



## **North Wales Prison, Wrexham**

### **North Wales Prison**

Remediation Strategy and  
Method Statement, Areas 2 & 3  
(Outline Planning Permission Ref:  
P/2013/0671)

Report for



**October 2014**

Hydrock Ref: R/14656/003



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**Issued by:** Hydrock Consultants Limited  
4 Lakeside  
Festival Park  
Stoke-on-Trent  
ST1 5RY

Tel: 01782 261919  
Fax: 01782 262020  
www.hydrock.com

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| Prepared      |   | Terry Wraxton BSc FGS                         |  |
| Checked       |   | Eric Cooper SiLC, CGeol, FGS, MSc, BSc (Hons) |  |
| Approved      |   | Dr Scott Elliott                              |  |

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## **1.0 INTRODUCTION**

### **1.1 Terms of Reference**

Lend Lease has commissioned Hydrock Consultants Limited (Hydrock), to prepare a Remediation Strategy and Method Statement (RMS) for the proposed North Wales Prison in Wrexham (the 'site') off Bridge Road South, Wrexham Industrial Estate, Wrexham.

A site location plan (Drawing 14656/D001), a site survey plan (14656/D002) and a proposed development layout (14656/D003) are presented in Appendix A.

In total, the development site covers approximately 26.7ha and currently comprises an area of open, derelict land, which until August 2014 was covered partly in dense vegetation, although this has now been removed.

It is proposed to build a prison at the site, with the main prison buildings occupying the central and eastern parts of the site; car parking areas and auxiliary buildings in the northwest; and a large, rectangular area of ground in the southwest (the Expansion Zone) which will be walled and included in the grounds of the main prison building. Also included in the development scheme is a relatively small, landscaped area in the western corner of the site.

For the purposes of this assessment the site has been considered as three distinct areas:

- Car parking area in the northwest of the site and expansion zone in southwest of the site (combined) – Area 1
- Main prison building - Area 2
- Landscaped area in west of the site – Area 3

This division of the site into two separate areas is an operational expediency based on an assumption prior to the Hydrock 2014 investigations that Area 1 carried a lower risk of encountering asbestos in soils compared to Areas 2 and 3. The demarcation is shown on Drawing 14656/D006 at Appendix A.

It may be noted that the same division applied to Hydrock Reports R/14656/003 and R/14656/005 which are Remediation Method Statements for Area 1, and the combined Areas 2 and 3, respectively.

These areas are to be subjected to varying degrees of cut-to-fill in order to achieve the required finished ground levels to allow the development to take place. For further details, please refer to the drawings provided in Appendix A.

This RMS relates to Areas 2 and 3. The RMS relating to Area 1 has been issued previously as Hydrock report R.14656/003, dated 1<sup>st</sup> October 2014.

This RMS for Areas 2 and 3 also takes into account the findings of a site investigation and risk assessment for asbestos in soils across the whole of the site, the findings of which are presented in Hydrock Report R.14656/006 dated 15 October 2014.



Outline Planning Permission ref P/2013/0671 for the Prison has been issued by Wrexham County Borough Council (WCBC). Contaminated land matters are covered by Condition 9, as follows:

*The reserved matters application shall include a scheme to deal with potential contamination at the site. This scheme shall include a phased investigation approach to identify the extent of contamination and any measures required to remediate the site, including post-development monitoring.*

It was subsequently agreed with WCBC that this Condition could be discharged in a phased way, with a submission for Area 1 being issued for approval separate to a second submission relating to the remaining areas of the site (i.e. Areas 2 and 3). From previous communications with WCBC, the rationale of this RMS has been agreed.

## **1.2 Objectives**

The objective of this RMS is to present remedial goals and outline how the remediation of the site will be undertaken and validated. In addition, the RMS explains how the works will be permitted under current regulatory regimes.

The remediation will ensure that upon completion of the Prison development, the site soil conditions are appropriate for its intended use and that it will not pose an unacceptable contamination risk to identified receptors.

This document therefore covers the protective measures to be installed during the enablement and construction phases of the redevelopment.

A separate assessment of ground gas issues will be prepared by Hydrock and issued to the Council for review.

It is understood that there may be small areas of Area 2 where soft landscaping may be present, including prison gardens for the growing of fruit and vegetables. In addition, although the end use of Area 3 is currently anticipated to be public open space, this area may eventually also be used as a prison garden for the growing of fruit and vegetables.

Therefore, when assessing the significance of the chemical soil testing results acquired during the ESI (2012), WYG (2013) and Hydrock (August - September 2014) investigations, both Area 2 and Area 3 have been assessed as a commercial end use, a public open space end use, and a residential with plant uptake end use to take into account any uncertainties in the final uses of the various parts of the site. For further details of the risk assessment undertaken in respect of Areas 2 and 3 please refer to Section 3.0.

Updates to this RMS can be issued for agreement with the relevant regulatory bodies at any stage during development, dependent on the conditions encountered.

This document should be read and the recommendations implemented with reference to finally agreed site levels and the cut and fill operations required to create them.



This version constitutes R14656/005 Version 1. Please contact Hydrock Consultants if you are unsure of the current issue.

### **1.3 Scope**

The scope of work for this commission comprises:

- summary of the conceptual model;
- summary of the results of risk assessment undertaken at the site;
- a remediation options assessment; and
- requirements for remediation works.

### **1.4 General Comment**

Site investigation has shown that the principal contamination risk relevant to Areas 2 and 3 is asbestos in soils. Conditions in this respect are evaluated in detail in Hydrock Report R/14656/006: Risk Assessment of Asbestos in Soils, which contains the findings of a site investigation focussed on asbestos in soils at the site. It may be noted that whilst this report covered the whole of the development site, previous investigations (WYG 2014) had indicated that it was in Areas 2 and 3 that asbestos was most likely to be found.

The general outcome of these investigations was that relatively low levels of asbestos are present (range 0.01% w/w -0.001% w/w) with little or no gross contamination being present. On that basis, some of the recommendations contained in this Hydrock RMS may appear over-precautionary.

However it is the nature of asbestos in soils to be sporadic, and consequently neither the occurrence of higher w/w concentrations nor the unexpected occurrence of gross quantities of asbestos can be discounted entirely, and a precautionary approach is therefore justified.

The intention is that all reasonably foreseeable eventualities are covered by the content of this RMS.



## 1.5 Provided Information

This RMS provides further information regarding proposed soil remediation works at the site and is based on:

- Travers Morgan Ltd: “Firestone Development Site, Wrexham”, reference 1W35245/contam, dated 31st May 1994.
- Various correspondence from Travers Morgan (and later Symonds Travers Morgan) to the Welsh Development Agency, including report summaries and recommendations for remediation.
- ESI Ltd: “Preliminary Risk Assessment, Former Firestone Site, Wrexham Industrial Estate”, reference 60895R1, dated December 2012.
- ESI Ltd: “Phase 2 Contaminated Land Investigation, Former Firestone Site, Wrexham Industrial Estate”, reference 60895R2, dated December 2012.
- WYG Environment: “New Prison North Wales, Ground Investigation Factual Report”, Version 3, reference A083839, dated 14th January 2014.
- Hydrock: “North Wales Prison, Wrexham, Land Quality Statement: Area 1”, version2, reference R/14656/002, dated 24th September 2014.
- Hydrock: “North Wales Prison, Wrexham, Land Quality Statement: Areas 2 and 3”, reference R/14656/004, dated 8th October 2014.

These reports should be read in conjunction with this RMS, along with the previous reports referred to in the Ground Investigation Reports detailed above.

## 1.6 Limitations

Hydrock has prepared the report based on available information obtained during the project period. Although every reasonable effort has been made to gather all relevant information, all potential environmental constraints or liabilities associated with the site may not have been revealed.

The report has been prepared for the exclusive benefit of Lend Lease and those parties designated by them for the purpose of providing information on the remediation and validation works to be undertaken during the enablement and construction phase of the development. The report contents should only be used in that context. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Hydrock has used reasonable skill, care and diligence in the design of the remediation of the site. The inherent variation of ground conditions allows only definition of the actual conditions at the locations and depths of trial pits and boreholes at the time of the investigation. At intermediate locations, conditions can only be inferred. Information provided by third parties has been used in good faith and is taken at face value. However, Hydrock cannot guarantee its accuracy or completeness.



The work has been carried out in general accordance with recognised best practice as detailed in guidance documents such as in the CLR 11 Model Procedures (Environment Agency 2004), BS5930:1999 and BS10175:2011.



## 2.0 CONCEPTUAL MODEL

Detailed below is a summary of the principal conceptual characteristics of the site. The summary covers the whole of the development area, apart from land to the southwest and southeast of the prison boundaries designated as a nature reserve. Features specifically relevant to Areas 2 and 3 are highlighted in the text. Please refer to the previous Hydrock Ground Investigation Reports, referred to in Section 1.4 for further details.

### 2.1 Site Referencing

The site is referenced in Table 2.1.

**Table 2.1: Site Referencing Information**

| Item                             | Brief Description                                                                                                                                                                                        |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site name                        | North Wales Prison Site, Wrexham.                                                                                                                                                                        |
| Site location and grid reference | To the south of Bridge Road South, Wrexham Industrial Estate, Wrexham, Flintshire. The nearest postcode is LL13 3QA, and the approximate National Grid Reference of the site centre is 337900E, 349040N. |

A site location plan is provided in Appendix A (Drawing 14656-D001).

A general description of the site conditions is summarised in Table 2.2, from investigations during August 2014.

**Table 2.2: Site Description**

| Item                       | Brief Description                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Site access                | The primary access into the site is directly from Bridge Road South via locked steel double gates located on the northwest site boundary. Additional access is available from an unnamed service road serving Spectrum Business Park via locked steel double gates located in the southeastern site boundary.                                                                                                          |
| Land area                  | The proposed development area extends to approximately 26.7 ha.                                                                                                                                                                                                                                                                                                                                                        |
| Elevation, topography etc. | The development site is approximately rectangular in plan, with the long axis trending northeast-southwest. It is largely flat across the majority of its area, although ground levels in the southwestern half of the site rise gently towards the southwest and south.                                                                                                                                               |
| Site boundaries            | The site boundaries are currently formed by steel palisade fencing on the northwestern, northeastern and most of the southeastern sides; by fencing and industrial units on the southwestern side; and by steel palisade fencing and open land on the southeastern side, with the River Clywedog approximately 200m to the south.                                                                                      |
| Geomorphic features        | There are no notable geomorphic features at the site, other than a drain / stream that runs approximately north-south through the eastern part of the site.                                                                                                                                                                                                                                                            |
| Present land use           | The site represents brownfield land formerly occupied by a tyre factory and a Royal Ordnance Factory associated with the manufacture and storage of explosives. All surface structures and the vast majority of subsurface structures were removed following the closure and demolition of the facilities, and ground levels across the site were regraded to create the present day, essentially flat ground profile. |



| Item             | Brief Description                                                                                                                                                                                                                                                                                                                                                                 |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vegetation       | Until recently (August 2014) the site was in large part covered in dense vegetation, although this has now been removed to allow the various stages of ground investigation etc. to be undertaken.                                                                                                                                                                                |
| Surrounding land | The site is located on the southern edge of Wrexham Industrial Estate. The development area is bound to the southwest, northeast and east by industrial units. To the southeast is open land leading down to the River Clywedog; this area is to remain undeveloped and will be retained as a nature reserve. A housing estate and industrial units are located to the northwest. |

## 2.2 Site History

Hydrock have acquired and reviewed historical maps for the site, and the key points are summarised in Table 2.3 below.

**Table 2.3: Site Description**

| Map Edition and Scale                   | Key Points                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1872 (1:10,560) & 1872-73 (1:2,500)     | The site is shown to be predominantly composed of a number of open fields with ponds of various size scattered throughout. A road runs northeast to southwest through the eastern half of the site, and a chapel, a farmhouse and associated farm buildings run in a line along the southern side of the road. In the southern part of the site, a spur runs off the road towards the southeast.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 1898 (1:10,560) & 1899 (1:2,500)        | The buildings on the southern side of the internal road are indicated to include a smithy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 1909 & 1938 (1:10,560) & 1912 (1:2,500) | No significant change.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 1949 (1:10,560)                         | <p>All previous structures and roads on-site have been removed, and the site is now occupied by a large number of small (mostly c. 8m x 14m or smaller), widely separated buildings connected by a network of roads and served by numerous water hydrants. Three larger (c. 7m x 40m) buildings are located along the northeastern site boundary, each of which is bound on its northwestern, southwestern and southeastern sides by large bunds, presumably for blast protection, and another larger building (c. 8m x 30m) is located in the eastern corner of the site. The internal roads extend off-site and connect up to similar buildings, which are located throughout the general area surrounding the site.</p> <p>It is known from other sources (see below*) that the structures occupying the site and the surrounding areas were part of a Royal Ordnance Factory (ROF) site that was established during the Second World War to manufacture and store explosives for munitions. However, the relatively small size of the majority of the buildings would suggest they were used for materials storage rather than any manufacturing processes. At this time (1949) at least part of this area, presumably including the site itself, was marked Wrexham Trading Estate, suggesting that the ROF facility had closed following the end of hostilities and the various buildings were now used for other purpose.</p> |
| 1960-64 (1:10,560) & 1959-60 (1:2,500)  | No significant change.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



| Map Edition and Scale                                                                                                                                                                                                                                                                                                                                                                                                                                            | Key Points                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1976 & 1977-82 (1:2,500) & 1977-82 (1:10,000)                                                                                                                                                                                                                                                                                                                                                                                                                    | All but two of the structures formerly occupying the northwestern half of the site have been removed, and this area is now occupied by a large, elongate factory building (i.e. the Firestone Tyre Factory) surrounded by areas of open land, presumably representing roadways and areas of hardstanding for car and lorry parking, and possibly materials storage.<br>The southeastern half of the site remains unchanged. |
| 1983-89 (1:2,500)                                                                                                                                                                                                                                                                                                                                                                                                                                                | No significant change.                                                                                                                                                                                                                                                                                                                                                                                                      |
| 1990-93 (1:2,500) & 1992 (1:10,000)                                                                                                                                                                                                                                                                                                                                                                                                                              | All of the former ROF structures, including the two relict buildings formerly located adjacent to the southeastern side of the tyre factory building, have gone, with the southeastern half of the site now shown to be open land. A large, rectangular building is now shown adjacent and parallel to the southeastern side of the main factory building in the northwest of the site.                                     |
| 1994 (1:2,500)                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The site has been cleared of all structures to leave open land.                                                                                                                                                                                                                                                                                                                                                             |
| 2002-2014 (1:10,000)                                                                                                                                                                                                                                                                                                                                                                                                                                             | The site is shown to be open land, with a drain running approximately north-south through the eastern part of the site, as today.                                                                                                                                                                                                                                                                                           |
| <p>* <a href="http://www.coflein.gov.uk/en/site/308980/details/MARCHWIEL+ROYAL+ORDNANCE+FACTORY,+WREXHAM/">http://www.coflein.gov.uk/en/site/308980/details/MARCHWIEL+ROYAL+ORDNANCE+FACTORY,+WREXHAM/</a><br/> <a href="http://en.wikipedia.org/wiki/Wrexham_Industrial_Estate">http://en.wikipedia.org/wiki/Wrexham_Industrial_Estate</a><br/> <a href="http://www.theviewfromthenorth.org/rof-wrexham">http://www.theviewfromthenorth.org/rof-wrexham</a></p> |                                                                                                                                                                                                                                                                                                                                                                                                                             |

## 2.3 Unexploded Ordnance/Bombs

Due to the site's known past use as a Royal Ordnance Factory, qualified Explosive Ordnance Disposal Engineers were present throughout the excavation of the WYG trial pits and boreholes. In addition, selected soil samples recovered during both the ESI 2012 and WYG 2013 investigations were submitted for chemical testing to determine the presence of explosive substances and their constituent compounds, such as picric acid, nitroglycerine and 2,4,6-trinitrotoluene (TNT).

During the WYG investigation no traces of potential explosives were found within the excavations, and no explosives residues were detected in any of the ESI and WYG soil samples tested. As a consequence, it is considered that the risks from UXO at the site are low. However, Hydrock recommend that a UXO induction briefing is undertaken for Contractors undertaking groundworks.

## 2.4 Geology and Hydrogeology

The general geology of the site area is shown on the 1:50,000 geological map of Wrexham (Sheet 121) and is summarised in Table 2.4.

**Table 2.4: Geology**

| Stratigraphic Name | Age                              | Description                                                                                                                                                     |
|--------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Glacial Till       | Devensian                        | Typically clay and silt with variable amounts of sand, gravel and cobbles, and occasionally boulders, with common discontinuous lenses of sand and / or gravel. |
| Salop Formation    | Westphalian D (Cisuralian Epoch) | Red and red-brown mudstone and sandstone containing beds of pebbly sandstone and conglomerate. Thin limestone beds and                                          |



| Stratigraphic Name | Age | Description                            |
|--------------------|-----|----------------------------------------|
|                    |     | caliche in the lower part of the unit. |

Given the known site history, a variable thickness of Made Ground would be expected beneath most, if not all, of the site.

The Made Ground and Glacial Till are unproductive Strata. The Salop Formation is a Secondary Aquifer.

The vast majority of the development site lies outside of any groundwater Source Protection Zones (SPZ). However, the whole of the southeastern edge of the development site lies within a SPZ III (total catchment) and SPZ II (Outer Catchment).

There is a single active groundwater abstraction in the vicinity of the site. This licence, Ref. WA/067/0007/006, is a modified version of an earlier licence and became active on 1/04/2012. It allows the abstraction of up to 131,400m<sup>3</sup> / annum or 600m<sup>3</sup> / day of groundwater from a 144m deep borehole located at the industrial unit immediately adjacent to the eastern corner of the site. The licence is due to expire on 31/03/2022.

## 2.5 Hydrology and Flooding

The surface water features in the vicinity of the site are listed in Table 2.5 and, where appropriate, are marked on the Site Zonation Plan in Appendix A.

**Table 2.5: Surface Water Features**

| Feature                        | Location Relative to the Development Site                                  |
|--------------------------------|----------------------------------------------------------------------------|
| Drain                          | On-site, running from north to south through the eastern part of the site. |
| River Clywedog (Primary River) | Approximately 200m to the southeast.                                       |
| Various drains                 | Located throughout the general area.                                       |

There are no licensed surface water abstractions within 1km of the site.

The site is in Flood Zone 1, with low probability of flooding. A Flood Zone 2 is located approximately 125m to the southeast of the development site, associated with the River Clywedog. No further consideration of flood risk is undertaken in this report. Specialist flood risk advice should be sought with regards to drainage and flooding.

## 2.6 Previous Site Investigations

A number of ground investigations have been undertaken at the site and are reviewed below.

### 2.6.1 Travers Morgan Report, May 1994

In May 1994 Travers Morgan issued a site investigation report (Ref. 1W35245/contam) which described two phases of ground investigation at the site undertaken by, or on behalf of, Travers Morgan, as well as an earlier investigation undertaken in 1992 by Subsoil Surveys on behalf of JR Grimley Eve. Hydrock reviewed these reports and consider the data not to be



commensurate with current risk assessment standards. For further details, please refer to the Hydrock Land Quality Statement for Area 1 (Ref: R/14656/002, 24<sup>th</sup> September 2014) and the Land Quality Statement for Areas 2 and 3 (Ref: R/14656/004, 8<sup>th</sup> October 2014).

## **2.6.2 ESI Phase 2 Contaminated Land Investigation Report 2012**

The ESI ground investigation took place in October 2012, and involved the excavation of a total of 38 trial pits (as shown on Drawing 14656/D004, presented at Appendix A of this report). Of these, 12 were located within the development footprint of the prison (Area 2) and 4 were located in Area 3.

Laboratory chemical testing was undertaken on a total of 33 soil samples recovered during the investigation, of which 5 were taken from Area 2, and one of which was taken from Area 3.

A further 5 soil samples were tested for the presence of explosive residues, including nitroglycerine, nitrocellulose and picrate. One of these samples was taken from trial pit ESI-TP01, excavated in the eastern corner of Area 2.

Testing was also on groundwater samples recovered from 4 of the pits, although none of these were located within the development footprint of the prison.

The key findings of the ESI investigation are summarised below.

## **2.6.3 Ground Conditions – Area 2**

### ***Made Ground***

The ESI investigation recorded Made Ground at all locations in Area 2, to depths of between 0.25m and 3.0m below ground level (bgl).

The Made Ground described fell into two broad classes:

- The majority of the Made Ground comprised demolition rubble, typically represented by varying amounts of gravel, cobbles and boulders of brick (including sections of brick walls) and concrete (including concrete slabs) in a matrix of ash and sand, occasionally clayey or very clayey, and locally also including asphalt, plaster, metal pipes, plastic, charcoal and rock; and
- The remainder of the Made Ground comprised sandy clay with generally small amounts of brick gravel or cobbles, and locally also including fragments of concrete, tile, asphalt, plaster and charcoal.

The thickness of the Made Ground, where proven, ranged from 0.25m to 3.0m, however at 3 locations (ESI-TP04, ESI-TP20 and ESI-TP38) the Made Ground was still present when the trial pits were terminated at depths of between 1.0m and 1.2m bgl, and consequently the true thickness of the Made Ground at these locations is not known.



### ***Alluvium***

Material interpreted by ESI as representing Alluvium was recorded directly below the Made Ground at 5 locations in Area 2 (ESI-TP03, ESI-TP15, ESI-TP24, ESI-TP27 and ESI-TP37) .

The Alluvium was described as typically comprising very soft to stiff, locally very sandy, clays or silts of various colours. Where present, the top of the Alluvium was recorded beneath the Made Ground at depths of between 0.25m and 1.3m bgl, and locally extended down to depths in excess of 1.4m bgl.

### ***Glacial Till***

The Glacial Till was encountered at the 4 locations where the Made Ground and / or Alluvium was fully penetrated, and typically comprised firm to stiff red-brown clay with occasional gravel and cobbles. Depths to the top of the Glacial Till in Area 2 ranged from 0.35m to 0.9m bgl.

## **2.6.4 Ground Conditions – Area 3**

### ***Made Ground***

The ESI investigation recorded Made Ground at 2 of the 4 exploratory hole locations in Area 3, to depths of between 0.2m and 0.3m bgl. At ESI-TP07 the Made Ground comprised soft, red-brown, sandy clay with occasional gravel of brick, tile and concrete. At ESI-TP10 the Made Ground was represented by firm, red-brown, sandy clay with pockets of dark grey and black ash.

### ***Glacial Till***

The Glacial Till was encountered at all 4 locations, being present from surface at 2 of the locations (ESI-TP08 and ESI-TP09). The Glacial Till was described as stiff, locally sandy and / or gravelly, red clay.

## **2.6.5 Contamination Testing – Areas 2 and 3**

The results of the chemical soil testing carried out by ESI can be summarised as follows:

- Low concentrations of metals were recorded in the Made Ground;
- Low concentrations of more environmentally persistent petroleum hydrocarbons were observed locally;
- Low concentrations of various PAH compounds were detected in approximately 33% of the samples tested;
- All other volatile organic compounds and semi-volatile organic compounds (VOCs and SVOCs) were less than their relevant laboratory limits of detection;
- All explosive compounds tested for were less than their relevant laboratory limits of detection; and
- No asbestos fibres were detected in any of the soil samples tested.



Given the significant thickness (c.40m) of low permeability clays underlying the site, the ESI report concluded that the low concentrations of some contaminants recorded in the shallow groundwater are unlikely to pose a risk to controlled waters.

Further assessment of the chemical soil testing results from the ESI investigation is undertaken in Section 3.0 of this report.

#### **2.6.6 WYG Investigation 2013**

The WYG investigation took place in November 2013 and the data acquired was presented in a Factual Report dated 14<sup>th</sup> January 2014. The WYG investigation included the following:

- The mechanical excavation of 18 trial pits, with in situ plate bearing and CBR testing at 6 of the trial pit locations;
- The mechanical excavation of a further 12 trial pits;
- The drilling of 19 boreholes with in situ geotechnical testing and 50mm diameter gas and groundwater monitoring standpipes in each borehole;
- The hand-excavation of 4 shallow pits;
- Laboratory soil and groundwater testing; and
- Gas and groundwater level monitoring.

A total of 24 of the WYG exploratory holes were located within Area 2, with a further 2 (WYG-TP10 and WYG-BH01) being located in Area 3.

The findings of the WYG investigation are summarised in the following sections.

#### **2.6.7 Ground Conditions – Area 2**

##### ***Made Ground***

Made Ground was recorded at surface at all locations in Area 2.

The Made Ground predominantly comprised clay with varying amounts of sand and gravel, and locally also included cobbles and boulders. The sand locally included ash. Gravel and cobble components were predominantly brick, concrete, sandstone and mudstone, but locally also included metal, plastic, ceramic, clinker, limestone and coal. The boulders included concrete, sandstone and mudstone.

At 4 locations (WYG-BH9, WYG-BH10, WYG-BH10A and WYG-BH17) the Made Ground was represented by gravelly sand or sandy gravel with varying amounts of cobbles. The gravel component predominantly comprised brick, concrete, sandstone and mudstone, and locally also included plastic, metal, limestone and coal.

Where the base of the Made Ground was proven it was found to range in thickness from 0.2m to 2.2m. However, at one location, WYG-BH10, the borehole was terminated within the Made Ground at a depth of 4.6m bgl.



### ***Glacial Till***

The Glacial Till was recorded at all locations in Area 2 where the Made Ground was fully penetrated, at depths ranging from 0.3m to 2.2m bgl, although, as discussed above, in the area around WYG-BH10 it would be present at a depth in excess of 4.6m bgl.

The Glacial Till was indicated on the WYG logs to generally comprise firm to stiff, silty clay with varying amounts of gravel and localised lenses of clayey gravel or clayey sand.

### ***Groundwater***

Perched water was frequently encountered within the shallow Made Ground across the development site. Groundwater was generally absent, but where it was encountered within the Glacial Till the strikes were recorded at depths of between 2.3m and 13.0m bgl.

## **2.6.8 Ground Conditions – Area 3**

### ***Made Ground***

Made Ground was recorded at surface at both WYG exploratory hole locations in Area 3.

At WYG-BH01 the Made Ground comprised slightly sand silty clay with gravel and cobbles of brick, concrete, sandstone, mudstone, ceramic and wood to a depth of 2.3m bgl.

At WYG-TP10 the Made Ground was present to 0.9m depth and comprised slightly sandy silty clay with gravel of brick, concrete, sandstone, mudstone, quartzite, plastic and wood, and cobbles of brick.

### ***Glacial Till***

The Glacial Till was recorded immediately beneath the Made Ground at both locations in Area 3, and comprised firm to stiff, slightly sandy, slightly gravelly, silty clay.

### ***Groundwater***

Perched water was encountered within the shallow Made Ground at depths of between 0.4m and 0.5m bgl.

## **2.6.9 Chemical Testing Results**

The chemical testing results obtained by WYG during their 2013 site investigation and that are relevant to Areas 2 and 3 are assessed in Section 3.0.

## **2.6.10 Asbestos**

Asbestos containing materials or loose asbestos fibres were recorded in a number of the soil samples recovered from Areas 2 and 3, as summarised in Table 2.6. The locations are shown on Drawing 14656/D004 in **Error! Reference source not found..**



**Table 2.6: Asbestos, WYG 2013 Investigation**

| Location  | Depth (m bgl) | Asbestos Results    | Level        |
|-----------|---------------|---------------------|--------------|
| WYG BH9   | 0.5           | Amosite, chrysotile | Quantifiable |
|           | 1.0           | Amosite, chrysotile | Quantifiable |
| WYG BH17  | 0.2           | Chrysotile          | Trace        |
| WYG BH10  | 1.0           | Chrysotile          | Quantifiable |
| WYG BH10A | 0.5           | Chrysotile          | Quantifiable |
|           | 1.0           | Amosite, chrysotile | Quantifiable |
| WYG BH12  | 0.5           | Chrysotile          | Trace        |
| WYG TP17  | 0.5           | Chrysotile          | Quantifiable |
|           | 1.0           | Chrysotile          | Trace        |
| WYG BH13  | 0.5           | Chrysotile          | Quantifiable |
| WYG BH14  | 1.0           | Chrysotile          | Quantifiable |
| WYG BH19  | 0.3           | Chrysotile          | Quantifiable |
| WYG HDP1  | 0.5           | Chrysotile          | Quantifiable |
| WYG HDP3  | 0.5           | Chrysotile          | Quantifiable |
| WYG HDP4  | 0.5           | Chrysotile          | Quantifiable |

### ***Chemical Testing Results***

The chemical testing results obtained by WYG during their 2013 site investigation and that are relevant to Areas 2 and 3 are assessed in Hydrock Report R/14656/004.

## **2.7 Hydrock Ground Investigations 2014**

### **2.7.1 Introduction**

A preliminary ground investigation was undertaken by Hydrock across the development area during August 2014. The preliminary investigation comprised the mechanical excavation of 30 trial pits, 24 of which were located in Area 2, and the drilling of 15 cable percussive boreholes, all of which were located in Area 2, with gas and groundwater monitoring standpipes in 10 of the boreholes, as shown on Drawing 14656/D004. It may be noted that as the locations of the August 2014 Hydrock exploratory holes were instructed by Tarmac Property Services (TPS) these exploratory holes have been prefixed "TPS".

Shortly after the completion of the August 2014 a second phase of investigation was undertaken. The elements of those works relevant to the current assessment (i.e. relevant to the ground conditions in Areas 2 and 3) included:



- The excavation of 136 shallow trial pits, under the direct supervision of a third party specialist asbestos surveyor (REC Ltd) qualified to P402, specifically targeting areas previously identified as being affected by asbestos (marked as Zone 1, 2 and 3 on Drawing 14656/D007);
- The excavation of 16 trial pits, primarily for the purposes of geotechnical investigation, 3 of which were located within Area 3.

It may be noted that the focus of the REC trial pit investigation was sampling for asbestos in the Made Ground in a previously investigated area. Consequently the records of the ground conditions encountered are limited in geological detail. Therefore, the following discussion uses only ground conditions data acquired directly by ESI, WYG and Hydrock.

### **2.7.2 Asbestos: Sampling Strategy**

At Zone 1, a grid composed of 24 cells measuring 50m x 50m was set out on the ground, with 5 trial pits being excavated in each cell; one trial pit in each corner and one trial pit in the centre (Drawing 14656/D007). Shallow soil samples were recovered from each of the five trial pits and combined, using coning and quartering, to provide a composite sample. The composite sample from each cell was then submitted for laboratory analysis to determine the presence or otherwise of asbestos fibres.

Wherever the composite sample was found to contain asbestos fibres, the samples from the 5 constituent samples were subjected to similar analysis.

The samples were referenced as follows:

- For each sample taken from a cell, the five samples were labelled according to the cell of origin (e.g. A3) followed by a letter denoting the location (E for east, N for north, C for centre etc.);
- The composite sample for a particular cell was suffixed with "6th"; for example, C26th was the composite sample taken from cell C2;

In each of Zone 2 and Zone 3 a single cell was set out, designed to include the areas where ACM was recorded during the WYG 2013 investigation. Four trial pits were excavated on each of the corners of the grid. For each sample taken from the cell, the four samples were labelled according to the zone number (e.g. Z3) followed by a letter denoting the location a, b, c and d.

In addition to this further trial pits were excavated in Zone 2 and Zone 3 to help strengthen the data set. These trial pits were designated A2a-d in Zone 2 and A3a-d in Zone 3.

In addition to the trial pits excavated by REC, a number of trial pits were also excavated by Hydrock to provide more data regarding the distribution of asbestos across Area 1 (i.e. the car parking area and the Expansion Zone) generally. To distinguish those trial pits from others previously excavated at the site by Hydrock, they contained the letters "ASB" in their names, e.g. HYD-ASB12, HYD-ASB13 etc.

Although these trial pits targeted Area 1 the results of the investigation are included here for completeness.



### 2.7.3 Ground Conditions – Area 2

The ground conditions recorded in Area 2 during the combined August and September Hydrock investigations are summarised below.

#### ***Made Ground***

Made Ground was recorded from surface at all locations across Area 2. Where the depth of the Made Ground was proven it was found to range in thickness from 0.1m to 2.6m. However, at 4 locations the trial pits were terminated within the Made Ground at depths of 0.3m bgl (TPS-TP20, after a buried concrete slab was encountered) and at depths of between 2.2m and 2.8m bgl following collapse of the trial pits at TPS-TP24, TPS-TP25 and TPS-TP30.

The Made Ground was found to comprise sandy clay, locally a very clayey sand, with varying amounts of gravel comprising brick, concrete and sandstone, and locally also including metal and wood, and occasional cobbles of brick and concrete.

#### ***Glacial Till***

The Glacial Till was recorded at all locations where the Made Ground was fully penetrated, and comprised firm to very stiff, silty clay with pockets of siltstone. Where encountered, the top of the Glacial Till was intercepted at depths of between 0.1m and 2.6m bgl.

### 2.7.4 Ground Conditions – Area 3

The ground conditions recorded in Area 3 during the combined August and September Hydrock investigations are summarised below.

#### ***Made Ground***

Made Ground was recorded from surface at all four locations in Area 3. Where the depth of the Made Ground was proven it was found to range in thickness from 0.4m to 1.9m. Trial pit HYD-TP11 was terminated within the Made Ground at a depth of 1.8m bgl.

The Made Ground was generally found to comprise slightly sandy or sandy clay with varying amounts of gravel and cobbles including brick, concrete and quartzite. However, at HYD-TP11 a layer of brown, clayey sand with gravel of brick, concrete and quartzite was recorded from 0.6m to 1.8m bgl.

#### ***Glacial Till***

The Glacial Till was recorded at all locations where the Made Ground was fully penetrated, and comprised very stiff, silty clay with pockets of siltstone. Where encountered, the top of the Glacial Till was intercepted at depths of between 0.1m and 2.6m bgl.

#### ***Groundwater***

No groundwater was encountered during the excavation of the exploratory holes, although perched water was recorded within the Made Ground at HYD-TP11 at a depth of 1.7m bgl.



## 2.7.5 Asbestos

During the site-wide August 2014 Hydrock investigation a number of the soil samples tested were found to contain asbestos containing materials or loose asbestos fibres. A sample recovered from TPS TP29, located in the area of the proposed car park in the northwest of the site (i.e. in Area 1) did not show visual evidence of asbestos fibres but subsequent testing proved it to contain 0.002 % w/w asbestos (initially identified as chrysotile but subsequently identified by a specialist laboratory as being amosite).

Further investigations were undertaken by Hydrock in September 2014 to acquire more data on the distribution of ACM in Area 1, and also to delineate the areas affected by ACM identified by WYG during their 2013 investigation.

The occurrence of asbestos (as confirmed by later laboratory testing) recorded during the Hydrock August and September 2014 investigations is summarised in Table 2.7.

**Table 2.7: Asbestos, Hydrock 2014 Investigations**

| Location   | Area | Depth (m bgl) | Asbestos Results    | Level               |
|------------|------|---------------|---------------------|---------------------|
| TPS-TP29   | 1    | 0.3           | Amosite             | 0.002%              |
| HYD-ASB01  |      | 0.1           | Chrysotile, amosite | 0.014%              |
| HYD-ASB09  |      | 1.0           | Chrysotile          | <0.001%             |
| HYD-ASB012 |      | 0.5           | Chrysotile          | <0.001%             |
| TPS-TP05   |      | 1.0           | Chrysotile          | Detected            |
| HYD-TP03   |      | 0.3           | Chrysotile          | Identification only |
| TPS-TP16   | 2    | 0.1           | Chrysotile          | Detected            |
| TPS-TP18   |      | 0.3           | Chrysotile, amosite | Detected            |
| TPS-TP19   |      | 0.3           | Chrysotile          | Detected            |
| TPS-TP22   |      | 0.2           | Chrysotile          | Detected            |
| TPS-TP24   |      | 0.4           | Chrysotile, amosite | <0.001%             |
| TPS-TP25   |      | 0.5           | Chrysotile, amosite | 0.002%              |
| TPS-TP30   |      | 0.3           | Chrysotile          | <0.001%             |
| D16th      |      | Not recorded  | Chrysotile          | <0.001%             |
| D26th      |      | Not recorded  | Chrysotile          | <0.001%             |
| C26th      |      | Not recorded  | Chrysotile          | 0.001%              |
| C56th      |      | Not recorded  | Chrysotile          | 0.002%              |
| B46th      |      | Not recorded  | Chrysotile          | 0.001%              |
| C46th      |      | Not recorded  | Chrysotile          | 0.001%              |
| HYD-A2a    |      | Not recorded  | Chrysotile          | 0.001%              |



| Location | Area | Depth (m bgl) | Asbestos Results | Level               |
|----------|------|---------------|------------------|---------------------|
| HYD-A2b  | 2    | Not recorded  | Chrysotile       | 0.01%               |
| HYD-Z2a  |      | Not recorded  | Amosite          | 0.001               |
| A36th    |      | Not recorded  | Amosite          | 0.002               |
| A16th    |      | Not recorded  | Amosite          | <0.001%             |
| A3S      |      | Not recorded  | Chrysotile       | <0.001%             |
| A3E      |      | Not recorded  | Chrysotile       | <0.001%             |
| D4E      |      | Not recorded  | Chrysotile       | Identification only |
| D5C      |      | Not recorded  | Chrysotile       | Identification only |
| D5S      |      | Not recorded  | Chrysotile       | Identification only |
| C5C      |      | Not recorded  | Chrysotile       | Identification only |
| HYD-A3a  |      | Not recorded  | Chrysotile       | <0.001%             |
| HYD-A3b  |      | Not recorded  | Amosite          | 0.01                |
| HYD-A3c  |      | Not recorded  | Amosite          | <0.001%             |
| A66th    |      | Not recorded  | Amosite          | <0.001%             |
| A56th    |      | Not recorded  | Amosite          | 0.001%              |
| HYD-Z3b  | 3    | Not recorded  | Chrysotile       | <0.001%             |
| HYD-Z3c  |      | Not recorded  | Chrysotile       | <0.001%             |
| HYD-Z3d  |      | Not recorded  | Chrysotile       | <0.001%             |

## 2.8 Summary of Ground Conditions Encountered

The various phases of ground investigation undertaken across the development area by ESI (2012), WYG (2013) and Hydrock (August 2014 and ongoing) has recorded Made Ground across almost all the prison footprint. The thickness of the Made Ground was variable, with deeper Made Ground (>4.6m bgl) being recorded in the northeastern part of the site formerly occupied by the factory building.

The Made Ground typically comprised sandy clay with varying amounts of gravel and cobbles of brick, concrete, sandstone and mudstone. Locally, the Made Ground also included fragments of metal, plastic, timber, clinker, limestone, coal and ceramic, as well as boulders of concrete, sandstone and mudstone.

Natural soils encountered comprised Glacial Till, typically firm to stiff clay, which locally was overlain by Alluvium, typically sandy clay.



### **3.0 RISK ASSESSMENT REVIEW**

#### **3.1 Conceptual Model**

##### **3.1.1 Area 2**

The various phases of ground investigation undertaken across the study site by ESI (2012), WYG (2013) and Hydrock (August and September 2014) has recorded Made Ground across the whole of Area 2. Where the base of the Made Ground was proven it was found to range in thickness between 0.1m and 2.6m, however deeper Made Ground (in excess of 4.6m bgl) was recorded at WYG-BH10 in the northeastern part of the site formerly occupied by the factory building.

The Made Ground typically comprised sandy clay with varying amounts of gravel and cobbles of brick, concrete, sandstone and mudstone. Locally, the Made Ground also included fragments of metal, plastic, timber, clinker, limestone, coal and ceramic, as well as boulders of concrete, sandstone and mudstone. At some locations the Made Ground was represented by gravelly sand or sandy gravel with varying amounts of cobbles. The gravel at these locations component predominantly comprised brick, concrete, sandstone and mudstone, and locally also included plastic, metal, limestone and coal.

At 6 locations within Area 2 where the Made Ground was penetrated it was found to overlie Alluvium, typically comprising sandy clay. The top of the Alluvium was recorded at depths ranging from 0.25m to 1.3m bgl.

Glacial Till, comprising firm to very stiff silty clay with occasional gravel and pockets of siltstone, was intercepted at all locations where the base of the Made Ground and Alluvium was fully penetrated, with the depths to the top of the Till ranging between 0.3m and 3.0m bgl across Area 2.

Perched water was frequently encountered within the shallow Made Ground across Area 2. Groundwater was generally absent, but where it was encountered within the Glacial Till the strikes were recorded at depths of between 2.3m and 13.0m bgl.

##### **3.1.2 Area 3**

Made Ground was recorded from surface at 8 locations in Area 3 to depths of between 0.2m and 2.3m bgl, and typically comprised sandy clay with varying amounts of gravel and cobbles of brick, concrete, sandstone, mudstone, quartzite, plastic and wood.

At all locations the Made Ground lay directly on the Glacial Till.

#### **3.2 Preliminary Exposure Model**

The preliminary exposure model is used for geo-environmental hazard identification and establishing potential contaminant linkages in line with the Statutory Guidance to Part 2A of the Environmental Protection Act 1990, also known as 'potential pollution linkages' in the Model Procedures of CLR11 (Environment Agency, 2004). This is based on the contaminant-pathway-receptor linkage approach.



### **3.2.1 Potential Contaminants**

- Elevated concentrations of metals and polycyclic aromatic hydrocarbons (PAHs) in the shallow Made Ground;
- Asbestos containing materials and loose asbestos fibres in the shallow Made Ground;
- Possible elevated concentrations of metals within the natural soils.

Previous investigations have not identified significant petroleum hydrocarbon, SVOC or VOC contamination of the shallow soils at the site, and these contaminants are not considered further.

### **3.2.2 Potential Receptors**

- Humans (site end-users and users of neighbouring premises);
- Development end use (buildings, utilities and landscaping);
- Surface water: various ponds to the southeast of the site and the River Clywedog 200m to the southeast.

It is assumed that the on-site drain currently running through the east of the site will be removed as part of the development, and will therefore not constitute a viable receptor post-development.

Due to the significant thickness of low permeability clay underlying the site groundwater in the underlying Coal Measures strata is not considered to be at risk from the shallow soils beneath the site.

### **3.2.3 Potential Pathways**

- Humans: ingestion, skin contact, inhalation of dust and outdoor air;
- Humans; inhalation of indoor gases or vapours;
- Plant life: root uptake;
- Surface water: overland flow;
- Surface water: drainage discharge; and
- Buildings: direct contact with substances deleterious to building materials.

## **3.3 Chemical Soil Quality**

Area 2 is the main prison facility. The currently anticipated layout is shown on Drawing 14656/D003. It is a mix of buildings or other hardstanding, artificial sports pitches, and grassed areas. There is no area of cultivation planned but a contingency assumption has been made that such a facility might be incorporated into the development.

Therefore, when assessing the significance of the chemical soil testing results acquired during the ESI (2012), WYG (2013) and Hydrock (August 2014) investigations, both Area 2 and Area 3 have been assessed as a commercial end use, a public open space end use, and a residential with plant uptake end use to take into account any uncertainties in the final uses of the various parts of the site.



The results of the chemical testing undertaken on samples of soil recovered from the ESI, WYG and Hydrock exploratory holes located in Area 2 have been considered together and statistically analysed to determine the chemical quality of the Made Ground across this part of the site. Similarly, the results from the investigation works previously undertaken by ESI and WYG across Area 3 have also been assessed together.

The statistical analysis is presented in Appendix B and demonstrates that the shallow Made Ground in both Area 2 and Area 3 does not contain pervasive levels of any contaminant (i.e. the US<sub>95</sub> computations are all less than the GAC under any of the proposed end uses considered, and is therefore chemically suitable for its intended use. Therefore, there is no pervasive contamination risk that requires further evaluation.

However, the data set for residential with plant uptake and that for plant life includes some individual exceedences which are assessed individually below. The locations are shown on Drawing 14656/D008 in Appendix A in relation to the most sensitive end use (residential with plant uptake), with a bespoke evaluation of each. General assumptions are that:

- If the location is beneath a building (including exercise yards) and access roads then a commercial end use is applicable as this end use is fixed as part of the prison design;
- At any other location Residential with Plant Uptake is regarded as a possible alternative, no matter how low the likelihood.

As noted in respect of individual locations, the Made Ground in which the exceedences are located is frequently composed of broken brick and concrete and would not be suitable as a growing medium such that imported fertile topsoil will need to be imported. The prospect of such a requirement further reduces the risk, over and above the assessments provided below.

A specification for imported topsoil is provided in Section 6.5 of this report.

### **WYG TP20 and WYG HDP3**

These are both located in proposed grassed areas: although these locations are characterised by elevated levels of zinc (a phytotoxic metal) it may be noted that prior to the investigation taking place these areas had to be cleared of very dense vegetation, suggesting that the presence of the elevated levels of zinc was not impacting on the health of the plants there.

Furthermore, it is anticipated that the developer would import good quality topsoil into all areas of soft landscaping to produce a more suitable growing medium than the Made Ground currently underlying the site. Consequently, the presence of the elevated zinc concentrations in these areas is not considered significant with respect to plant health.

### **WYG BH09**

Roadway (Kitchen Deliveries): Commercial GAC applies; no reassessment required.

### **WYG BH10A and TPS TP22**

Sports Pitch (artificial surface): it is only if this area became the site of a horticultural development that there is a GAC exceedence issue, that being in respect of benzo(a)pyrene



(BaP). The recorded concentrations were 2.15 mg/kg and 2.3 mg/kg, compared with a GAC of 0.94 mg/kg for the most sensitive end use (residential with plant uptake).

Shallow ground conditions recorded at WYG BH10A was described as comprising sandy gravel and cobbles of brick and concrete with cobbles of brick and fragments of metal. Shallow ground conditions at TPS TP22 comprised very clayey sand with gravel and cobbles of brick, concrete, metal and timber.

These ground conditions would clearly be unsuitable as a growing medium, should the area proposed as a sports pitch ever be considered for horticultural use, and consequently the existing ground would need to be replaced with good quality topsoil, thus removing the source of the BaP contamination.

#### **WYG HDP4**

Exercise yard: Commercial GAC applies; no reassessment required.

#### **WYG BH13**

Prison building: Commercial GAC applies; no reassessment required.

### **3.4 Asbestos**

#### **3.4.1 Basis for Assessment**

Unlike chemical contaminants there are no GAC values to provide a straightforward assessment of the risk. CIRIA C733 (2014) provides guidance on the management of risk in soil and Made Ground which contains asbestos. The key issue is the propensity for asbestos in the ground to be released as fibres and (perhaps other than where gross asbestos contamination is found, such as bundles of lagging) properties such as the exposure of such soils to wind and dampness of the soil are the critical issues.

In assessing the risk and determining an appropriate remedial strategy, CIRIA 733 recommends:

- Overall compliance with CAR 2012;
- Identification and evaluation of all likely reasonably likely exposure routes;
- Development of an appropriate remediation strategy.

In the case of Area 2, the site investigation data indicate no gross accumulations of asbestos fibres (such as lagging) and that asbestos is restricted to a low level presence in Made Ground at the site.

The two main potential exposure routes are:

- Wind-blown dusts during earthworks; and
- Exposure of site end users of the development to soils containing asbestos.

Measures to mitigate the risk are described in Section 4.



It may be noted that whilst CIRIA 733 notes that an asbestos concentration threshold of 0.001% w/w as being an ICRL (1990) threshold value and not valid as a risk assessment tool, 0.001% w/w is the standard minimum gravimetric level of detection for asbestos. However, single fibres may be detected in samples containing <0.001 % w/w.

#### **3.4.2 Area 1**

Additional sampling and testing has shown that the risk of encountering asbestos in Area 1 is low, with measureable quantities of asbestos being present at two places only (TPS-TP29 and HYD-TP03) in a total area of 11.3ha.

#### **3.4.3 Area 2**

Additional ground investigation works in Zone 1 and Zone 2 have demonstrated that asbestos contamination in Area 2 is not widespread, with most soil samples tested being found to contain either no asbestos or concentrations below 0.001% w/w.

At WYGTP20 a suspected asbestos pipe was found but this was not confirmed by a subsequent GPR survey for services.

Areas where asbestos concentrations at or above 0.001% w/w were recorded are shown on Drawing 14656/D006 in Appendix A.

#### **3.4.4 Area 3**

One of the trial pits excavated by REC Ltd in Zone 3, HYD-A3b, was found to contain 0.01% w/w of amosite. This trial pit was excavated very close to WYG-BH01, where asbestos was previously identified by WYG in 2013. All other soil samples taken from Area 3 contained concentrations of asbestos at or below 0.001% w/w.

### **3.5 Conclusion**

The presence of asbestos in soils at concentrations greater than 0.001% w/w is considered to be a risk that requires mitigation and proposals to deal with this risk are presented in Section 5.



## **4.0 REMEDIATION OPTIONS APPRAISAL**

### **4.1 Introduction**

This Options Appraisal has been undertaken in general accordance with Chapter 3 (Options Appraisal) of CLR11 (Model Procedures for Management of Land Contamination), DEFRA, 2004. There are four main stages to this appraisal:

1. Identifying Key Risk Drivers.
2. Identifying feasible remediation options for each relevant pollutant linkage.
3. Carrying out a detailed evaluation of feasible remediation options to identify the most appropriate option for any particular linkage.
4. Producing a remediation strategy that addresses all relevant pollutant linkages, where appropriate by combining remediation options.

### **4.2 Key Risk Drivers for Remedial Action of Soils**

Before earthworks commence the Principal Contractor will ensure works are set up in accordance with legislation and guidance, including appropriate licensing Control of Asbestos Regulations 2012 and Environmental Permitting Regulations to allow the progression of remediation and earthworks.

Hydrock Reports R/14656/002 version 2, R/14656/004, and R/14656/006 have identified that the key risk driver with regards to the requirement for remediation comprises asbestos fibres and potential asbestos containing materials (ACM) in Made Ground soils.

The following sections of this report are intended to identify optimum remedial techniques, which can be applied to the site in order to achieve a site, which is suitable for the proposed prison development.

### **4.3 Remediation Options and Evaluation of Feasibility**

#### **4.3.1 Preliminary Assessment of Soil Remediation Options**

Investigation and risk assessment has concluded that the site will require remediation in order to mitigate the risk to the identified receptors.

The objectives of the remediation are to sever one or more of the linkages within the *source-pathway-receptor* model.

The initial screening process considers all of the available remedial techniques based on following key criteria for the soil remediation works:

- Effectiveness. The strategy must, in theory at least, work within the context of the site and be effective in the removal of contamination.



- **Practicality.** The strategy has to have been successfully used in similar situations on other sites and readily available within the UK market. Novel solutions or those still in the research stage are not considered here.
- **Durability.** The strategy needs to be durable and not reliant on on-going maintenance to continue being effective.
- **Relative Cost.** The strategy must be affordable.
- **Relative Operational Time:** The strategy should work in a feasible and realistic time scale.
- **Sustainability.** More sustainable options are preferred.

The following Table 4.1 summarises all of the accepted remedial techniques readily available in the UK and assesses each against the six key parameters listed above.

In the first instance, each of the listed remedial techniques is assessed in terms of effectiveness at treating the contamination, which is broken down into: effective (Y), partially effective (P) or ineffective (N).

The listed techniques are then assessed in terms of relative cost ranging from negligible cost (-£) through moderately expensive (££) to prohibitively expensive (£££+).

Timescale over which the remediation technique is operational has been broadly assessed in units of weeks, months, years and decades. If for example a given technique is only effective over a period in the order of years to decades, then its overall feasibility is diminished.

Previous site experience, technical literature and Hydrock's in house knowledge have been used to reject the majority of remediation options. The primary reason for rejection of an option was sustainability, the on-going operational constraints, the cost and the inability to treat all the required determinants present.

In some instances, there may be a number of treatment options identified with the best practicable option unable to be determined at this stage. In these instances, all potential remedial options are carried forward.



**Table 4.1: Applicability of Remediation Options and Initial Assessment – Soils**

| Remedial Activity                                                                             | Effective with Asbestos | Relative Cost | Relative Operational Time | Comments (Practicality / Sustainability / Durability)                                                                                                                                                                                          | Feasibility (Y - YES, N - NO)                                                                                                                      |
|-----------------------------------------------------------------------------------------------|-------------------------|---------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Civil Engineering Methods                                                                     |                         |               |                           |                                                                                                                                                                                                                                                |                                                                                                                                                    |
| Engineered Cover System                                                                       | Y                       | £             | Weeks                     | Will prevent contact between future site users and deeper soils and break the S-P-R linkage.                                                                                                                                                   | N – site levels would need to be raised and materials imported.                                                                                    |
| Excavation and Disposal of soils.                                                             | Y                       | £££+          | Months                    | Will effectively remove the source of the contamination.<br>Excavation and disposal of all materials is not considered sustainable.<br><b>For excavations, potential for asbestos in made ground - risk to environs need to be controlled.</b> | Y – due to cut and fill operations necessary for development final levels. Requires careful control of excavations and stockpiling of made ground. |
| Materials Management – Controlled Excavation and Stockpiling for Re-Use of Suitable Materials | Y                       | ££            | Weeks                     | Testing in situ with excavation and selective disposal is considered sustainable using an appropriate MMP.<br><b>For excavation, potential for asbestos in made ground - screening / sorting not to be undertaken.</b>                         |                                                                                                                                                    |
| Biological Methods                                                                            |                         |               |                           |                                                                                                                                                                                                                                                |                                                                                                                                                    |
| Not applicable to soils in this instance                                                      |                         |               |                           |                                                                                                                                                                                                                                                |                                                                                                                                                    |
| Chemical Methods                                                                              |                         |               |                           |                                                                                                                                                                                                                                                |                                                                                                                                                    |
| Not applicable to soils in this instance                                                      |                         |               |                           |                                                                                                                                                                                                                                                |                                                                                                                                                    |
| Physical Methods                                                                              |                         |               |                           |                                                                                                                                                                                                                                                |                                                                                                                                                    |
| Soil Washing                                                                                  | Y                       | £££           | Months                    | Treat process streams (water, sediment) and route to appropriate off-site disposal, as required.<br>Will potentially result in a significant proportion of soils, which are geotechnically unsuitable without extensive treatment.             | N – due to the creation of geotechnically unsuitable soils, which would require disposal.                                                          |
| Hand Picking                                                                                  | Y                       | ££            | Weeks                     | Hand picking visible ACM fragments using trained operatives during excavation works.                                                                                                                                                           | Y – in conjunction with other technologies.                                                                                                        |
| Stabilisation and Solidification                                                              |                         |               |                           |                                                                                                                                                                                                                                                |                                                                                                                                                    |
| Hydraulic Binders                                                                             | Y                       | ££            | Weeks to Months           | Mixing of additives into soils to bind contamination thereby minimising migration from soil to and dissolved phases.<br>Additives may include binding agents for organics and cementitious materials.                                          | Y, but discounted as would require excavation and mixing of soils with asbestos and there is no need for such an aggressive remediation technique. |



#### 4.3.2 Viable Soil Remedial Options

As described above, and included in Table 4.1 certain technologies were rejected on the basis of ineffectiveness, excessive cost, sustainability, or those which are required to operate in timescales of years or greater. The short-list of options presented below represent those technologies, which were not rejected at the pre-screening process and as such, are taken forward to the options appraisal process in conjunction with each other:

- Processing - Handpicking visible ACM as far as reasonably practicable.
- Materials Management, for a Cover System.
- Disposal of unsuitable soils with asbestos.

##### ***Processing (hand picking) for asbestos***

In teRMS of excavation and processing hand picking of visible ACM asbestos will be undertaken on exposed ground during controlled excavation.

The hand picking would be undertaken to remove any visible, notifiable asbestos and “gross” asbestos cement products, as far as reasonably practicable, and should be effective on reducing the percentage asbestos present in the soils prior to re-use. It may be noted that site investigation results indicate that the risk of encountering gross asbestos contamination is low but the sporadic nature of asbestos in soils is such that the risk must not be discounted entirely.

The benefits of this option are:

- parameters can be monitored during the works, to ensure maximum efficiency;
- hand-picking and then re-use of suitable materials on site would be able to be undertaken in association with the earthworks;
- it is consistent with the principles of the Landfill Directive i.e. a reduction in the quantity of materials sent for landfill disposal;
- it would reduce haulage wagon movements to a minimum, and
- it is a tried and tested technique.

The disadvantages of this option are:

- an Environmental Permit or Exemption may be required;
- a Mobile Plant Permit (MPP) may be required;
- the works may need to be undertaken under fully licensed conditions by a specialist asbestos removal contractor in accordance with the Control of Asbestos Regulations 2012. This will include an ASB5 notification to the HSE with a 14-day notification period as standard;
- the methodology for the removal of the asbestos will need to be agreed with the Environmental Health Officer and possibly HSE representatives as required prior to the commencement of works on site; and



- strict control measures will be required by the Contractor, including personal and environmental monitoring for airborne asbestos fibres.

### ***Materials Management (Re-Use of Suitable Materials) - with a Cover System***

Excavation and re-use of Suitable Materials has been widely used in the UK for managing risks associated with brownfield land. The method involves determining the soils suitability (both chemically and geotechnically) and replacement as part of an earthworks programme. The final part of the remediation would be the placement of an engineered cover to form a barrier between the contaminant and site users, hence breaking the source-pathway-receptor linkage.

This option is technically simple and represents a low cost strategy that can be implemented rapidly. However, the principal disadvantage to this strategy is that because the contaminants present in the soils are not removed, there remains a risk of future site users exposing the contaminants and therefore the potential for long-term liabilities must be considered during the design process.

There are a number of measures to mitigate the risks associated with the contaminants being exposed in the future that can be implemented, for example:

- planning the works (in accordance with a MMP) to ensure any potential Contaminant of Concern (for example soils containing asbestos) are placed at depths where the risk of future contact is low; and
- over-excavation of service trenches, so that future maintenance workers are not exposed to asbestos containing soils.

It may be noted that over-digging will also apply to the drainage system (the immobile nature of asbestos in sub-surface water will prevent any ingress of fibres under such circumstances).

Whilst in some instances presence of a cover system may place a constraint on the potential future land use for that area. Hydrock believe in this instance as long as the cover system is installed in line with Hollingsworth (2004) and CIRIA SP124 (1996), the cover system will be robust and the site will not pose a risk to future site users.

As the exercise is predominantly an earthworks exercise, the timescales are relatively quick allowing for rapid completion of the remediation objectives and this remediation solution could be designed and implemented within a matter of months.

This strategy lies outside of the EA waste management regime therefore an Environmental Permit would not be required to allow the installation of the cover system. As soil containing asbestos is present, an Environmental Permit will be required to allow the movement and re-use of soils at the site. In addition, if hand picking of asbestos needs to be undertaken a Mobile Treatment Licence (MTL) will also be required.

Hydrock believe that soils with asbestos fibres present do not necessarily need to be disposed of off-site, provided that:

- they are handled in accordance with a MMP with A Qualified Person Declaration;
- soils containing asbestos are placed in accordance with the overriding requirements;



- they are geotechnically suitable for use as general fill;
- a cover system is placed over them;
- all service trenches are over excavated and replaced with clean fill;
- soils containing asbestos fibres are handled using appropriate task specific risk assessments and method statements with appropriate PPE and if required RPE provided and utilised;
- all works are undertaken in accordance with an Environmental Permit by suitably qualified contractors and in accordance with CAR 2012; and
- appropriate monitoring is in place to verify the works do not create a risk to site workers or neighbours.

### ***Excavation and Disposal***

Excavation and Disposal involves the removal of contaminant material from site and disposal at an appropriately licensed waste management facility.

The advantages with regards to excavation and disposal are:

- it represents a relatively rapid remediation strategy; and
- provides a high degree of certainty in the suitability of the site for its intended end use.

The disadvantages with full Excavation and Disposal are:

- cost of disposal, especially as the majority of the soils are suitable for use as general fill; and
- does not represent a sustainable remediation strategy as significant vehicle movement will be required to & from the site and the contamination is not destroyed but simply relocated to a waste management facility, thus taking up valuable landfill space.

Hydrock does not believe that full Excavation and Disposal of all impacted soils is applicable at the site. However, partial disposal, however unlikely, may be required and it is considered valuable if used in conjunction with other techniques.



## 5.0 REMEDIAL STRATEGY IMPLEMENTATION

Remediation will be undertaken such that the site is suitable for its proposed use as a Prison development.

The site is to be subjected to varying degrees of cut-to-fill in order to achieve the required finished ground levels to allow the development to take place.

Consequently, the required standard of remediation will be achieved through:

- The hand picking of visible ACM fragments during excavation, as far as reasonably practicable.
- The careful management of the Made Ground, which has been demonstrated to contain sporadic asbestos fibres.
- Re-use of soils where suitable as a cap to ground below.

The implementation of the remediation strategy will be in accordance with documented quality assurance procedures. These will include the following:

**Detailed Remediation Method Statement** – This sets out the requirements for gathering data to demonstrate the effectiveness of the remediation in teRMS of meeting the remediation objectives. This is detailed in the following sections of this report.

**Verification Report** - this will provide a complete record of the remediation activities undertaken at the site and the data collected as part of the verification plan to support compliance with remediation objectives and criteria. It will also include descriptions of the works with associated 'as built' drawings and details of any unforeseen conditions encountered during the works and how they were dealt with.

In addition to the above, the Contractor will be required to secure all necessary permits and licences to allow remediation to be undertaken and prepare appropriate Health and Safety Risk Assessments and Method Statement.

It is recommended that all remediation works are to be overseen by a qualified and experienced geo-environmental engineer who will undertake the necessary verification. The contractor will be expected to provide a full and comprehensive validation report at the end of the earthworks contract.

### 5.1 Summary of Remediation Proposals

Based upon the findings of the previous ground investigations and risk assessments and the Remediation Options Appraisal in Section 4, the following works will be undertaken to create a site, which is suitable for its proposed end use.

The proposed soil remediation and associated earthworks during the development phases for the site is reasonably anticipated to comprise the following tasks:

- Task 1: Project setup and management including liaison with LA and EA where necessary with appropriate permits / licences / consents / approvals granted.



- Task 2: Pre-works Air Quality Boundary Monitoring for Dust and Asbestos, before earthworks commence and during the earthworks.
- Task 3: Excavations to the required formation level to create the redevelopment level;
- Task 4. Hand picking of ACM, if required, and as far as reasonably practicable.
- Task 5: Placement of Service Corridor (if required by utility authority).
- Task 6: Supervision, Verification and Reporting

The Principal Contractor will be responsible for ensuring all working areas are cleared of public utilities or infrastructure and for preventing damage to these services and infrastructure.

Specialist asbestos remediation works (if required) are to be overseen by a P402 trained asbestos surveyor to undertake the necessary verification works detailed and provide assistance as required by Lend Lease.

To enable the discharge of planning conditions, the Earthworks Contractor shall provide all the information detailed in this RMS and any further information for the Verification Report.

## 5.2 Task 1: Project Setup and Management

The development of the site is being undertaken under outline planning permission reference P/2013/0671. Before commencement of site activities, detailed planning of the project has been undertaken including liaison with the stakeholders listed below and will include issue of this report along with copies of previous environmental reports regarding the Site to the Local Authority for comment.

### **Project Team**

The project is notifiable, and being undertaken, under Construction, Design and Management (CDM) Regulations, (2007).

Under these CDM regulations, Lend Lease will appoint a CDM Co-ordinator (CDMC). The CDMC will undertake and / or oversee the Pre Construction Information Report (PCIR) and a Principal Contractor who would provide a site specific Construction Phase Plan (CPP) before works commence. The CDMC will review the CPP and if required notify the local office of the Health and Safety Executive (HSE) of the works prior to commencing (form F10). Table 5.1 below provides a broad outline of the overall project team.

**Table 5.1: Project Team**

| Main Earthworks Contractor | Remediation Supervision & Validation                                         | Client & Principal Contractor | Other Stakeholders                                                                                                    |
|----------------------------|------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Jones Brothers             | To be appointed (Environmental Consultants including P402 Asbestos Surveyor) | Lend Lease                    | CDM Coordinator.<br>Wrexham County Borough Council,<br>Environmental Health (lead regulator for planning conditions). |



The Principal Contractor and main contractors will need to have suitable experience working in a similar setting, with ground conditions and soils with asbestos in soils.

The Principal Contractor and main contractors must manage the risks in accordance with the legal requirements outlined in this document and will need to prepare appropriate health and safety documentation and obtain appropriate approvals, licences, consents and permits prior to commencement.

Regarding permits, for this development site, this specifically refers to remediation requirements as related to asbestos.

If hand picking of asbestos materials proves to be required, an Environmental Permit or an Exemption will be needed. Area 1 is expected to have less significantly than 1,000m<sup>3</sup> of ACM impacted soils which require hand picking. If that is the case, the work could be covered by an Exemption (from Natural Resource Wales). In the absence of a requirement for hand picking or any other form of soil treatment, the works will be covered by the Materials Management Plan.

Furthermore, excavation of the Made Ground with asbestos fibres will need to comply with Control of Asbestos Regulations 2012 (CAR 2012). For further details, please refer to 5.3.

The Principal Contractor will ensure appropriate Method Statement and Management Plans are produced to control risks to environs in accordance with planning conditions, including condition 9 regarding contamination.

It is recommended as part of the Construction Phase Plan that an induction UXO Briefing be delivered to all new Contractors

The remediation works are designed to break the source-pathway-receptor linkage from asbestos within the Made Ground.

### **5.3 Task 2: Air Quality Boundary Monitoring for Asbestos and Dust**

From the investigations undertaken asbestos in the Made Ground has been encountered, with excavation and filling required to achieve the required development levels.

Consequently, boundary dust monitoring will be undertaken before site works commence to establish baseline conditions and include airborne asbestos fibres (e.g. Frisbee type dust monitors). This monitoring will continue during earthworks to determine if during the works there is evidence of an increased risk of release of fibres to the air / surface soils.

Boundary air monitoring results during works shall be compared with acceptable maximum standards set by the HSE. For asbestos these air monitoring procedures and limits are given in HSG 248 entitled "Asbestos: The analysts' guide for sampling, analysis and clearance procedures" and CAR 2012. The limit used is governed by the levels stated in the above guidance documents and the accuracy of the testing used.

However, for asbestos Hydrock recommend using the most stringent limit set by the HSE. Asbestos air monitoring results are acceptable only if they fall below this limit and are as low as



reasonably practical. Exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

#### **5.4 Task 3: Excavation for Development Levels**

Dependent on site levels required in the planning conditions / development plans, excavation of the Made Ground is required.

As part of implementing an effective Material Tracking System trial pits will be excavated and tested in advance of earth movements. Further details are presented in Section 5.7.

The excavations may also include over excavation of the Made Ground to remove unsuitable geotechnical soils. In addition, it may be necessary to over excavate the natural soil to provide geotechnically suitable materials for re-use.

##### **5.4.1 Task 3a Made Ground Excavation – Control of Asbestos Trial**

To demonstrate that Made Ground with asbestos can be appropriately excavated and risks to environs controlled, Hydrock recommend 'activity trials' to be undertaken where Made Ground has been encountered with asbestos.

Potential risk to construction workers relate to the potential for asbestos fibres to be released from the soil matrix and become airborne or attached to clothing that could be laundered at home. As such, any future excavation works should employ methodologies and procedures, which are designed to minimise fibre release and minimise transmission of fibres during earthworks and construction. Ongoing assessment works are required to finalise a methodology for future excavation works and to assess fully the risks.

The assessment works with regards to the construction methodology would need to be separated into 2 stages:

1. Assessment of risk; and
2. Working Methodology.

With regards to assessment of risk:

- The quantification data indicates that a low percentage of asbestos is present in the samples where asbestos has been identified in a screen. This already suggests a low risk, i.e. most of the samples are below the limit of detection (<0.001%) and the maximum is only 0.01%.
- This excavation method trial will include ambient air monitoring during the excavation works and personal monitoring of those staff working on the ground to understand the potential for fibre release, whilst undertaking the same type of works as is expected of the ground-worker in the same area. The combination of activity based air monitoring and additional soil sampling would enable a full assessment of the risks to site workers.



- This trial would be undertaken by a UKATA Category C Qualified excavator operator, and a suitably P402 trained asbestos surveyor to sample, and monitor the works replicating the likely activity of the ground-worker.

The following measures are recommended to control the possible risks from asbestos during the trial. Groundworkers are to have appropriate personal UKAS accredited air monitoring to monitor for the presence of airborne asbestos fibres, along with access to a combination of suitable personal protective equipment (PPE) and respiratory protective equipment (RPE) for immediate use if required.

Should elevated levels of airborne asbestos fibre be recorded during personal monitoring, the work item or area shall be suspended and the area affected will be declared a total exclusion zone, the perimeter of which being 3m beyond the limit of the asbestos. A further 3m safety zone shall be established and clearly marked. The Principal Contractor Site Manager shall be immediately informed, who will consider if further mitigation measures are necessary, e.g. whether materials need to be further covered. The Site Manager will inform the client and the EHO within 24 hours of the encountering suspected asbestos materials / the airborne asbestos fibres recorded and agree measures necessary.

For legislation and working methodology matters, please refer to the following section.

#### **5.4.2 Task 3b Made Ground Excavation – During Cut and Fill Activities**

Once the trial has been undertaken in the previously identified asbestos impacted areas, measures can be refined for the earthworks.

##### Working Methodologies

Appropriate measures to control possible risks are discussed below.

The Principal and Main Contractor will manage Works in accordance with relevant legislation (including the Control of Asbestos Regulations 2012 implementing EU Directive 2009/148/EC):

- The Health and Safety at Work Act 1974 forms the basis of health and safety legislation in the UK. In addition, the Control of Asbestos Regulations 2012 (CAR 2012) applies throughout the UK. CAR 2012 applies if land has significant asbestos content and is relevant to any work conducted on asbestos contaminated land.
- CAR 2012 defines a “control limit” of 0.1 fibres per cubic centimetre of air averaged over a continuous period of 4 hours. This limit is not risk based and may be much higher than the levels for control of environmental pollution.
- CAR 2012 applies even where exposure to asbestos of employees is sporadic and of low intensity and where exposure to asbestos of any employee will not exceed the control limit. In addition, the work must be of short non-continuous activities where non-friable materials are handled, or removal without deterioration of non-degraded materials in which asbestos fibres are firmly linked in a matrix.
- Broken fragments of asbestos and loose fibres have the potential to release airborne fibres in dry conditions. In addition, as the ACM and asbestos fibres have been contained in the soil for many years, the likelihood is that they would be degraded to some extent.



However, the asbestos fibres detected at the site are within a soil matrix and if this is kept damp, this should assist in minimising the risk of the release of airborne fibres.

- Given the above factors, it is possible that the works being undertaken would not be exempt from CAR 2012 licensing requirements. Therefore, until proven otherwise, Hydrock considers that the contractor should treat the work involving handling of the soils as licensed work as defined in CAR 2012.

Soils shall be inspected for suspect ACM followed by hand-picking of such materials for disposal. A P402 trained asbestos surveyor will be present to sample and assist as necessary. Task specific risk assessments and method statements should be in place, and risks and required mitigation measures communicated to all relevant personnel prior to the works commencing (e.g. under an Environmental Permit, refer to ICRCL Guidance Note 64/85 and any recent updates). General comments to assist on Method Statements are detailed below.

- Site operatives will be trained in respect of asbestos awareness to an extent that fully complies with the Control of Asbestos Regulations 2012.
- A select few of the Contractors staff should be trained as UKATA Category B Non-Licensed Asbestos Removal. This will allow the Contractor to relatively easily deal in a safe manner with any asbestos cement materials, using their own staff, e.g. wetting down, picking the asbestos and double bagging for disposal in an asbestos skip.
- If potentially notifiable asbestos containing material (e.g. visible asbestos lagging) were identified, there would need to be a step in the procedure to stop works, call in a licenced asbestos surveyor to sample, and advise on a suitably licensed contractor to remove the any licensable product.
- General dust should be kept down by the use of water to dampen down.
- Any excavation works should be undertaken using water to dampen the soils and prevent the generation of dust (typically aiming for 15% to 18% moisture content).
- Subject to the findings from the trials, staff working in the known asbestos areas may be required to wear protective outer coveralls, wellington boots and maybe RPE that are discarded before leaving the area to access other parts of the site (the need for this would be dependent upon the results of the excavation method trial).
- All works on the wider site should be undertaken using standard hygiene rules (i.e. no smoking on site and no eating or smoking without washing hands).
- Adhere to site hygiene practices sufficient to prevent soils being transported into welfare spaces and subsequently drying out (for example, the incorporation of a boot wash facility);

It should be noted that information presented in this document is provided to assist in managing the soil at the site.

#### **5.4.3 Task 3c Bulk Earthworks - Cut and Fill Activities**

Bulk earthworks will require controlled excavation and separate stockpiling of topsoil and the various excavated materials (separated according to their lithology).

Segregation and stockpiling of soils will also be based on classifying materials for disposal.



During the earthworks, appropriate mitigation measures will need to be put in place by the contractor. This may include (not an exhaustive list):

### ***General***

To reduce the potential for the generation of dust, it is recommended that double handling of soils is kept to a minimum and soils are disposed of by direct transfer to wagons and measures to minimise dust (e.g. wind or plant / vehicle movements) should be undertaken.

As a matter of good practice, construction workers and services personnel should follow guidance stated in 'HSG 66 Protection of Workers and the General Public during Redevelopment of Contaminated Land' during development works. Adequate standard personal protective equipment and the implementation of basic hygiene measures will be necessary.

Ground workers and sub-surface maintenance workers should be made aware of the possibility of encountering contaminants within soils or groundwater at the site through 'toolbox' talks.

Safe working procedures should be implemented in accordance with CIRIA132, good standards of personal hygiene should be observed, and appropriate levels of PPE provided and utilised.

Eating, drinking and smoking should be strictly prohibited in the development site other than in designated mess areas.

### ***Stockpiles and Dust Prevention***

Appropriate risk assessment and mitigation measures should be in place throughout the development. As a minimum, this should include damping down of the site surface, excavations and stockpiles to prevent the generation of dust, additional measures may include:

- stockpiles (if any are created) should be kept to a minimum to reduce 'wind whip' causing potentially hazardous material to be blown from the pile;
- air quality and dust monitoring stations will be set up and monitored by the contractor to record the dust concentrations during the works;
- stockpiles shall be placed on a suitable and robust polythene membrane or hardstanding to prevent any cross contamination;
- care should be taken not to pierce the sheeting when placing the bulky elements of the material;
- stockpiles should be dampened down or covered to prevent dust - whilst the Contractor, based on site constraints, should make the final choice, the options may include covering with plastic/polythene membrane, or by a layer of clean soil material;
- plant will be appropriately loaded to prevent spillages;
- the drop distance from excavator bucket to stockpile/process plant will be kept as short as reasonably practicable to reduce dust;
- appropriate signage should be displayed so that site workers/visitors are alerted to the potential hazards associated with the material to be stored on site, and
- roadways within the site will be kept moist by spraying from a water bowser.



Appendix B includes Stockpile Template FoRMS to assist the controlled management of stockpiles. These measures to dampen down dust are especially important to prevent airborne fibres of asbestos from the made ground.

#### ***Control of Odour and Volatile Emissions***

Odours are not considered a significant risk. However, it is advised they are formally assessed by twice-daily inspections of all site boundaries.

Where any potential nuisance odours are detected, abatement measures should be applied.

#### ***Control of Noise and Vibration***

Consideration should be given to the generation of noise and vibration and potential disturbance to neighbouring properties.

Appropriate measures to mitigate any disturbances will be put in place e.g. works will only be undertaken within the times agreed with the Local Planning Authority.

If necessary working methods will be altered in order to ensure that the level of noise generated from the works is within published tolerable limits.

#### ***Water Quality Controls during Works***

Adequate drainage sumps will be installed during works and cut off trenches / dewatering measures will be used as required to manage surface water run-off, to prevent any water from entering watercourses, either directly as surface water run-off, or indirectly via the surface water drainage systems;

If materials escape, appropriate remedial action will be taken as soon as possible.

Given that asbestos is not mobile in sub-surface water, the dust suppression measures relevant to earthworks generally will prevent migration of asbestos into any surface water drains left open during construction (noting that such drains will be covered over in the completed development). Also see Page 28 reference sub-surface drainage.

#### ***Vehicle Movements***

Risks associated with the transport of soils that potentially contain asbestos fibres, such as dust emission, should be appropriately managed.

The works could create mud from vehicle movements and subsequent tracking off site on vehicle tyres. This will be managed during the works to prevent off site mud transfer. Measures to control these issues may include the provision of a wheel wash facility and when necessary a mechanical road sweeper to further ensure that the road is kept clean.

#### ***Off-site Disposal of Waste Material***

Any material excavated on site may be classified as waste and it is the responsibility of the holders of a material to form their own view on whether or not it is waste. This includes determining when waste that has been treated in some way it can cease to be classed as waste



for a particular purpose. All arisings should be regarded as contaminated unless proven otherwise.

Any Made Ground to be removed from site are to be removed to a licensed waste management facility. The waste is to be taken by a registered waste carrier in accordance with applicable Waste Management Regulations.

A Site Waste Management Plan (SWMP) will be required in accordance with Site Waste Management Plans Regulations 2008.

Waste consignment / transfer notices will be required and are to be retained by the Contractor. Copies of all waste consignment / transfer notices are to be provided for inclusion in the Validation Report.

Any soils deemed hazardous waste for whatever reason will require representative samples to be collected and chemical analysis for Waste Classification and Waste Acceptance Criteria (WAC) testing prior to acceptance of the waste at a licensed hazardous waste landfill.

## **5.5 Task 4: Material Management**

Works will need to be controlled by the Earthworks Contractor to ensure regulatory guidance is followed. Detailed below are the main processes to facilitate this.

### **5.5.1 Waste Issues**

Material excavated on site will be classified as waste as soon as it is excavated, unless there is a Materials Management Plan in place for the re-use of soils at the site.

One of the ways this can be achieved is set out in The Definition of Waste: Development Industry Code of Practice, 2nd Edition (CoP).

The Earthworks Contractor will be responsible for preparing a Materials Management Plan (MMP) to gain a Qualified Persons Declaration, in accordance with the CoP.

The handling, re-use or disposal of waste is regulated by the Environment Agency. The Agency will take into account the use of the CoP in deciding whether to regulate materials as waste.

If materials are dealt with in accordance with the CoP, the Environment Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development. This is because the materials were never discarded in the first place, or because they have been submitted to a recovery operation and have been completely recovered so that they have ceased to be waste.

The procedures to be followed for the production of the MMP will need to follow the protocols outlined for 'Route B' – Design Statement'.



### 5.5.2 Earthworks Placement Requirements

For the asbestos identified in the Made Ground, in terms of materials placement the following criteria are necessary

- Soils in the depth zone finished ground level to 1m depth must be characterised by 'below limit of detection' that is, < 0.001% w/w;
- Soils containing 0.1% w/w – 0.001% w/w asbestos are considered to be contaminated with asbestos and can only be re-used at depths >1m below finished ground level;
- The boundary between the clean material and the asbestos contaminated materials will be marked with a coloured geotextile to warn future groundworkers. The geotextile marker will be a distinctive, clearly visible marker membrane which separates the soils with residual asbestos >1m depth from the shallower soils. There is a general preference for placing soils containing 0.1% w/w – 0.001% w/w asbestos where they will not be disturbed in the future. An accurate record of where such soils are placed must be kept in a health & safety file.
- Soils containing >0.1% w/w asbestos must be removed from site for disposal at an appropriate facility.
- Provision will need to be made for hand picking of Asbestos Containing Materials where these are observed

These criteria have been used on similar sites to the satisfaction of the relevant local authority.

Thereby, end users will have a cover system and a warning geotextile break layer, as reasonably practicable, to inhibit further digging into soils beneath, by for example potential maintenance workers.

Following completion of the above works verification reports, undertaken by a suitably qualified independent third party will be required.

Liaison should be continued during implementation and subsequent verification.

Records of all activities undertaken, especially where soils containing 0.1% w/w -0.001% w/w are placed below 1m, will be kept in a Health & Safety file for future reference, noting that this primarily applies to persons engaged in excavation works below 1m depth.

### 5.6 Task 5: Placement of Service Corridor

Asbestos fibres may remain below 1m from the final development level. Consequently, services shall be placed in soils with asbestos at <0.001% w/w. To avoid further cost and lengthening the programme for utility works, it is recommended service corridors are installed during the earthworks.

Alternatively, service corridors can be placed by over excavation following block earthworks. This would be very likely to require further disposal of soils containing asbestos and increased costs and delays in utility authorities providing services with further PPE required.

"Protectaline" services will also be required and the requirements of utility companies should be sought before earthworks commence.



## 5.7 Task 6: Supervision, Verification and Reporting

### ***Site Supervision***

A suitably qualified and experienced geo-environmental engineer will oversee the works on a full time basis.

To enable the discharge of planning conditions, the Contractor shall provide all the information detailed in this RMS and any further information requested for the Verification Report.

### ***Collection of Samples***

All samples will be taken in accordance with relevant guidance (e.g. BS 10175:2011). Soils for inorganic analysis will be sealed in airtight polythene tubs. Soils for organic analysis will be sealed in amber glass jars with the minimal practicable headspace.

All samples were scheduled on chain of custody forms prior to being dispatched to the UKAS accredited laboratory for analysis.

Excavated Made Ground will be sampled for asbestos testing at a rate of 1 sample per 1000m<sup>3</sup> in the areas where asbestos has not been recorded and 1 sample per 500m<sup>3</sup> where it has. Please refer to drawing 14656/D006 Rev B for the areas affected.

Excavated Natural Soil will be sampled and analysed at a rate of 1 sample per 2,500m<sup>3</sup>.

The geo-environmental engineer will need to be suitably trained in taking samples for verification activities specifically relating to asbestos. Guided by the results of previous investigations (reference Asbestos Remediation Plan, drawing 14656/D006 Rev B), it is understood that trial pits will be used to sample soils in advance of the earthworks activities. Whilst the advantage of such an approach is an avoidance of double handling such a proposal will also reduce the potential for fibre release as no stockpiles will be created.

### ***Stockpile Verification***

The Contractors shall work to ensure the following.

The Contractor with clear signs shall identify all stockpiles. Each stockpile of material should be given a clear reference number and designated sheet recording the following:

- Identification reference (e.g. Stockpile A, B, C etc.).
- Material Type (e.g. Made Ground / natural).
- Source cell / grid – refer to drawing 14656/D006 Rev B for reference.
- The approximate volume.
- Destination of the material to be used (i.e. Source cell / grid – refer to drawing 14656/D006 Rev B for reference).

Each entry shall be signed and dated by the Site Manager or their Assistant. A template form is provided in Appendix B. Other templates or documentation may be used.



A Stockpile / Soil Tracker Sheet shall record where excavated materials originated from and destination used or disposed off-site.

These sheets should be available for inspection by the Engineer, , Local Authority staff and others involved with this development. A copy should also be given to the Engineer when verification visits are made.

### **Verification**

To enable the discharge of planning conditions, the Contractor shall provide all the information detailed in this RMS for the Verification Report. Contractor information provided will include full survey as built drawings to demonstrate the excavation materials (cut) and for fill activities the thickness of the cover material (i.e. the material containing less than 0.001% asbestos) to be consistent with records of the materials were placed where.

Verification pits will be undertaken on a 75m grid with asbestos testing of soils.

On completion of the verification works a Verification Report will be issued to the client and the Local Authority, detailing the works that have been completed in accordance with the agreed RMS, will be forwarded. The Verification Report is to include:

- the chemical analysis reports for the samples taken, including validation and confirmation that the material is consistent with the RMS;
- details on site observations;
- confirmation that soils have been managed in accordance with this documentation and the MMP;
- if necessary confirmation of the source of imported material and any sampling and analysis undertaken, and
- confirmation of the physical suitability of the material as per Section 6.3.

Details of all waste removed from the site (waste carrier transfer notes etc.).

Necessary changes to the agreed Implementation Plan, arising during the course of the works, are to be agreed in writing with the Local Authority before being undertaken on site.

The Verification Report and Ground Investigation Reports are to be included in the Construction Health & Safety File for future stakeholders. Thereby, future site users and those undertaking works, including maintenance, can review the soil information to assess potential risks for any works related to the soils.



## **6.0 IMPORT / COVER SOILS SPECIFICATION**

Whether soils will be imported has not been decided, as development plans are being rationalised. Should soils require importing this section shall be taken into consideration.

It may be noted that the main approach to dealing with asbestos-contaminated soils is their re-use, under a Materials Management Plan, at depths >1m below ground level. The only currently envisaged requirement to import soil is for the purposes of small-scale horticulture or landscaping, noting that removal of existing Made Ground and its replacement by a fertile growing medium will add another layer of protection against exposure to asbestos or the minor contamination exceedences referred to in Section 3.

### **6.1 Sourcing of Material**

It is anticipated that appropriate Topsoil and Subsoil may be imported for use on site, under the supervision of an arborist. The criteria for imported material for reuse as part of the cover system will be the RTVs as detailed in Table 6.1. Sample frequency for verification testing will be undertaken as detailed in Section 6.5.

Any imported soils should be from a source not expected to be contaminated and meet both physical and chemical criteria, as detailed in Sections 6.4 and 6.5.

Before importation of Topsoil and Subsoil, certification should be obtained from the Supplier detailing the source site, its previous and current land use and relevant test results.

In addition to certification from the Supplier, chemical testing of the imported soils will be required once the material arrives at site. See Section 6.5 for quantities of testing and testing schedules.

### **6.2 Stockpiling of Materials**

On importation of Topsoil and other materials, the materials should be stockpiled. Copies of the carrier's consignment notes shall be retained and be available on request.

Topsoil and Subsoil should be stockpiled separately and away from areas designated for storing other materials or potential sources of contamination.

Separate stockpiles should also be created for each different source. Topsoil stockpiles to be kept below 2m in height at all times and traffic is to be minimised on the stockpile.

All stockpiles should be identified with clear signs and each stockpile of imported material should be given a clear reference number and designated sheet recording the following:

- Identification reference (e.g. Stockpile A, B, C etc.);
- Material Type (e.g. Topsoil);
- Source site;
- The carrier's consignment note reference numbers;
- The approximate volume (amount of loads); and



- Which plots the material is to be used on and where (i.e. Plot number and front or rear garden).

Each entry shall be signed and dated by the Site Manager or their Assistant. A template form is provided in Appendix B. Other templates or documentation may be used.

These sheets should be available for inspection by the Engineer, NHBC Inspectors, Local Authority staff and others involved with this development. A copy should also be given to the Engineer when verification visits are made.

### **6.3 Testing Requirements**

The document issued by the Welsh Land Contamination Working Group (WLCWG) titled “Requirements for the Chemical Testing of Imported Materials for Various End Uses and Validation of Cover Systems” specifies testing requirements for imported materials. Should there be a requirement to import soils for any purpose the requirements of this guidance will be followed.

### **6.4 Physical Requirements**

Imported Topsoil should conform to the requirements of BS 3882:2007 (Specification for Topsoil and requirements for use), or as agreed with the Client.

Topsoil and Subsoil should comprise chalk, clay or sand and should have a maximum of 60% of fragments in excess of 2mm, a maximum of 30% in excess of 20mm and a maximum of 10% in excess of 50mm, with nothing in excess of 75mm. This is to be confirmed by visual inspection of the material by a suitably qualified Geo-environmental Engineer and if necessary by laboratory Particle Size Distribution assessment.

Topsoil and Subsoil should be free of asbestos, metal, plastic, wood, glass, tarmac, brick, paper, concrete or other potentially hazardous foreign material that could cause injury.

In addition, all materials must be free from aggressive / invasive weeds (especially Japanese Knotweed and Giant Hogweed) and bulk vegetative growth, in order to ensure negligible risk of subsequent weed problems.

### **6.5 Chemical Requirements**

Chemical testing of the imported soils will be required once the material arrives at site. This should be undertaken at a rate of one test per 250m<sup>3</sup> for material from a natural source.

If the source of the material is not natural or if the material has been site won, chemical testing should be undertaken at a rate of one test per 100m<sup>3</sup>.

A minimum of 4 chemical suites will be undertaken on any individual source material or import round.

Depending on the source or variability of imported material, the Engineer may, at their discretion, request additional testing to be undertaken.



If constant sources are used for the Topsoil and Subsoil and the results recorded are consistently low, consideration may be given to reducing the number of samples tested.

Analysis should be carried out for the following general suite of contaminants:

- As, B (water soluble), Be, Cd, Cr (total), Cr(VI), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulfide, pH, asbestos fibres, speciated polycyclic aromatic hydrocarbons (PAH, by GC-FID), total phenols, total TPH and fraction of organic carbon.
- If high total cyanide is detected, this will be re-analysed for “free” and “complex” species if appropriate.

## 6.6 Import Criteria

The results of chemical testing are to be compared with the site import criteria presented in Table 6.1.

If any of these thresholds are exceeded the material and data shall be reviewed to assess its suitability for use, depending on the proposals / intended use, using these comparison values (CV).

**Table 6.1: Import Criteria**

| Chemical of Concern | Proposed CV<br>mg/kg |  | Chemical of Concern    | Proposed CV<br>mg/kg |
|---------------------|----------------------|--|------------------------|----------------------|
| Arsenic             | 32                   |  | Acenaphthene           | 280                  |
| Beryllium           | 51                   |  | Acenaphthylene         | 170                  |
| Boron               | 290                  |  | Anthracene             | 2300                 |
| Cadmium             | 11                   |  | Benz(a)anthracene      | 3.1                  |
| Chromium (III)      | 630                  |  | Benzo(a)pyrene         | 0.83                 |
| Chromium (VI)       | 4.3                  |  | Benzo(b)fluoranthene   | 5.6                  |
| Copper              | 2300                 |  | Benzo(ghi)perylene     | 44                   |
| Lead                | 200                  |  | Benzo(k)fluoranthene   | 8.5                  |
| Mercury, inorganic  | 170                  |  | Chrysene               | 6                    |
| Nickel              | 130                  |  | Dibenz(a,h)anthracene  | 0.76                 |
| Selenium            | 350                  |  | Fluoranthene           | 260                  |
| Vanadium            | 74                   |  | Fluorene               | 160                  |
| Zinc                | 3,700                |  | Indeno(1,2,3,cd)pyrene | 3.2                  |
| Cyanide (free)      | 750                  |  | Naphthalene            | 1.5                  |
| Phenol (total)      | 180                  |  | Phenanthrene           | 92                   |
| Total TPH           | 50                   |  | Pyrene                 | 560                  |
| Asbestos            | Nil                  |  | Total PAH              | 50                   |



## **7.0 AREAS OF UNEXPECTED FINDS / CONTAMINATION**

There is the potential for areas of unexpected contamination to be present, due to the former industrial use of the site. Any significant quantities of suspected oily or odorous material, significant ashy soils and unusual brightly coloured or asbestos materials should be considered as possibly contaminated.

The Discovery Strategy, included in Appendix C, must remain on site at all times and demonstrates a clear allocation of responsibility for reporting and dealing with contamination. A copy of the Discovery Strategy must be placed on the Health & Safety Notice Board and /or displayed in a prominent area where all site staff are able to take note of and consult the document at any time. Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the requirement to follow the Discovery Strategy.

A report will be prepared and submitted to the regulatory parties, the Local Authority and the NHBC and the Environment Agency where groundwater may potentially have been impacted.



## **8.0 REGULATORY REQUIREMENT**

### **8.1 Remediation**

A verification report will be submitted in accordance with Environment Agency guidance, please refer to Section 5 for further details.

### **8.2 Licences, Permits and Consents**

Any conditions associated planning permission should be addressed prior to carrying out the works.

It will be a requirement of the Contractor (to be appointed) to obtain any of the necessary permits and undertake the appropriate notifications and assessments. All statutory records are to be kept in the site manager's office and these may include (not an exhaustive list):

- ASB NNLW1 – Notification of non-licensed asbestos work if the work is deemed not be requiring a licence;
- If required following demolition works appropriate licence with regards to CAR 2012 if the work is deemed to require a licence;
- HSE Notification F10;
- Pre-Construction Information Pack;
- Construction Phase Health and Safety Plan;
- Method Statements and Risk Assessments;
- Environmental Permit deployment form and associated paperwork (if required);
- Exemptions for Environmental Permit deployment (if required);
- Discharge Consents for disposal of groundwater;
- Competence records (including asbestos awareness training);
- Service records;
- Plant and machinery maintenance records;
- Duty of Care paperwork.

In addition, it is recommended that:

- asbestos awareness training to be given to all staff;
- ASB402 licensed surveyor on call to assist the Earthworks Contractor;
- depending on conditions following demolition works, background and on-going air monitoring to be undertaken to check for presence of asbestos fibres during the works; and



During works on the site, detailed control measures will be required to include (but not limited to):

- monitoring of actual changes to ensure mitigation of potential adverse effects;
- education of workers to risks associated with contamination;
- posting of appropriate warning signs; and
- provision of suitable PPE and welfare.

### **8.3 Health and Safety Requirements**

The works are to be undertaken in compliance with all relevant regulations, guidance and legislation. Whilst not exhaustive, the following list of pertinent regulations, guidance and legislation is highlighted to the Contractor and should be complied with at all times:

- The Health and Safety at Work etc Act 1974;
- Health and Safety Executive 'Protection of Workers and the General Public during Redevelopment of Contaminated Land' HS (G) 66, HMSO 1991;
- The Construction, Design and Management Regulations 2007;
- The Control of Substances Hazardous to Health Regulations 2002 (COSHH Regulations); and
- The Control of Asbestos Regulations, 2012.

The contractor is responsible for obtaining all necessary approvals from regulatory bodies and third parties to implement fully the works. The Contractor should only expect others have sought approvals where explicitly provided to the Contractor or advised in writing.

A Construction Phase Plan (CPP) will be submitted to the CDM co-ordinator, the Client and the LPA in advance of mobilisation to site. The CPP will be passed to the Site Manager who will implement all Health and Safety measures on site. The Site Manager will fully induct the Site Operatives prior to commencement of any works. The CPP will be kept as an open document and will be adapted as required to during the project. This will include (as a minimum):

- welfare arrangements, storage and security;
- air monitoring requirements (and action levels);
- traffic management plan;
- segregation of working areas and site welfare (and decontamination units if required);
- site inductions, daily safety briefings and toolbox talks;
- method statement briefings;
- daily inspection records, and
- permit to works.



## 9.0 REFERENCES

BRITISH STANDARDS INSTITUTION. 1999. Code of practice for Site Investigations. *BS 5930 Incorporating Amendment No.2:2010*. BSI, London.

BRITISH STANDARDS INSTITUTION. 2011. Code of Practice for Investigation of Potentially Contaminated sites. *BS 10175*. BSI, London.

BRITISH STANDARDS INSTITUTION. 2003. Geotechnical investigation and testing - Identification and classification of rock - Part 1: Identification and description. *BS EN ISO 14689-1 Incorporating Corrigendum No.1*. BSI, London

BRITISH STANDARDS INSTITUTION. 2007. Code of practice for the characterization and remediation from ground gas in affected developments. *BS 8485*. BSI, London.

BRITISH STANDARDS INSTITUTION. 2009. Code of practice for earthworks. *BS 6031 Incorporating Corrigendum No.1:2010*. BSI, London.

CL:AIRE. March 2011. *The Definition of Waste: Development Industry Code of Practice, Version 2*. Contaminated Land: Applications in the Real Environment (CL:AIRE), London.

DCLG. March 2012. *National Planning Policy Framework*. DCLG, London.

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ENVIRONMENT AGENCY. 2004. Model procedures for the management of land contamination. *Contaminated Land Report 11*. The Environment Agency.

HIGHWAYS AGENCY. 1994. Design Manual, Road and Bridges: Volume 4, Geotechnics and Drainage; Section 1, Earthworks; Part 5, HA 70/94, Construction of Highway Earthworks. *HA 70/94*. Highway Agency, London.

HIGHWAYS AGENCY. 2008. Manual of Contract Documents for Highway Works, *Specification for Highway Works: Volume 1*. Highway Agency, London.

HSG 248. 2006. Asbestos: The analysts' guide for sampling, analysis and clearance procedures.

RUDLAND, D. J., LANCEFIELD, R. M. and MAYELL, P. N. 2001. Contaminated land risk assessment. A guide to good practice. *CIRIA Report C552*. CIRIA, London. 158 pp.

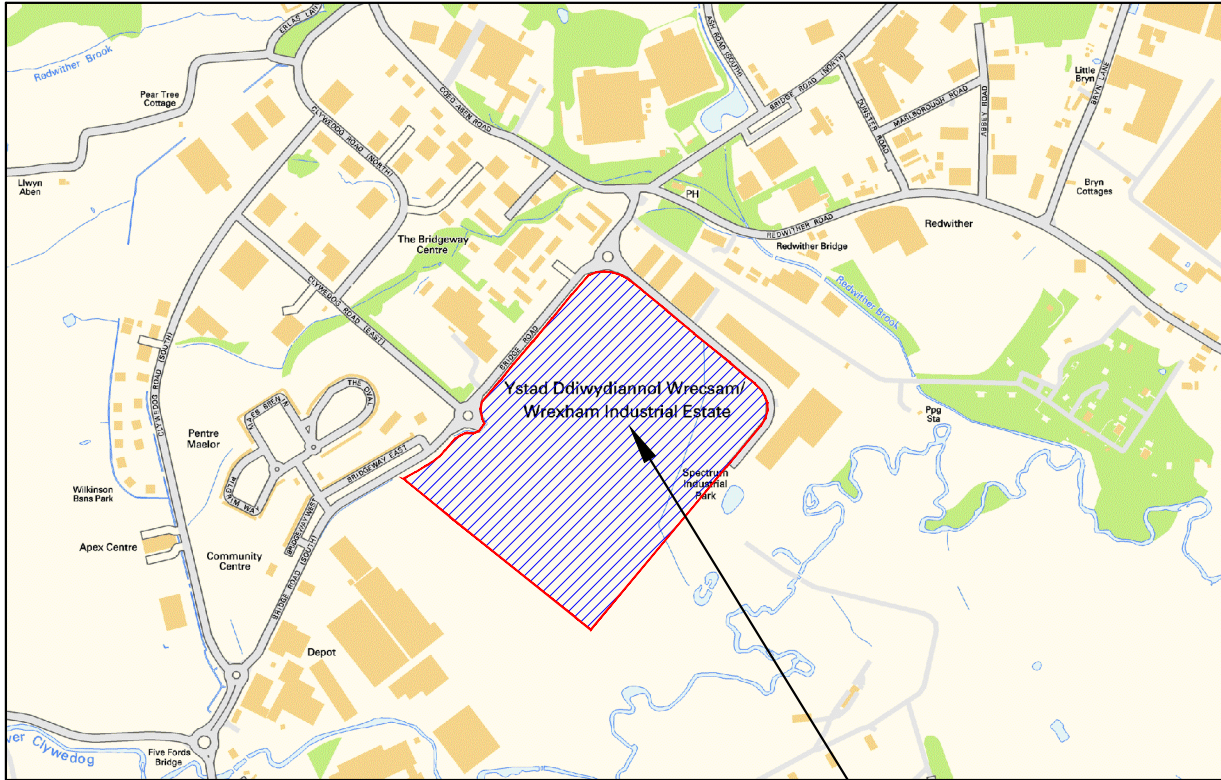
UK WATER INDUSTRY RESEARCH (UKWIR). 2010 re-issued. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. *Report 10/WM/03/21*.

**Hydrock Consultants Limited**



## **Appendix A**

### Drawings



**SITE LOCATION**



|     |          |             |    |     |
|-----|----------|-------------|----|-----|
| A   | 07/10/14 | FINAL       | LW | TW  |
| Rev | Date     | Description | By | Ckd |

This drawing is the copyright of Hydrock Consultants Ltd

|          |            |
|----------|------------|
| Client : | LEND LEASE |
|----------|------------|

Project Title:  
**NORTH WALES PRISON**

|             |                    |
|-------------|--------------------|
| Architect : | Site Location Plan |
|-------------|--------------------|

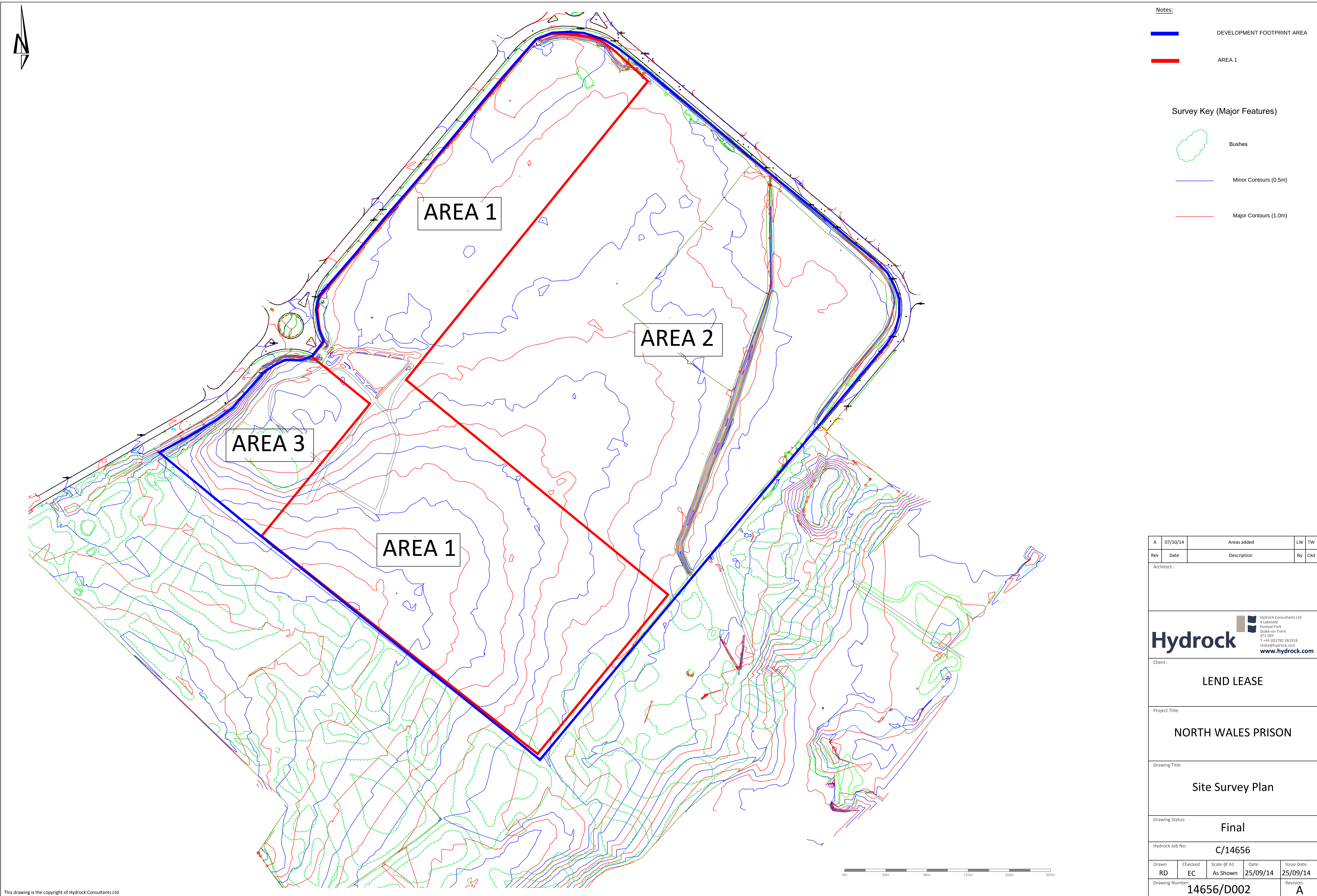
Drawing Title:  
**Site Location Plan**

|                 |       |
|-----------------|-------|
| Drawing Status: | FINAL |
|-----------------|-------|



Hydrock Consultants Ltd  
4 Lakeside  
Festival Park  
Stoke-on-Trent  
ST1 5RY  
T +44 (0)1782 261919  
stoke@hydrock.com  
[www.hydrock.com](http://www.hydrock.com)

|                 |         |            |          |            |         |
|-----------------|---------|------------|----------|------------|---------|
| Hydrock Job No: |         |            |          |            | C/14656 |
| Drawn           | Checked | Scale @ A4 | Date     | Issue Date |         |
| LW              | TW      | AS SHOWN   | 12/09/14 | 12/09/14   |         |
| Drawing Number: |         |            |          | Revision:  |         |
| 14656/D001      |         |            |          | A          |         |



Architect :

Client : LEND LEASE

Project Title:

# NORTH WALES PRISON

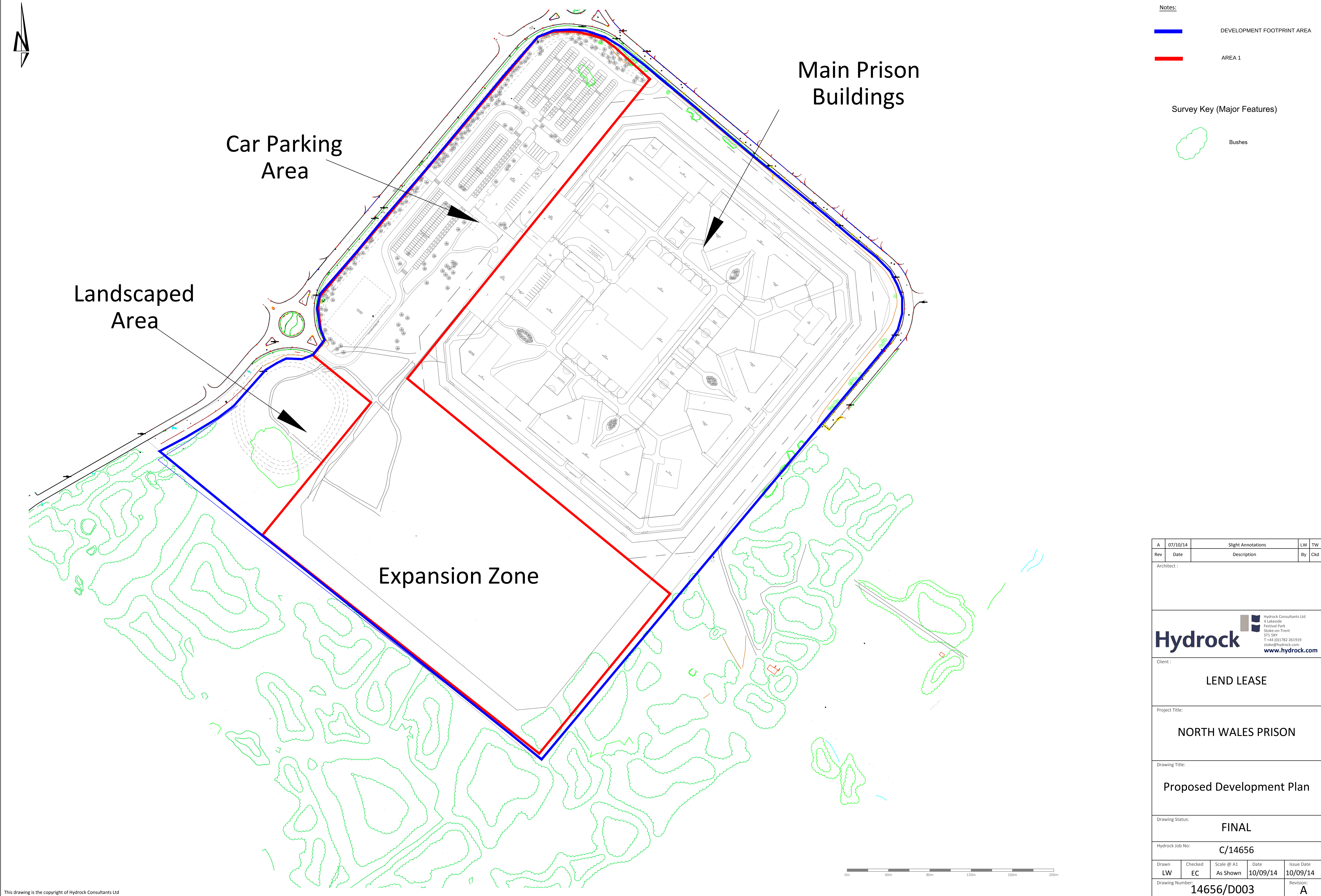
Drawing Title:

# Site Survey Plan

Drawing Status: **Final**

Hydrock Job No: C/14656

|                                      |                       |
|--------------------------------------|-----------------------|
| Drawing Number:<br><b>14656/D002</b> | Revision:<br><b>A</b> |
|--------------------------------------|-----------------------|



Notes:



DEVELOPMENT FOOTPRINT AREA



AREA 1

Survey Key (Major Features)



Bushes

| A   | 07/10/14 | Slight Annotations | LW | TW  |
|-----|----------|--------------------|----|-----|
| Rev | Date     | Description        | By | Ckd |

Architect :



Hydrock Consultants Ltd  
4 Lakeside  
Festival Park  
Stoke-on-Trent  
ST1 5BY  
T +44 (0)1782 261919  
stoke@hydrock.com  
[www.hydrock.com](http://www.hydrock.com)

Client :

LEND LEASE

Project Title:

NORTH WALES PRISON

Drawing Title:

Proposed Development Plan

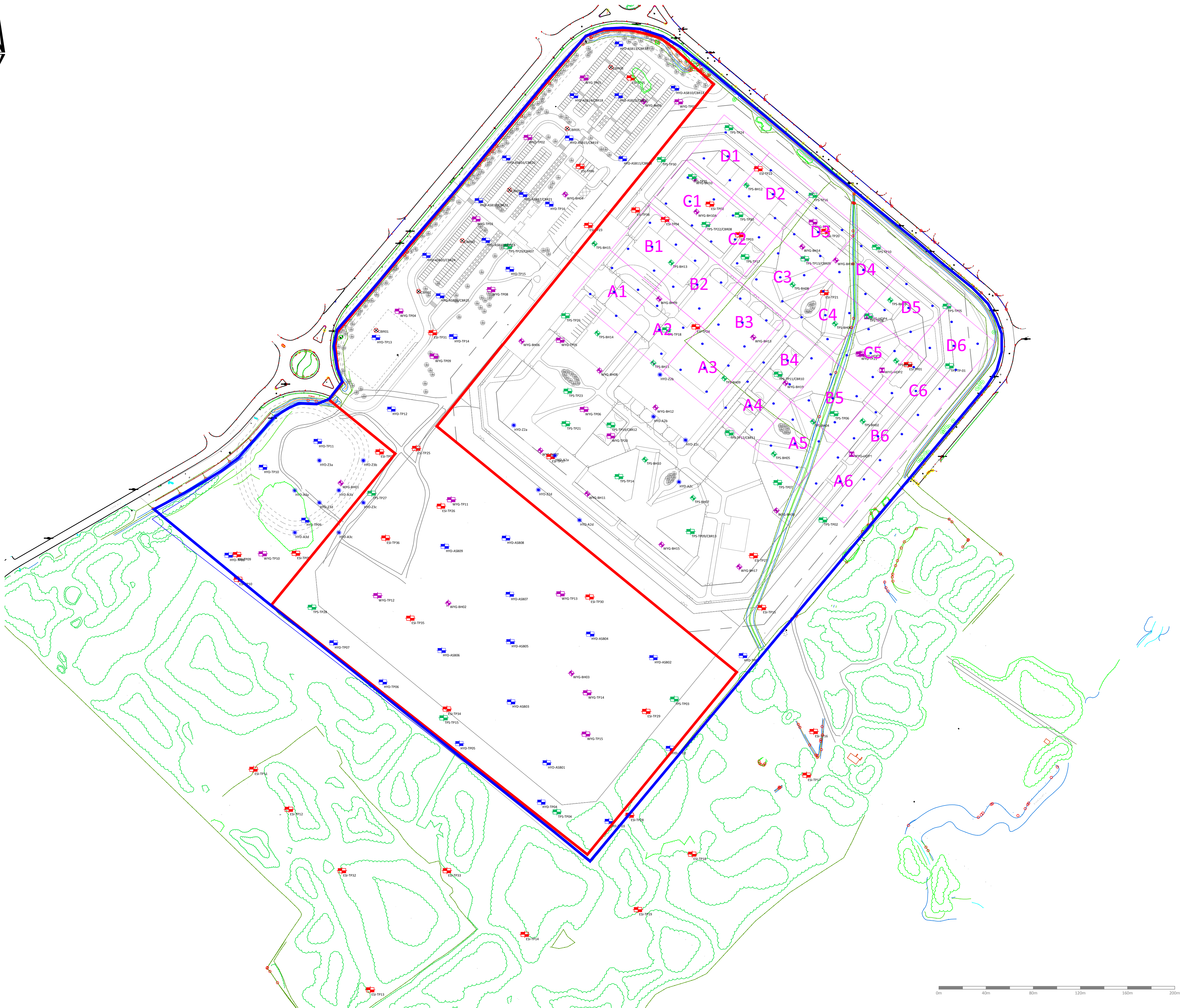
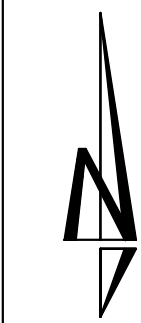
Drawing Status:

FINAL

Hydrock Job No:

C/14656

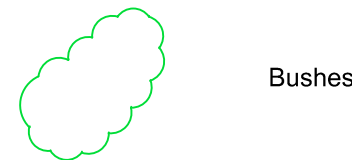
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| LW              | EC      | As Shown   | 10/09/14 | 10/09/14   |
| Drawing Number: |         |            |          | Revision:  |
| 14656/D003      |         |            |          | A          |



Notes:

- DEVELOPMENT FOOTPRINT AREA
- AREA 1
- HYD-E6 HYDROCK ASBESTOS TRIAL PIT 2014
- HYD-TP01 HYDROCK TRIAL PIT 2014
- HYD-ASB01 HYDROCK ADDITIONAL ASBESTOS TRIAL PIT 2014
- HYD-ASB01/CBR013 HYDROCK ADDITIONAL ASBESTOS TRIAL PIT 2014 AND CBR LOCATION
- CBR01 CBR TESTING 2014
- TPS-TP05 TPS HYDROCK TRIAL PIT 2014
- TPS-TP05/CBR01 TPS HYDROCK TRIAL PIT 2014 AND CBR LOCATION
- TPS-BH07 TPS HYDROCK BOREHOLE 2014
- WYG-TP17 WYG TRIAL PIT 2013
- WYG-HDP2 WYG HAND-DUG PIT 2013
- WYG-BH13 WYG BOREHOLE 2013
- ESI-TP30 ESI TRIAL PIT 2013

Survey Key (Major Features)



Bushes

| Rev                                                                                                                                                                                                           | Date    | Description | By       | Ckd        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------------|----------|------------|
| Architect :                                                                                                                                                                                                   |         |             |          |            |
| <div><div><div>Hydrock</div><div>Hydrock Consultants Ltd<br/>4 Lakeside<br/>Festival Park<br/>Stoke-on-Trent<br/>ST1 5BY<br/>T +44 (0)1782 261919<br/>stoke@hydrock.com<br/>www.hydrock.com</div></div></div> |         |             |          |            |
| Client :                                                                                                                                                                                                      |         |             |          |            |
| LEND LEASE                                                                                                                                                                                                    |         |             |          |            |
| Project Title:                                                                                                                                                                                                |         |             |          |            |
| NORTH WALES PRISON                                                                                                                                                                                            |         |             |          |            |
| Drawing Title:                                                                                                                                                                                                |         |             |          |            |
| Ground Investigation Plan                                                                                                                                                                                     |         |             |          |            |
| Drawing Status:                                                                                                                                                                                               |         |             |          |            |
| Final                                                                                                                                                                                                         |         |             |          |            |
| Hydrock Job No:                                                                                                                                                                                               |         |             |          |            |
| C/14656                                                                                                                                                                                                       |         |             |          |            |
| Drawn                                                                                                                                                                                                         | Checked | Scale @ A1  | Date     | Issue Date |
| RD                                                                                                                                                                                                            | EC      | As Shown    | 25/09/14 | 25/09/14   |
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| 14656/D004                                                                                                                                                                                                    |         |             |          | -          |

Hydrock 2014 Asbestos Investigation

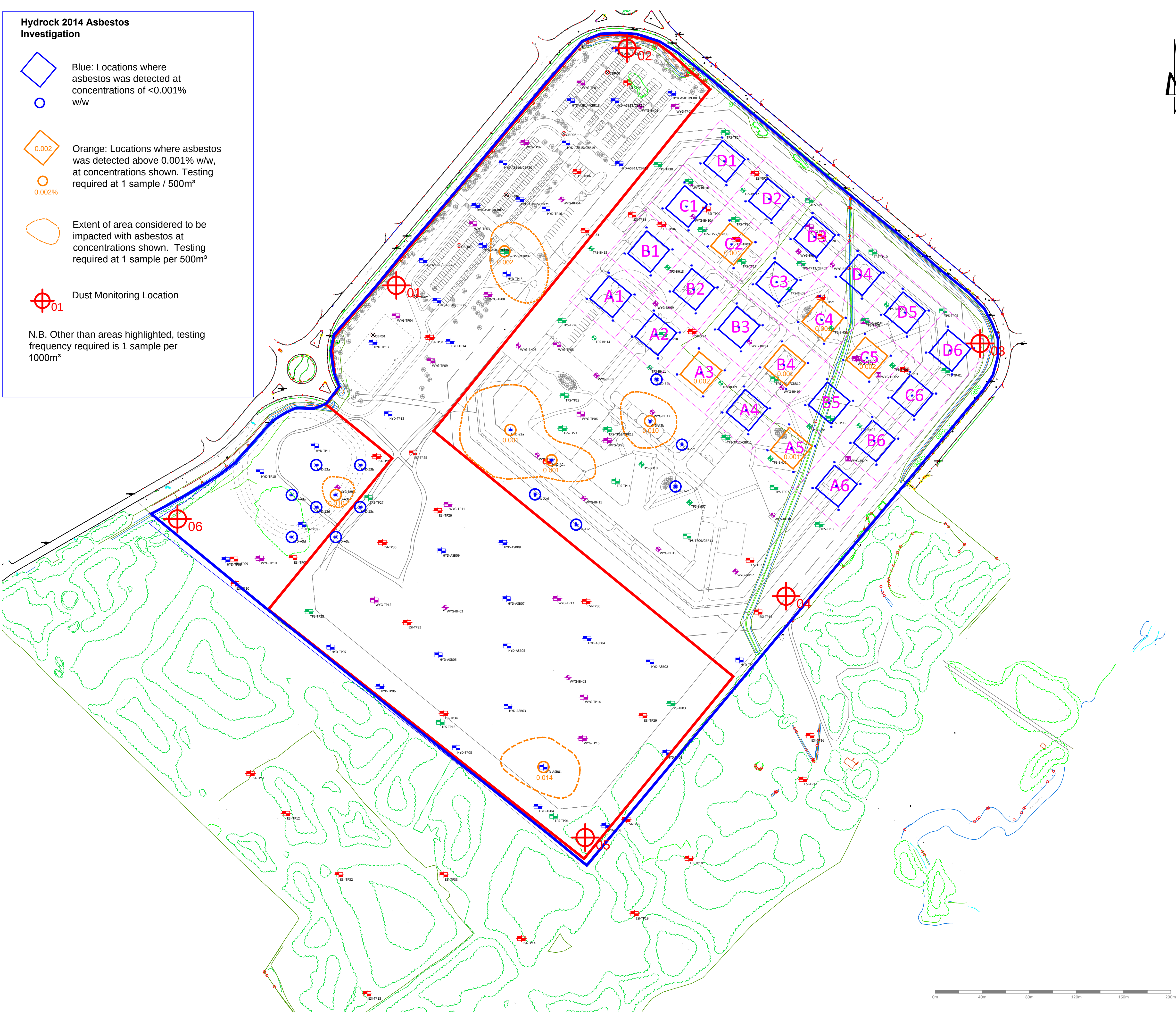
Blue: Locations where asbestos was detected at concentrations of <0.001% w/w

Orange: Locations where asbestos was detected above 0.001% w/w, at concentrations shown. Testing required at 1 sample / 500m³

Extent of area considered to be impacted with asbestos at concentrations shown. Testing required at 1 sample per 500m³

Dust Monitoring Location

N.B. Other than areas highlighted, testing frequency required is 1 sample per 1000m³



- Notes:
- DEVELOPMENT FOOTPRINT AREA

AREA 1

HYDROCK ASBESTOS TRIAL PIT 2014

HYDROCK TRIAL PIT 2014

HYDROCK ADDITIONAL ASBESTOS TRIAL PIT 2014

HYDROCK ADDITIONAL ASBESTOS TRIAL PIT 2014 AND CBR LOCATION

CBR TESTING 2014

TPS HYDROCK TRIAL PIT 2014

TPS HYDROCK TRIAL PIT 2014 AND CBR LOCATION

TPS HYDROCK BOREHOLE 2014

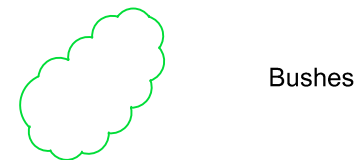
WYG TRIAL PIT 2013

WYG HAND-DUG PIT 2013

WYG BOREHOLE 2013

ESI TRIAL PIT 2013

Survey Key (Major Features)



|     |            |                                             |    |     |
|-----|------------|---------------------------------------------|----|-----|
| B   | 08/10/2014 | Minor Amendments                            | KD | EC  |
| A   | 08/10/2014 | Updated drawing, following additional works | TW | EC  |
| Rev | Date       | Description                                 | By | Ckd |

Architect :

Hydrock

Hydrock Consultants Ltd

4 Lakeside

Festival Park

Stoke-on-Trent

ST1 5BY

T +44 (0)1782 261919

stoke@hydrock.com

www.hydrock.com

Client :

LEND LEASE

Project Title:

NORTH WALES PRISON

Drawing Title:

Asbestos Remediation Plan

Drawing Status:

FINAL

Hydrock Job No:

C/14656

|                 |            |            |          |            |
|-----------------|------------|------------|----------|------------|
| Drawn           | Checked    | Scale @ A1 | Date     | Issue Date |
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| Drawing Number: | 14656/D006 |            |          | Revision:  |
|                 |            |            |          | B          |



## **Appendix B**

### Stockpile Template Form

## NORTH WALES PRISON, WREXHAM

### Soil Documentation Form

|                                          |  |
|------------------------------------------|--|
| Stockpile Identification Reference       |  |
| Material Type                            |  |
| Source Site                              |  |
| Consignment Note Reference Numbers       |  |
| Volume of Stockpile (or number of loads) |  |
| Plots Material to be used in             |  |
| Stockpile Identification Reference       |  |

#### Sketch Plan of Stockpile Location and Sample Points

Signed \_\_\_\_\_

Position \_\_\_\_\_

Date \_\_\_\_\_

| Material Movements (Around Site) |  |
|----------------------------------|--|
|----------------------------------|--|

| Date       | Material UIC           | Dumper Loads | Moved From                | Moved To                | Moved or Excavated | Volume |
|------------|------------------------|--------------|---------------------------|-------------------------|--------------------|--------|
| DD/MM/YY   | BLOCK / STOCKPILE NAME | NUMBER       | EXCAVATION / STOCKPILE ID | LOCATION / STOCKPILE ID | M or E             | (m³)   |
| 04/06/2012 | HY.SSA.IN              | 26           | P1C                       | AREA 5                  | M                  | 254.8  |
| 05/06/2012 | HY.SSA.IN              | 28           | P1C                       | AREA 5                  | M                  | 274.4  |
| 06/06/2012 | HY.SSA.IN              | 19           | P1C                       | AREA 5                  | M                  | 186.2  |
| 07/06/2012 | HY.SSA.IN              | 12           | P1C                       | AREA 5                  | M                  | 117.6  |
| 15/06/2012 | HY.SSB.IN              | 16           | EXCAVATION                | RS1                     | E                  | 156.8  |
| 16/06/2012 | HY.SSB.IN              | 18           | EXCAVATION                | RS1                     | E                  | 176.4  |
| 17/06/2012 | HY.SSB.IN              | 18           | EXCAVATION                | RS1                     | E                  | 176.4  |
| 18/06/2012 | HY.SSB.IN              | 20           | EXCAVATION                | RS2                     | E                  | 196    |
| 19/06/2012 | HY.SSB.IN              | 21           | EXCAVATION                | RS2                     | E                  | 205.8  |
| 20/06/2012 | HY.SSB.IN              | 10           | EXCAVATION                | RS2                     | E                  | 98     |
| 20/06/2012 | HY.SSB.IN              | 23           | EXCAVATION                | RS3                     | E                  | 225.4  |

\*Example

\*Example

\*Example

\*Example

\*Example

\*Example

\*Example

\*Example

\*Example

\*Example

\*Example

SOP010

**MATERIAL TRACKING SYSTEM (MTS)  
REJECTED MATERIAL RECORD**



Site Location/ Project No:

Date:

Unique Identification Code (UIC):

Total Volume of Material Rejected:

Reasons for rejection (e.g. targets not achieved):

Landfill Details:

Waste Carrier Details:

EWC:

SIC (if applicable):

Duty of Care Ticket No:

Weighbridge Ticket Confirmation:

Consignment Note Confirmation (if applicable):

Sign and Date Completed Form:

SOP009

**MATERIAL TRACKING SYSTEM (MTS)  
TREATMENT AND VERIFICATION PHASE (CONTAMINATED)  
VERIFICATION PHASE (INERT)**

Site Location/ Project No.

Date:

Unique Identification Code (UIC):

Total Volume of Material Accepted from Donor Site (single UIC):

**A Contaminated Material Treatment Phase**

Record location of material on the Stockpile Location Plan

Commence treatment of material as required to achieve Target Values

Undertake validation testing in accordance with the agreed frequency\*

Does the treated material meet the Target Values?

Record date that Target Values achieved

If material has been successfully validated proceed to place as fill and verify placement:

Record placement on the Fill Location Plan

Record date of placement as Fill

If material fails the validation criteria continue treatment until Target Values are met or remove material to a licensed facility\*\*

**B Inert Material Verification Phase**

Stockpile inert material appropriately\*\*\*

Record location of material on the Stockpile Location Plan

Undertake validation testing in accordance with the agreed frequency\*

Does the material meet the Inert Criteria?

Record placement on the Fill Location Plan

Record date as placement as Fill

If material does not conform to inert criteria transfer material to Treatment Hub and commence treatment in accordance with HYD/MTL/009/A

## Project Information

|                      |       |               |       |
|----------------------|-------|---------------|-------|
| Project Name:        | _____ | Contract No:  | _____ |
| Address:             | _____ | Date/Time:    | _____ |
| Client Name:         | _____ | Weather       | _____ |
| Report Completed by: | _____ |               |       |
| Signed:              | _____ | WAMITAB Cert: | _____ |

Estimated Soil Volume: \_\_\_\_\_

Soil Description: \_\_\_\_\_

|                                                                  |      |                          |
|------------------------------------------------------------------|------|--------------------------|
| Upon inspection does the material match the expected properties? | Yes: | <input type="checkbox"/> |
|                                                                  | No:  | <input type="checkbox"/> |

If answered (Yes) please sign and date.

If answered (No) please indicate 'non-permitted' characteristics

\_\_\_\_\_

|                                            |                                                                    |
|--------------------------------------------|--------------------------------------------------------------------|
| Does the material require further testing? | Does the material need to be stockpiled separately or quarantined? |
| Yes: <input type="checkbox"/>              | Yes: <input type="checkbox"/>                                      |
| No: <input type="checkbox"/>               | No: <input type="checkbox"/>                                       |

Describe any additional containment measures:

\_\_\_\_\_

|                                                  |                                                                                                                                                                                                  |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Does the Environment Agency need to be informed? | <b>Note:</b> unless otherwise agreed with the Agency, any non-permitted soils will be removed from site within 7-days (subject to additional testing and identification of a suitable landfill). |
| Yes: <input type="checkbox"/>                    |                                                                                                                                                                                                  |
| No: <input type="checkbox"/>                     |                                                                                                                                                                                                  |

**IN EMERGENCY CONTACT THE ENVIRONMENT AGENCY ON 0800 807060**



SOP003

## DAILY TREATMENT LOG (SOIL)

## Project Information

Project Name: \_\_\_\_\_ Contract No: \_\_\_\_\_

Address: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Client Name: \_\_\_\_\_ Weather \_\_\_\_\_

Report Completed by:

Signed: \_\_\_\_\_ WAMITAB Cert: \_\_\_\_\_

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Soil Type & Condition:

|                       |
|-----------------------|
| Contaminants Treated: |
|-----------------------|

Treatment Type:

Volume Treated (m3):

|     | Daily | Accumulative |
|-----|-------|--------------|
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|                               |
|-------------------------------|
| Treatment Parameters/ Method: |
|-------------------------------|



Project Information

|                      |  |               |  |
|----------------------|--|---------------|--|
| Project Name:        |  | Contract No:  |  |
| Address:             |  | Date/Time:    |  |
| Client Name:         |  | Weather       |  |
| Report Completed by: |  |               |  |
| Signed:              |  | WAMITAB Cert: |  |

| Day | Summary of remediation activities |
|-----|-----------------------------------|
|-----|-----------------------------------|

|  |  |
|--|--|
|  |  |
|--|--|

**EG**

## Imported Soil Documentation Form

|                                                 |  |
|-------------------------------------------------|--|
| <b>Stockpile Identification Reference</b>       |  |
| <b>Material Type</b>                            |  |
| <b>Source Site</b>                              |  |
| <b>Consignment Note Reference Numbers</b>       |  |
| <b>Volume of Stockpile (or number of loads)</b> |  |
| <b>Plots Material to be used in</b>             |  |
| <b>Stockpile Identification Reference</b>       |  |

### Sketch Plan of Stockpile Location and Sample Points

**Signed** \_\_\_\_\_

**Position** \_\_\_\_\_

**Date** \_\_\_\_\_



## **Appendix C**

### Discovery Strategy/Unexpected Finds



## DISCOVERY STRATEGY- CONSTRUCTION PHASE

### CONTAMINATED MATERIALS

#### SITE: NORTH WALES PRISON, WREXHAM

#### DISPLAY & AWARENESS

- The Discovery Strategy must be placed on the **Health & Safety Notice Board** and / or displayed in a prominent area where all site staff are able to consult the document at any time.
- Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the discovery strategy.

#### HOW TO IDENTIFY POTENTIAL CONTAMINATED MATERIAL

- Looks oily and has an oily odour
- Solvent type of odour
- Man-made materials in fill such as paint cans, car parts, glass fragments
- Contains fragments of white asbestos sheeting, coal/coke clinker
- Sand bags, and or/ subsurface concrete structures

(Examples only – This list is not exhaustive. If in any doubt ask the Site Manager)

#### PROCEDURE

If unexpected evidence of contamination is found the following procedures shall be adhered, including:

1. All site works at the position of the suspected contamination should stop.
2. Site Personnel to inform the Site Manager / Agent.
3. Visual and olfactory observations of the condition of the ground and the extent of contamination should be made and notification shall be given to Hydrock Consultants, who will inform the Local Authority within circa 24 hours after discovery. Should the contamination be likely to affect controlled waters the Environment Agency shall also be informed.
4. In the presence of a suitably qualified geo-environmental engineer, investigation works shall commence to recover samples for testing and, using visual and olfactory observations of the condition of the ground, delineate the area over which contaminated materials are present.
5. Should Hydrock deem it appropriate, the affected material may be excavated and placed in a stockpile on a suitable impermeable surface. This should be suitably quarantined with no addition to, or removal of, the stockpile while chemical analysis is being undertaken. Alternatively, the material should remain *in situ* until laboratory test results have been obtained.
6. A photographic record should also be made of relevant observations.
7. Hydrock will determine the testing suite based on visual and olfactory observations.



8. Test results will be compared against current assessment criteria suitable for the future use of the area of the site affected.
9. If after testing the ground is found to be contaminated, the Local Authority and NHBC shall be informed. After consultation with the Local Authority, NHBC and if necessary the Environment Agency, materials should either be removed for disposal to a licensed waste management facility or remediated to agreed clean-up criteria.

## UNEXPECTED TANKS

It is possible (but unlikely) that underground tanks, which have not been identified by the investigations to date, may be present. The following procedures are to be adhered to if tanks are identified:

1. All site works at the position of the tanks should stop.
2. A description of the tank should be made by Hydrock including; condition and surround, along with visual and olfactory observations should any contents in the tank be apparent. A photographic record should also be made of relevant observations.
3. The tank's position and depth should be determined and marked on a plan of the site.
4. Notification shall be given to Hydrock Consultants who will inform the Local Authority within 24 hours.
5. During the presence of a suitably qualified geo-environmental engineer, investigation works should be undertaken to obtain samples of any liquid or sludge contents and to establish dimensions of the tank.
6. Testing will be determined based on visual and olfactory observations by Hydrock Consultants.
7. Test results will be compared against current assessment criteria and proposals for disposal of any contents determined in agreement with the appropriate Regulatory Parties.
8. Emptying the tank and disposal of contents to a suitable licensed disposal facility.
9. Once the tank has been emptied in accordance with the above proposals, it is to be removed for disposal to a licensed waste management facility. Copies of the relevant waste consignment notes are to be forwarded to Hydrock Consultants.
10. Excavation and remediation of any contaminated soils in accordance with Section 6.1.
11. Samples of the base and sides of the resultant hole will be sampled as per the Engineer's instructions and an assessment as to whether this may have been a source for groundwater contamination made.

A report will be prepared by Hydrock and submitted to the regulatory parties, the Local Authority and the Environment Agency where groundwater may potentially have been impacted.

