railway line and associated infrastructure such as the rail cabin and a small water tank. The railway line is used to transport coal into Cement Works. The coal is currently stockpiled adjacent and to the south of the railway line, outside of the proposed development boundary. No visual evidence of contamination was observed in the line and the Site Representative noted that the ballast had recently been changed. An above ground storage tank in a brick structure which served as a bund was located to the northwest of the rail cabin. No visual evidence of contamination was observed in the tank, bund structure or the surrounding soils. According to the Site Representative, the tank has not been used for at least 15 years but it is thought it previously contained diesel fuel to be used in locomotives.

The Site representative was not aware of any health and safety claims or environmental prosecutions within the last 3 years for the part of the Site within the planning application area. The Site representative reported that no spills or leaks have occurred within the planning application area.

6.0 CONCEPTUAL SITE MODEL

In the definition that has become accepted by the environmental and waste industries, there are three components to any site conceptual model:

- The source is a potentially contaminating component;
- The pathways are any routes linking the source with the receptors including the underlying unsaturated geology in which degradation processes may occur; and
- The receptors are groundwater and surface water bodies that are connected to the source by the pathways, such as surface watercourses, local supply boreholes, or springs.



The three components are linked within a conceptual model for the Site. Should either one of the source, pathway, or receptor be absent from the site setting, negligible risk will be posed to the receptors.

6.1 Sources

6.1.1 On-site Sources

Existing railway line and associated infrastructure

Potential contaminants arising from the railway line include fuel oils, lubricating oils and greases in areas where the locomotives have stood for significant periods of time. There may also be localised contamination due to the use of antifreeze liquids such as ethylene glycol. General top soil contamination could have occurred through the wind dispersal of airborne contaminants, such as coal ash from open wagons and during disposal in the coal stockpile adjacent to the railway line. The empty tank located by the railway line could have contained fuel oil which had the potential to impact soil and groundwater if leaking. However, no visual evidence of staining or contamination was observed neither in the tank nor in the brick bund nor in the ground.

Electrical Sub-station

The electrical sub-station located by the limestone crusher building could contain, or have contained in the past, oil-filled transformers containing PCBs (Polychlorinated Biphenyls). There was no visual evidence of staining in the ground adjacent to the sub-station. The limestone crusher building is proposed to remain in place.

Boiler in the area of disused railway line

The boiler located in the area of the disused railway line may have the potential to contaminate the surrounding ground with oils. However, the boiler was observed to be in a good state of repair during the Site walkover and no evidence of staining was observed in the surrounding ground (hard-standing). The boiler may need removing for the proposed new rail loading facility.

Cement Works, including area of raised Made Ground

The main contamination sources of a typical Cement Works, such as the kiln, workshops and waste disposal facilities, are located outside of the proposed development. Potential contamination arising from the Cement Works within the proposed planning application area include contamination arising from loading of cement in the trucks and acids/bases in the area of the limestone crusher. The area of raised Made Ground, slightly overlapping an historical landfill, in the north of the Site may contain material such as brick, kiln ash, workshop wastes and asbestos.

In addition, asbestos may be encountered during demolition of existing Site infrastructure, such as Silos 7 -12.

Asbestos and Waste Containers

The two waste containers and plastic covered pallets containing asbestos may contribute with potential dispersion of asbestos fibres and contaminated dust to the surrounding ground.

6.1.2 Off-site

Area of raised Made Ground immediately north of the Site

Part of the area of raised Made Ground discussed in Section 6.1.1 is located outside of the proposed development boundary, overlying an historical landfill site. In addition to Made Ground material as discussed above, potential contaminants in the area include oils arising from the containers cabins, although no visual evidence of contamination was observed in the area during the Site walkover; heavy metal contamination arising from the metal structures currently stored in the area; and contamination with cement and PFA (Pulverised Fuel Ash) arising from the bags of stored material in the area.

Cement Works

Potential contaminants arising from the Cement Works include metals, inorganic compounds, solvents and fuels.



6.2 Sensitive Receptors

The receptors of potential contamination from the Site comprise the following:

- Groundwater present in the underlying Coal Measures aquifer which is likely to contribute to baseflow of the River Alyn some 2 km downgradient;
- An unnamed tributary to Black Brook adjacent to the eastern boundary of the Site;
- Current and future Site users; and
- Construction workers for the proposed development.

6.3 Pathways

The Padeswood Works will remain a Cement Works. There is the potential for receptors to be impacted by contamination by pathways created during and after the construction.

Underlying the planning application area is the Made Ground and *in-situ* superficial Drift deposits. The Drift deposits comprise lenses of alluvial sand and gravel and Glacial Till, which comprises a sandy gravelly clay. The clay has an average thickness of 10 m in the centre of the Site (Soil Mechanics, 2007a). Some lenses of alluvial sand deposits contain perched groundwater and some are dry suggesting that they are discontinuous (Golder, 2010).

The Drift deposits overlie the Coal Measures which comprise interbedded sandstones and mudstones. The water table in the Coal Measures is below the interface with the Glacial Till (Golder, 2010). The main potential pathway to groundwater present in the Coal Measures is vertical migration of contaminants through the Drift deposits and unsaturated Coal Measures. The main potential pathway to the unnamed tributary of the Black Brook is lateral migration of perched groundwater through the sporadic lenses of Sand and Gravel in the Drift deposits and surface run-off. Although no contaminant sources or spills have been recorded within the planning application area.

Human receptors could be exposed to ground contamination via dermal contact and inhalation and ingestion of contaminated soil particles. The proposed development comprises the creation of additional area of hard standing which will remove the pathway for direct contact between future Site users and soil contamination. This will also minimise rainfall infiltration into the ground, reducing the potential for contaminants in the ground to migrate to the underlying groundwater.

6.4 Source-Pathway-Receptor Risk Analysis

A summary table assessing each source-pathway-receptor link is presented in Table 4. Links which are considered to not be present are shown in grey.



PADESWOOD CEMENT MILL 5 - PHASE 1 CONTAMINATED LAND ASSESSMENT

Table 4: Source-Pathway-Receptor Linkages

Source	Potential Contaminants	Pathway	Receptor	Observations	Recommendations
Existing Railway line Tank by the railway line	Hydrocarbons PAHs Ash Ethylene glycol Sulphate	Surface water run-off Lateral migration of contaminants through the Drift deposits	Foundry Drain	The railway line and the tank are elevated with regards to the tributary. The railway line runs parallel and adjacent to the tributary. Potential contaminants can migrate to the stream via both surface water run-off and by lateral migration through the Drift deposits.	Environmental testing of samples of surface soil should be carried out in advance to or during the works to establish the need for mitigation measures.
		Vertical migration of contaminants	Aquifer in the Coal Measures	The Drift comprises a significant thickness of clay which will provide environmental protection from surface process and attenuation in the case of infiltrating perched groundwater.	No mitigation measures recommended.
	Hydrocarbons	Dermal contact Inhalation	Current and future Site users	Current and future Site users may be exposed to potential contaminants contained in the surface soils.	Environmental testing of samples of surface soil should be carried out in advance to or during the works to establish the need for mitigation measures.
		Dermal contact Inhalation	Construction workers	Construction workers may come into contact with potential contamination.	Appropriate PPE should be worn during the works.
Electrical sub-station by the Limestone Crusher Building Boiler in disused railway line Asbestos and waste containers	Hydrocarbons PCBs	Surface water run-off	Foundry Drain	These areas are currently located in hard-standing and it is proposed they continue to be on hard-standing. Potential contaminants may be mobilised during construction works via the Site drainage.	Site drainage should be protected during construction works to control migration off-site of potential contaminants.
		Lateral migration of contaminants through the Drift deposits	Foundry Drain	These areas are currently located in hard-standing and it is proposed they continue to be on hard-standing.	No mitigation measures recommended.
	Hydrocarbons Asbestos Metals Additional contaminants dependant on waste stored in containers	Vertical migration of contaminants	Aquifer in the Coal Measures	Surface water run-off is collected by the Site's surface water drainage.	The pathways for contamination are therefore not present.
		Dermal contact Inhalation	Current and future Site users		
Dermal contact Inhalation	Construction workers	Construction workers may come into contact with potential contamination.	Appropriate PPE should be worn during the works.		



PADESWOOD CEMENT MILL 5 - PHASE 1 CONTAMINATED LAND ASSESSMENT

Source	Potential Contaminants	Pathway	Receptor	Observations	Recommendations	
Raised area of Made Ground (northern part of Site and off-site)	Metals Solvents Hydrocarbons Asbestos	Surface water run-off Lateral migration of contaminants through the Drift deposits Vertical migration of contaminants	Foundry Drain Aquifer in the Coal Measures	It is understood that the area of raised Made Ground lies directly on the Drift deposits (i.e. there is no barrier protecting the Drift deposits). Potential contaminants can therefore migrate both laterally and vertically towards the receptors.	Environmental characterisation should be carried out in advance to or during the works to establish the need for mitigation measures.	
		Dermal contact Inhalation	Current and future Site users	Current and future Site users may be exposed to potential contaminants contained in the surface soils.		As above.
		Dermal contact Inhalation	Construction workers	Construction workers may come into contact with potential contamination.		Appropriate PPE should be worn during the works.
Cement Works (off site)	Metals Inorganic compounds Solvents Hydrocarbons	Surface water run-off Lateral migration of contaminants through the Drift deposits Vertical migration of contaminants	Foundry Drain Aquifer in the Coal Measures	The Cement Works are located at assumed downgradient of the proposed development and it is therefore unlikely that potential contamination would impact receptors beneath the proposed works.	None	

*greyed links are not considered to be present.



7.0 CONCLUSIONS AND RECOMMENDATIONS

The Padeswood site has been operational as a Cement Works since 1949 and therefore, potentially contaminative activities have been carried out on Site, i.e. within the planning application area, for over 60 years. However, no visual evidence of contamination, such as staining of the ground was observed during the Site walkover. Intrusive investigations carried out on Site have not indicated the presence of elevated concentrations of contaminants in the ground. Groundwater quality beneath the Site has not been characterised.

The proposed development will provide an opportunity to remove two of the major potential sources on Site, such as the existing railway track (ballast, rail and railway sleepers) and associated infrastructure, and the area of raised Made Ground in the northern part of the Site. It is recommended that environmental characterisation of the ground in these two areas is undertaken as part of the works. Samples of top soil and shallow Made Ground should be collected and analysed for the potential contaminants listed in Table 4. A selected number of Made Ground samples should be screened prior to the proposed earthworks to level the area of raised Made Ground for the contaminants listed in Table 4. The screening will support an evaluation of the risk to human health posed by the presence of potential contaminants in these two areas..

8.0 REFERENCES

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- Soil Mechanics (2007b). Castle Cement, Padeswood, Interpretative Report on Site Investigation, Volume 1: Desk Study. Report No F7019/1, March 2007.



Report Signature Page

GOLDER ASSOCIATES (UK) LTD

A handwritten signature in blue ink that reads "T. Fernandes".

Teresa Fernandes
Environmental Consultant

A handwritten signature in blue ink that reads "Richard Lansley".

Richard Lansley
Senior Hydrogeologist

Date: 2 June 2017

TF/RL/cr

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DRAWINGS



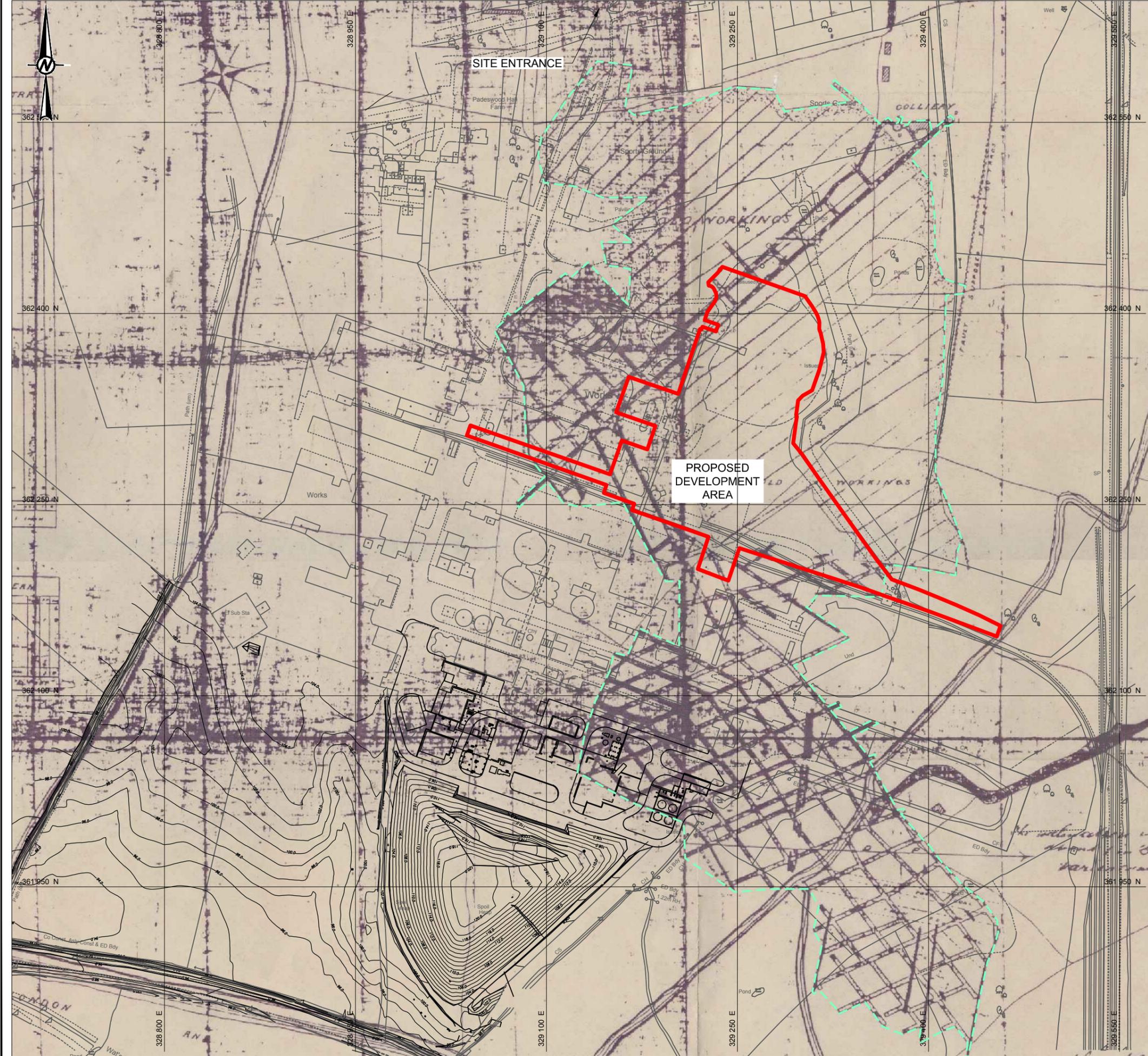
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		PADESWOOD CEMENT WORKS			
		PADESWOOD CEMENT MILL 5 - PHASE 1 CONTAMINATED LAND ASSESSMENT			
CONSULTANT		TITLE			
		SITE LOCATION PLAN			
		YYYY-MM-DD	2017-03-15		
		DESIGNED	TF		
		PREPARED	ECs		
REVIEWED	PW	PROJECT NO.	CONTROL	REV.	DRAWING
APPROVED	RL	1773079.504	0501-CL-0001	A	1

Last Edited By: iskiner Date: 2017-03-20 Time: 4:52:43 PM | Printed By: iskiner Date: 2017-05-22 Time: 10:52:59 AM
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LEGEND

- PROPOSED DEVELOPMENT BOUNDARY
- TUNNEL BOUNDARY

REFERENCE(S)
 HISTORICAL BACKGROUND PLAN OF PADESWOOD HALL COLLIERY HOLLIN COAL WORKINGS 1902 SUPPLIED BY CLIENT.



CLIENT



PROJECT
 PADESWOOD CEMENT WORKS
 PADESWOOD CEMENT MILL 5 - PHASE 1 CONTAMINATED
 LAND ASSESSMENT

TITLE
**PROPOSED DEVELOPMENT BOUNDARY IN RELATION TO
 MINE WORKINGS**

CONSULTANT	YYYY-MM-DD	2017-03-15
DESIGNED	TF	
PREPARED	ECS	
REVIEWED	PW	
APPROVED	RL	



PROJECT NO. 1773079.504 CONTROL 0501-CL-0002 REV. A DRAWING 2

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PHOTO 1: CEMENT LOADING



PHOTO 10: ELECTRICAL SUB-STATION



PHOTO 2



PHOTO 6: TANK

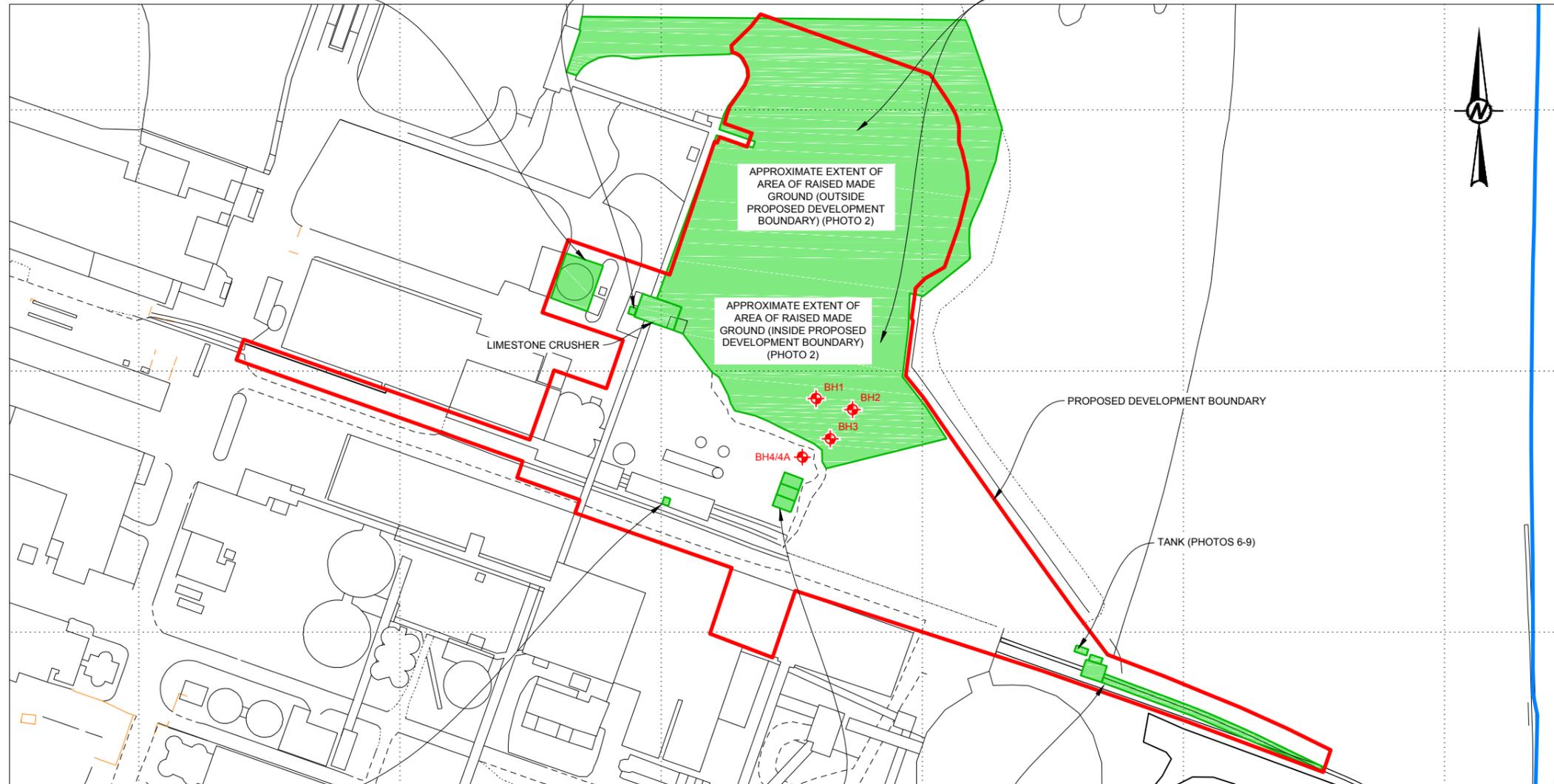


PHOTO 7: TANK



PHOTO 8: TANK



PHOTO 9: TANK



PHOTO 3: BOILER



PHOTO 4: WASTE SKIPS AND ASBESTOS

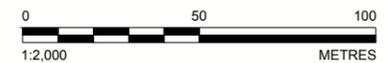


PHOTO 5: EXISTING RAILWAY LINE AND ASSOCIATED INFRASTRUCTURE

LEGEND

- PROPOSED DEVELOPMENT BOUNDARY
- OWNERSHIP BOUNDARY
- POTENTIAL CONTAMINATION SOURCES
- ◆ APPROXIMATE BOREHOLE LOCATIONS (SOIL MECHANICS, 2007a)

REFERENCE(S)
 BASED ON HANSON/HEIDELBERG CEMENT GROUP DRAWING No P103/48 SITE CONTEXT PLAN, DATED MARCH 2017.



CLIENT

PROJECT
**PADESWOOD CEMENT WORKS
 PADESWOOD CEMENT MILL 5 - PHASE 1 CONTAMINATED
 LAND ASSESSMENT**

TITLE
POTENTIAL SOURCES OF CONTAMINATION

CONSULTANT

	YYYY-MM-DD	2017-03-20
	DESIGNED	TF
	PREPARED	ECS
	REVIEWED	PW
	APPROVED	PW

PROJECT NO. 1773079.504 CONTROL 0501-CL-0003 REV. A DRAWING 3

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APPENDIX A

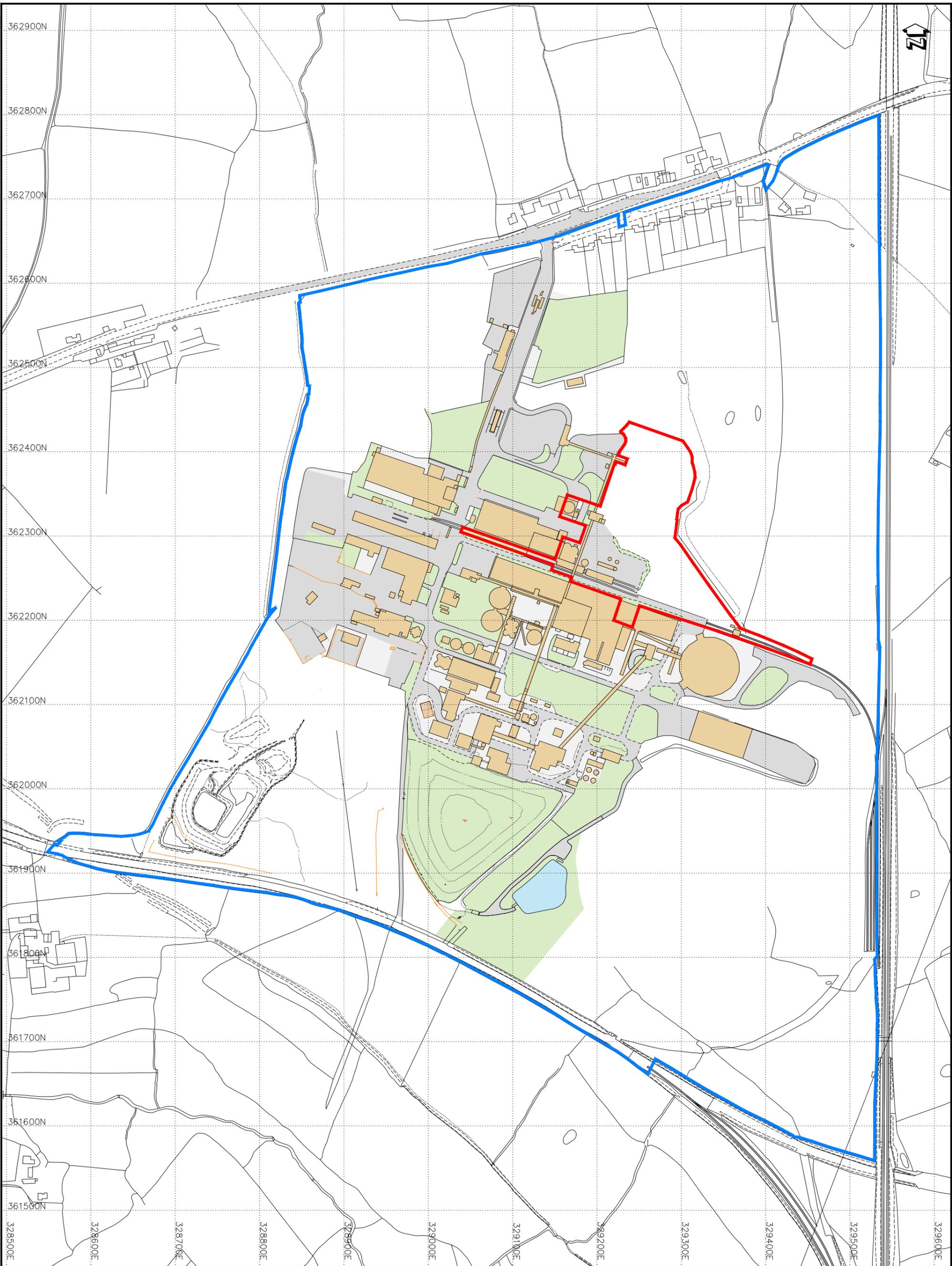
Envirocheck Landmark Report



APPENDIX B

Site Context Plans

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12

Legend

- Land Under the Control of the Applicant
- Planning Application Area



Site PADESWOOD - PLAN 2				
Title SITE CONTEXT PLAN				
Scale 1:4000	Paper Size A3	Drawn by AG	Drawing No. P103/48	Revision A
Date MAY 2017	Check by AB			

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