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PHASE 1 SITE INVESTIGATION

GOW HOLE FARM
GOWHOLE
FURNESS VALE
DERBYSHIRE
SK23 7QE

REPORT PREPARED FOR

Mr J Wood
Gow Hole Farm, Gowhole
Derbyshire, SK23 7QE

REPORT REFERENCE: 41694R1
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		Notes:		

1.0 INTRODUCTION

Peak Environmental Solutions Limited (PES) has been commissioned by Mr J Wood to provide a Phase 1 Site Investigation for a proposed development site at Gow Hole Farm, Gowhole, Furness Vale, Derbyshire, SK23 7QE. The National Grid Reference (NGR) for the centre of the site is 400950, 383970. The site location is shown in Figure 1 and the current layout in Figure 2.

The ~0.3 hectare site is located to the west of Marsh Lane in Gowhole and to the north of the village of Furness Vale. The site comprises an engineering workshop, a farmhouse adjacent to Marsh Lane and a complex of barns and out-buildings arranged around a yard area. This report has been prepared to assist Mr Wood with site redevelopment by collating relevant historical and environmental information/data relating to potential land contamination. The report will form part of the planning application submissions to High Peak Borough Council (HPBC).

The proposed redevelopment consists of the conversion of a number of the existing structures into five to six residential dwellings with gardens. The farmhouse will remain as a dwelling. The engineering workshop may also be converted into a dwelling. An outline layout for the proposed development is included in Figure 3.

The Phase 1 report includes a site conceptual model, a preliminary risk assessment and presents conclusions and recommendations to assist in site redevelopment for residential use.

The report has been produced in accordance with the umbrella framework laid out in DEFRA/EA CLR-11 '*Model Procedures for the Management of Land Contamination',* BS10175 *'Investigation of Potentially Contaminated Sites'* Code of Practice and NHBC/EA Publication R&D66 (*'Guidance for the Safe Development of Housing on Land Affected by Contamination'*), as well as in general accordance with the National Planning Policy Framework 2012.

The report was finalised in December 2014 and should be read in the light of any subsequent changes in legislation, statutory requirements, statutory and non-statutory guidance, relevant research and industry practices, and should be read in conjunction with the references are provided in Section 6.0. Information provided to or obtained by Peak Environmental Solutions has been relied upon in good faith. This report is subject to the standard terms and conditions of Peak Environmental Solutions and the limitations and exceptions detailed in Appendix A.

2.0 SCOPE OF WORK

2.1 Desk Study and Site Walkover

The information considered as part of the Phase 1 desk study includes historical Ordnance Survey mapping data, geological data/maps and site data held by the Environment Agency (EA) and others. Where appropriate, third party information has been referenced in the report or reproduced in the Appendices, with additional references listed in Section 6.0.

A site walkover was undertaken by Peak Environmental Solutions on the 11th November 2014 to assess the environmental site setting and check for visual evidence of site contamination. Photographs taken during the site walkover are presented in Appendix B. The walkover survey did not include an assessment of asbestos containing materials (ACM) in the buildings or invasive weeds such as Japanese knotweed, Himalayan balsam or Giant hogweed and these aspects fall outside the investigation scope of works.

2.2 Preliminary Risk Assessment

The qualitative preliminary risk assessment (PRA) considers the redeveloped land use and includes development of a conceptual site model (CSM) to assess the significance of risks associated with relevant pollutant linkages (RPLs) identified by a source-pathway-receptor analysis. The assessment of risk is based on a consideration of the following:

- The probability of an event occurring, taking into account both the presence of the hazard and receptor and the plausibility of the pathway (where probability is defined as the chance of a particular event occurring in a given period of time);
- The severity of the potential consequence, taking into account both the potential severity of the hazard (specific to the site) and the sensitivity of the receptor (where severity or consequence can be defined as the adverse effects (or harm) arising from a defined hazard, which impairs the quality of human health or the environment in the short or longer term).

The PRA uses the risk matrix, consequence, likelihood and risk classification scheme (Very Low to Very High) detailed in Appendix E. For the purposes of the qualitative assessment, identified Very Low to Low risks will be considered acceptable for the redeveloped use.

2.3 Conclusions and Recommendations

The report provides conclusions and recommended actions in relation to land contamination issues that should be considered to:

(i) ensure the site is suitable for redevelopment;

(ii) provide information that is likely to be required by HPBC to support a planning application for the development; and

(iii) provide information likely to be required to assist with the discharge of relevant planning conditions.

3.0 PHASE 1 SITE INVESTIGATION RESULTS

The findings of the Phase 1 site investigation or desk study are presented in tabular form as outlined in Table 1.

Table 1: Report Overview

Table Title	Aspect covered
Table 2: Site Description & Environmental Setting	Site Location & Description Contemporary Site Activities Contemporary Neighbouring Landuse Geology Geological Hazards Hydrogeology Hydrology Environmentally Sensitive Areas Conservation Designations
Table 3: Potentially Contaminative Landuse	Historical On-Site Landuse Historical Off-Site Landuse Contemporary On-Site Landuse Contemporary Off-Site Landuse Pollution Incidents Landfill Sites
Table 4: Substances of Concern	Likely contaminants based upon history of site and neighbouring land
Table 5: Conceptual Model & Preliminary Risk Assessment for Redeveloped Land Use	Relevant Pollutant Linkage Assessment Preliminary Risk Assessment (PRA)

Table 2: Site Description & Environmental Setting

Aspect	Comments	Sensitivity (Low, Moderate, High)
Site Location & Description	- The ~0.3 hectare site is located immediately to the west of Marsh Lane in Gowhole, Furness Vale. The National Grid Reference (NGR) for the centre of the site is 400950, 383970. The site location is shown in Figure 1 and the current site layout in Figure 2. - Adjacent to Marsh Lane in the east of the site are a two storey brick built engineering workshop and a 3 storey residential property. An access driveway between the workshop and the house slopes down to the west into a yard area around which the remainder of the site buildings are arranged. To the north of the yard is a long, rectangular, two storey, stone built shippon currently used for storage of machinery and equipment. To the south of the yard, a second rectangular stone built shippon building is fitted out on the ground floor as pig sties, but is currently used for general storage. The first floor of the second shippon is used as a games room. To the south-west of the yard there is an open sided, breeze block and corrugated barn currently in use for storage of machinery, vehicles and other materials including hay. - The central yard area is concrete surfaced and used for parking. In the west of the site there is a garden area with a caravan and summer house. To the south-east, to the rear of the southern shippon is a flat, over-grown area extending to a stream that crosses the site from north-east to south-west. Beyond the stream (to the south), the ground levels rise significantly via an extensive stone built retaining wall to the engineering workshop adjacent to Marsh Lane. Behind (to the south-west) of the engineering workshop is a further unsurfaced yard area. - The site is located on a hillside that falls from Marsh Lane to the east of the site to the River Goyt to the west. The front of the farm house and the engineering workshop are significantly raised over the remainder of the site, which has been partially levelled by cutting into the hillside in the east of the site. The central yard area is flat and at the same level as the adjacent garden in the west of the site. - In the south of the site, a disused and broken circular storage silo with a concrete base is present and, adjacent to the open sided barn, a raised plinth that formerly housed an above-ground diesel storage tank is present. A number of empty intermediate bulk storage containers (IBCs) are currently located in this area. No other above or below ground storage tanks were identified during the site walkover. - One underground structure was identified during the site walkover. A tunnel extends north from inside the northern shippon beneath the adjacent hillside to a breeze block cut off wall after ~8m. The tunnel has no current use. - The locations of features identified during the site walkover are shown in Figure 2.	Not applicable
Visual Evidence for Contamination	- No visual evidence of significant surface contamination was identified during the site walkover.	Not applicable
Contemporary Site Activities	- Significant ground contamination as a result of the contemporary site activities is considered unlikely. No significant quantities of oil were being used/stored in the engineering workshop. No oil storage was noted during internal inspection of the barns. Machinery containing oil (including cars, excavators etc) was being stored in various areas. No significant leaks or spills were noted during the walkover.	Not applicable

Aspect	Comments	Sensitivity (Low, Moderate, High)
Contemporary Neighbouring Landuse	- The following land uses immediately surround the site: • North: An access track and a field are present to the north of the site. • East: Marsh Lane and a field with some trees are present to the east with a large substation ~110m to the east at its closest point with railway lines beyond. The stream that flows through the site follows a tree line within the adjacent field. • South: A builders yard area, at the same level as the engineering workshop is present immediately to the south of the site. This area extends into woodland adjacent to the River Goyt. To the south, beyond the River Goyt is a field. • West: The River Goyt bounds the site to the west and south-west along the entire boundary length. The river at this location is ~8 m wide. Beyond the river, an area of trees extends to a large foam manufacturing plant (Trident Foams) ~30m to the south-west of the site.	**Moderate/High** - The River Goyt is present immediately adjacent to the site.
Proposed Site Use	- The proposed development layout is shown in Figure 3 and consists of five to six residential dwellings with gardens formed by the conversion of a number of the existing site buildings.	**High** - The proposed residential property represents a High sensitivity receptor to any on-site contaminant sources.

Aspect	Comments	Sensitivity (Low, Moderate, High)
Geology	- Information relating to the superficial and bedrock geology of the area has been obtained from the 1:50,000 scale geological mapping and was reviewed via the British Geological Survey (BGS) website (bgs.ac.uk). - Superficial (Drift) Geology: The mapping indicates that superficial alluvial deposits are present at the site surface. These are normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. River Terrace Gravels are also recorded in the near vicinity and may be present beneath the site. The superficial alluvial deposits are also likely to be underlain by Glacial Till deposits. - Solid (bedrock) Geology: The geological map indicates that solid geology beneath the site consists of the Milnrow Sandstone of the Carboniferous Pennine Lower Coal Measures. The Coal Measures consist of mudstones, siltstones and sandstones with subordinate coal seams. - The BGS also produce a database of logs for boreholes drilled across the UK. The nearest recorded log is located ~75m to the south-west of the site. The log records the presence of the Jow Hole Tunnel Portal (the Gow Hole Tunnel) as a former mine drainage adit built circa 1853 and later adopted for private and later public water supply. The tunnel is reported to have been driven 'to and beyond Lady Pit'. Lady Pit is a colliery historically located ~ 400m to the east of the site. - The database also records logs for boreholes drilled close the railway lines to the north-east of the site. These extended to around 10m below ground level (mbgl) and record the presence of glacial till deposits overlying sandstone at a depth of around 8 mbgl. Ground levels in this location are however likely to be raised significantly above the site levels. - The site is within an area that the Coal Authority recommend consideration be given to risks associated with past coal mining during development (a Coal Mining Reporting Area). A Coal Authority Mining Report for the site has been obtained and is presented in Appendix D. - The Coal Authority indicate in the report that according to their records, the site is not within the zone of likely physical influence on the surface from past underground workings. The Authority also state however that the site is in an area they believe that there is coal at or close to the surface. They state that this coal may have been worked at some time in the past and recommend that the potential presence of coal workings at or close to the surface be considered prior to any site works or development activity. The Coal Authority are not aware of any coal mine entries within 20m of the site. - According to the Radon Atlas produced by the Health Protection Agency, the site is located in an area where the estimated probability of the property being above the Action Level for radon is between 5 to 10% .	**Low - Moderate** - The bedrock geology does not represent a important geological resource. - The site is in an area where coal mining risks need to be considered. - The site is in an area where radon may affect the development.

Aspect	Comments	Sensitivity (Low, Moderate, High)
Hydrogeology	- EA defined groundwater vulnerability data records an aquifer status for superficial alluvial deposits and bedrock deposits. Both are classified as a Secondary A aquifer*: permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.* - The EA groundwater vulnerability map records the site as being over a minor aquifer with a high vulnerability to surface pollution. - The site is not within an EA defined Source Protection Zone (SPZ) for the protection of important groundwater resources within the area. The nearest SPZ is located >5 km to the east of the site. - No EA licensed groundwater abstractions have been identified on the EA database within 500m of the site. - The EA do not record the site as being within a Nitrate Vulnerable Zone (NVZ) for groundwater.	**Moderate** - Groundwater beneath the site is of relatively low sensitivity and is not abstracted for use in the vicinity of the site. Groundwater resources are recorded as being sensitive to surface pollution.
Hydrology	- An 1m wide un-named surface watercourse (tributary of the River Goyt) crosses the site from north to south. The watercourse was free and fast-flowing at the time of the site walkover. - The River Goyt flows to the north-west adjacent to the site boundary. - The unnamed watercourse is culverted beneath Marsh Land and then flows immediately to the north of the engineering workshop. It discharges to the River Goyt at the site boundary. No evidence for any surface water pollution was noted during the site walkover. - The EA do not hold any current or historic river water quality records for the River Goyt or its tributary in the vicinity of the site. - The site is in an area that the EA consider to be at risk of flooding. It is understood that risk of flooding is being considered as part of the development process. - No licensed abstractions from surface water recorded on the EA website within 500m of the site. - The EA do not record the site as being within a NVZ for surface water.	**High** - The site is not in very close proximity to surface water courses.
Environmentally Sensitive Areas/ Conservation Designations	- The Government Information website www.magic.gov.uk lists conservation designations for the area. The site is not located within an environmentally sensitive area. There are no designated areas or sites within 500m of the site including Areas of Outstanding Natural Beauty (AONB), Environmentally Sensitive Areas (ESA), Local Nature Reserves (LNR), National Nature Reserves (NNR), Sites of Special Scientific Interest (SSSI) or Specially Protected Areas (SPA). No Scheduled Ancient Monuments are present in the vicinity of the site.	**Low**

Table 3: Potentially Contaminative Landuse

Aspect	Comments	Sensitivity (Low, Moderate, High)
Historical Site Landuse	- Historic Ordnance Survey maps for the site have been obtained and are presented in Appendix C. The maps have been used to identify potentially contaminative historic land uses that may have been carried out on the site and within the near vicinity. - 1881/2: Two buildings are shown on the site in the locations of the farmhouse and the two shippon barns indicating that they were all constructed prior to this date. - 1888: A building is shown in the location of the engineering workshop, although its shape does not correspond exactly to the current building. The southern shippon appears to be divided into several adjoined buildings. - 1890/91: No significant change. - 1898: The site buildings appear to be in approximately their current layout with the exception of the open sided barn. - 1912/3: No significant change. - 1921 - 1924: No significant change. - 1938: No significant change. - 1948: No significant change. - 1954/5: No significant change. - 1968 - 1972: No significant change. - 1977 - 1983: No significant change. - 1989: The open sided barn in the west of the site has been constructed. - 1994: No significant change. - 1995: No significant change. - 2006: No significant change.	**Moderate** - Most of the site buildings have been in place since prior to the date of earliest mapping. Their exact use throughout this period is not known.

Aspect	Comments	Sensitivity (Low, Moderate, High)
Historical Off-Site Landuse	- 1881/2: The River Goyt and railway lines to the east are marked in their current positions. A smithy is shown ~30m to the south of the site and a small quarry ~30m to the north. Two gasometers are marked ~50m to the west and to the south of the site. The Furness Vale Print Works is an extensive development shown to extend to within 50m of the west of the site. The Lady Pit (coal mine) is shown ~400m to the east of the site. - 1888/9: The smithy to the south of the site appears to extend to the site boundary (possibly onto the site). Railway lines are also shown close to the south of the site. These are assumed to be associated with a colliery marked within ~50m of the south west of the site. A chimney is also shown in this area. Extensive mill ponds are shown to the south of the River Goyt, in close proximity to the site. - 1890/91: No significant change. - 1898: The print works to the west of the site has expanded further with tanks and buildings extending to within 50m of the west of the site. The colliery to the south also appears to have expanded. - 1912/3: No significant change. - 1921 - 1924: Railway lines to the south of the site have been removed and the smithy and colliery in this area are no longer marked. Gasometers to the south and west of the site are no longer marked as such. - 1938: A 'Shaft' is shown ~50m to the south-east of the site. The Lady Pit mine is marked as 'disused'. - 1948: No significant change. - 1954/5: Construction work on the substation to the east of the site appears to have begun. - 1968 - 1972: The Furness Vale Print Works is annotated 'disused'. The substation now exists to within ~110m of the east of the site. - 1977 - 1983: No significant change. - 1989: (Some data missing). Mill ponds to the south/south-west of the site have been infilled. - 1994: The print works is now marked as an industrial estate. - 1995: (Some data missing) Construction has occurred on the site of the former mill pond to the south/south-west of the site. - 2006: The former mill ponds now form part of an industrial estate (foam manufacturer). The former print works is shown as the Furness Vale Business Centre.	**High** - The site is located in an area where significant industrial development has occurred in close proximity.

Aspect	Comments	Sensitivity (Low, Moderate, High)
Other Historical Information	- Mr J Wood reported that he and his family have owned and occupied the site for the last ~20 years using it as a dwelling and for storage, along with engineering operations in the workshop adjacent to Marsh Lane. - It is understood that prior to Mr Wood purchasing the site, that it was used for animal rearing by Manchester University. Remaining evidence for this use includes the pig sties in the southern shippon; the upstairs space was also reportedly used for rearing guinea pigs. - Diesel is understood to have been stored in an above-ground tank adjacent to the open sided barn in the west of the site.	**Moderate/low** - Diesel and old vehicle storage may have resulted in limited ground contamination. - Historic site activities are only partially understood.
Contemporary On-Site Landuse	- No site activities are subject to any current or historic environmental permit or licence. - No visual or olfactory evidence of surface contamination was noted during the site walkover.	**Moderate/Low** - See above.
Contemporary Off-Site Landuse	- There is one process subject to EA regulation within 1 km of the site recorded on their database: wastewater treatment is licensed at the Whaley Bridge sewage treatment works located adjacent to the River Goyt approximately 800m upstream of the site.	**Low**
Pollution Incidents	- A 2011 pollution incident is recorded on the EA database: sewage materials were released to the River Goyt from the wastewater treatment works at Whaley Bridge. On-going impacts to the site are considered unlikely.	**Low**
Landfill Sites	- According to the EA database, two historic landfill sites are located 20 to 30m to the west of the site. The Disused Mill Lodge landfill and the Lodge Farm Landfill both appear to be infilled mill ponds associated with the former print works. The Disused Mill Lodge landfill received waste between 1979 and 1990 and is recorded as having received inert, industrial and commercial waste. The Lodge Farm landfill is recorded as having received inert and industrial waste between 1977 and 1987. - No currently operational landfill sites are recorded within 1 km of the site.	**High/Moderate** - Potentially contaminative and biodegradable waste has been historically deposited on land in the immediate site vicinity. - The landfill site has been partially redeveloped as a foam manufacturing site.

Table 4: Substances of Concern

Group	Substances	Comments
The site is located in an area with a long history of industrial land use including a smithy and two landfill sites within 30m of the site boundaries. In addition, a colliery and two gasometers were historically present within 50m of the site boundaries. Historical diesel fuel storage at the site.		
Inorganic Substances	- Metals. Typically characterised by: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc - Asbestos containing materials (ACMs)	- Anthropogenic metals associated with metal processing immediately to the south of the site may be present. - Coal storage and use are also likely to have occurred at the site as a result of mining and a colliery in the vicinity and possibly beneath the site. - ACMs may be present within the current site buildings and possibly site soils.
Organic Substances	- Oil/petroleum hydrocarbons. Typically characterised speciated aliphatic & aromatic total petroleum hydrocarbon (TPH) fractions C5-C44 - BTEX (benzene, toluene, ethylbenzene, xylenes - Polyaromatic hydrocarbons (PAHs). Typically characterised by the 'Priority 16' PAHs: naphthalene, acenaphthene, acenaphthylene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo-a-anthracene, chrysene, benzo-b-fluoranthene, benzo-k-fluoranthene, benzo-a-pyrene (BaP), dibenzo-a,h-anthracene, benzo-g,h,i-perylene, indeno-1,2,3-c,d-pyrene	- Anthropogenic TPH may be present as a result of semi industrial land use on site and in the immediate vicinity. - Oil storage has historically been carried out at the site. - PAHs are associated with coal use and processing and gas production and may be present as a result of land uses on or around the site.
Ground Gases	- Methane - Carbon dioxide - Volatile organic compound (VOC) vapours - Radon gas	- Landfill gas may migrate onto the site from nearby landfilling operations (landfilling occurred to the west of the River Goyt which may act as a barrier to migration. The fill depth is not known however and on-site migration is considered possible). - Vapours may be generated
The substances listed in Table 4 are those that may be present in the ground at the site based on the evidence presented in Tables 1 to 3. The selection of the potential specific substances and hazards of concern has been guided by our experience of brownfield sites, the primary sources present and information/guidance provided in published DOE industry profiles, CLR-8 (officially withdrawn, but still a valuable resource), EA publication R&D66:2008 and other relevant references. These documents have been used as an additional screening tool to help assess the significance of contaminants and contaminant/hazard groupings and help decide which contaminants/hazards warrant consideration by the Phase 1 site investigation as potential substances and hazards of concern.		

Table 5: Conceptual Model & Preliminary Risk Assessment for Redeveloped Land Use

Source	Sensitive Receptor	Pathway	Consequence	Likelihood	Risk Classification	Comments
Inorganic & organic substances in site soils and existing buildings	**Human Health (On site)** Future site users	Direct contact via Ingestion & dermal pathways	Medium	Likely	Moderate risk	If contaminants are not present in site soils, risks will be low. Based on the history of the site and its surroundings however, sampling and analysis will be necessary to confirm the contamination status of site soils. Contaminants may also be present within building materials.
		Inhalation of dusts	Medium	Likely	Moderate risk	
		Inhalation of vapours	Medium	Likely	Moderate risk	
	Human Health (Off site) Neighbouring properties	Inhalation of dust Inhalation of vapours	Medium	Unlikely	Low risk	-
	Controlled Waters Groundwater Off-site surface waters	Soils leaching to groundwater Lateral groundwater flow Discharge to surface waters	Medium	Likely	Moderate risk	Surface water is in very close proximity to the site and if contaminants are present, leaching to surface water in particular may be occurring.
	BBM&S Buildings, Building Materials and Services	Contact with soils and pore water	Medium	Likely	Moderate risk	Contaminants may affect performance of buildings/service materials.
	BBM&S Structures & Services	Vapour entry in structures and services	Medium	Unlikely	Low risk	Significant volatile contaminant concentrations are considered unlikely based on the age of the majority of contaminant sources in the area.
	BBM&S Potable water pipes	Contact with soils and pore water	Medium	Likely	Moderate risk	Contaminants may affect performance of pipes or enter water supply via underground pipework.
Ground gases	**Human Health (On site)** Future site users	Gas and vapour accumulation in buildings and services.	Medium	Likely	Moderate risk	Migration of ground gases from near-by landfilling operations cannot be ruled out without further information about the landfill or ground gas monitoring.
	Human Health (Off site) Neighbouring properties		Medium	Unlikely	Low risk	See above.
	BBM&S	Entry in structures and services	Medium	Likely	Moderate risk	See above.
Radon gas	**Human Health (On site)**	Inhalation	Medium	Low likelihood	Moderate/Low risk	Installation of basic radon protection measures will need to be considered in the development proposals.

Note: Identified Very Low and Low risks are considered acceptable for the redeveloped use.

4.0 CONCLUSIONS

4.1 Overview

The Phase 1 site investigation has identified the following key details about the site:

Sources of contamination

- With the exception of the last ~40 years, the exact use of the site buildings is not well understood based on the Phase 1 assessment. Agricultural use is considered most likely. However, the presence of a tunnel in the northern shippon and a smithy and colliery immediately to the south of the site indicates a possible (at least partial) historic site use for metal or coal processing and these uses may have resulted some ground contamination.
- Significant ground contamination as a result of the land use during the last ~40 years is considered unlikely. Diesel and vehicle storage and engineering work have however been carried out during this period and may have led to localised contamination hotspots.
- Two landfill sites have been identified in close proximity to the west of the site and migration of ground gases from these sources onto the site is considered possible. The presence of the River Goyt and its associated channel between the site and the landfills may remove potential contaminant migration pathways. However, migration of gases beneath the river channel cannot be ruled out without either additional information.
- Several other potentially contaminative historic land uses have been identified within relatively close proximity to the site. Coal gas production (probable), a printing works, metal processing (smithy), mining activities and a colliery have all been present in relatively close proximity to the site.
- The development proposal includes for the conversion of existing buildings and existing building materials may be contaminated (including with asbestos containing materials) as a result of past uses.

Pathways and receptors

- The future occupants of the converted residential properties will be the principal receptor for any contaminants that are present within site soils or buildings. Potential exposure pathways will include direct contact with contaminants, inhalation of soil dusts and the ingestion of site grown vegetables.
- The inhalation of soil vapours both indoors and outdoors will also need to be considered as a potential exposure pathways.
- Controlled water receptors may also be affected by contaminants at the site, surface water in particular is in very close proximity. However, specific consideration of this receptor may not be considered appropriate during the development process as the contribution to contaminant loading to the watercourse from the site is likely to be limited in the context of its surroundings.
- Other BBM&S receptors, including drinking water pipes and building materials, may also could also be affected by contaminants at the site.
- Adjacent land uses are unlikely to be significantly affected by contaminants at the site.

4.2 Preliminary Risk Assessment

Based upon the findings of the Phase I desk study, the PRA currently indicates:

- There is a *Moderate Risk* to future site users from potential site contamination.
- There is a *Low Risk* to off-site human health receptors from potential site contamination.
- There is a *Moderate Risk* to controlled waters from potential site contamination.
- There is a *Moderate Risk* to BBM&S from direct contact with potential site contamination.
- There is a *Moderate Risk to BBM&S* from ground gas and soil vapours.
- There is a *Moderate/low risk* to on site human health from radon gas.

Identified Very Low and Low risks are considered acceptable for the redeveloped use

5.0 RECOMMENDATIONS

Based on the findings of the Phase I site investigation and PRA, Peak Environmental Solutions recommend that the following actions be considered to manage the identified potential land contamination risks associated with development of the site:

- Phase 2 site investigation to include:
  - Targeted soil sampling around potential contaminant sources and in the proposed garden areas;
  - An assessment of the buildings to be converted for ACMs and other contaminants;
  - Generic/detailed quantitative risk assessment (GQRA/DQRA, as appropriate) to assess the significance of the potential contamination sources identified.
- A further assessment of the requirement for Phase 2 investigation to quantify risks associated with landfill gas generation and migration onto the site should be completed. This should initially involve obtaining any available information about the off site landfills from HPBC and the EA via site specific discussions as part of the planning process. If potential gas migration pathways to the site are considered possible, installation of gas monitoring wells in suitable locations to assess potential on-site migration of gases from the nearby landfill sites should be completed;
- Although the site is not located within a Coal Authority development high risk area, the Coal Authority Mining report identified potential risks associated with shallow coal mining in the vicinity of the site. The requirement for further assessment of risks associated with shallow mine workings should be discussed with the planning department at HPBC.
- Following the Phase 2 assessment, production of a land contamination remediation/protection strategy to ensure that existing buildings and existing and new site soils (including imported soils/sub-soil) do not represent a risk to the future site occupants and the environment following redevelopment. Imported materials or reused site-won materials should be managed and verified in an appropriately controlled and documented manner. Where appropriate, consideration should be given to adopting the CLAIRE 'Definition of Waste Development Industry Code of Practice' (DoW CoP).
- The remediation/protection strategy should include a Discovery Strategy/Protocol should unexpected impacted made ground deposits and/or natural soils and waste deposits be encountered during development.
- Potential ACMs in the buildings and site soils should be managed in-line with HSE guidance (http://www.hse.gov.uk/Asbestos/managing/index.htm). The proposed soil sampling and laboratory testing should include asbestos inspection/analysis.
- Liaison with Building Control to determine the requirements for ground gas, radon and/or soil vapour protection measures for the development.
- New site services should be laid in appropriate service corridors.
- Water supply services should comply with industry best practice for site development.
- Production of a verification report to document the successful implementation of the land contamination remediation/protection strategy and other mitigation measures implemented or relied upon.

6.0 REFERENCES

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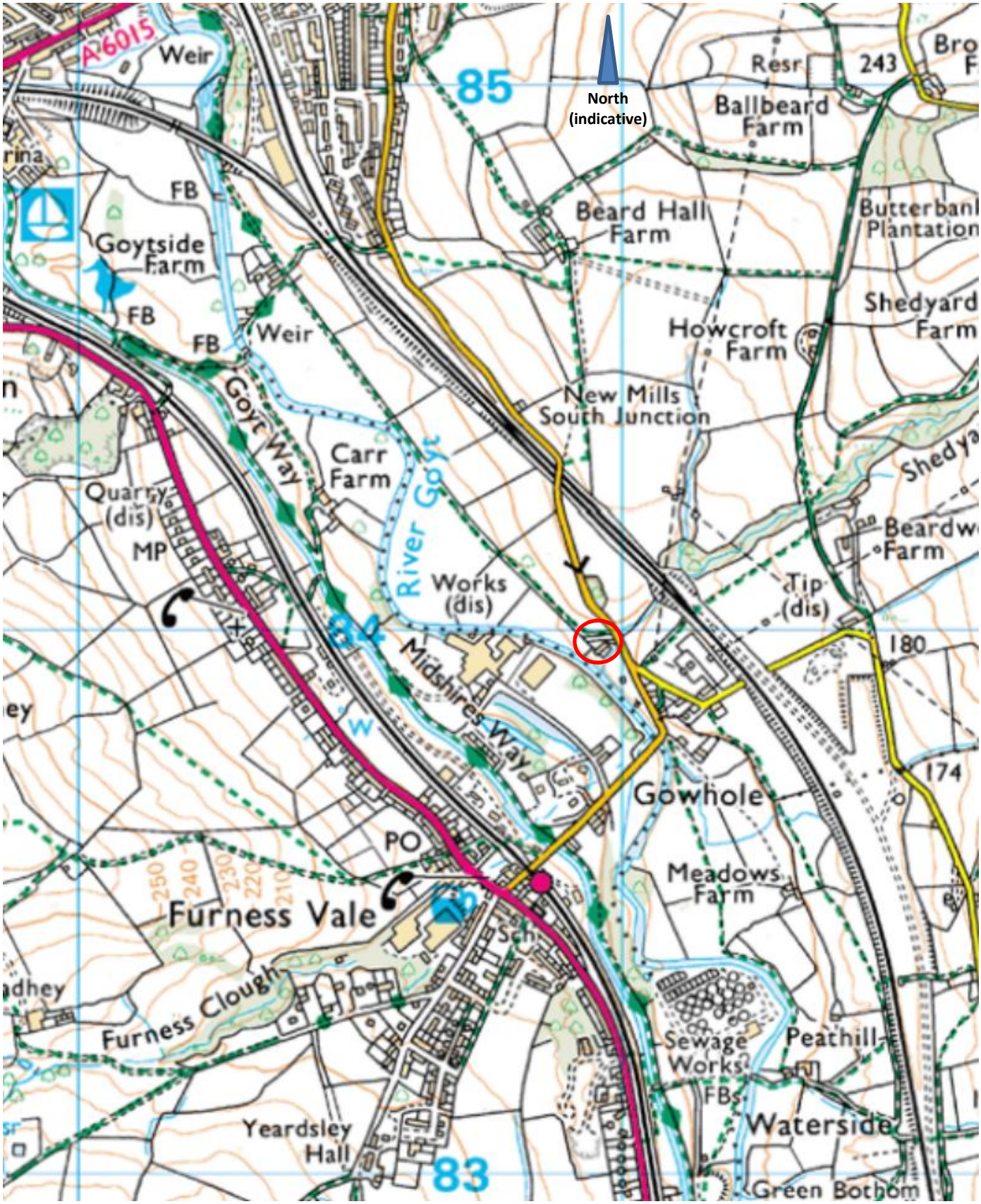
FIGURES



Site Location

Figure 1	Site Location Plan	Scale: Not to scale
41694	Gow Hole Farm, Gowhole, Furness Vale	

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Site Boundary (approximate)

Figure 2	**Site Layout Plan**	**Scale: Not to scale**
41694	**Gow Hole Farm, Gowhole, Furness Vale**	

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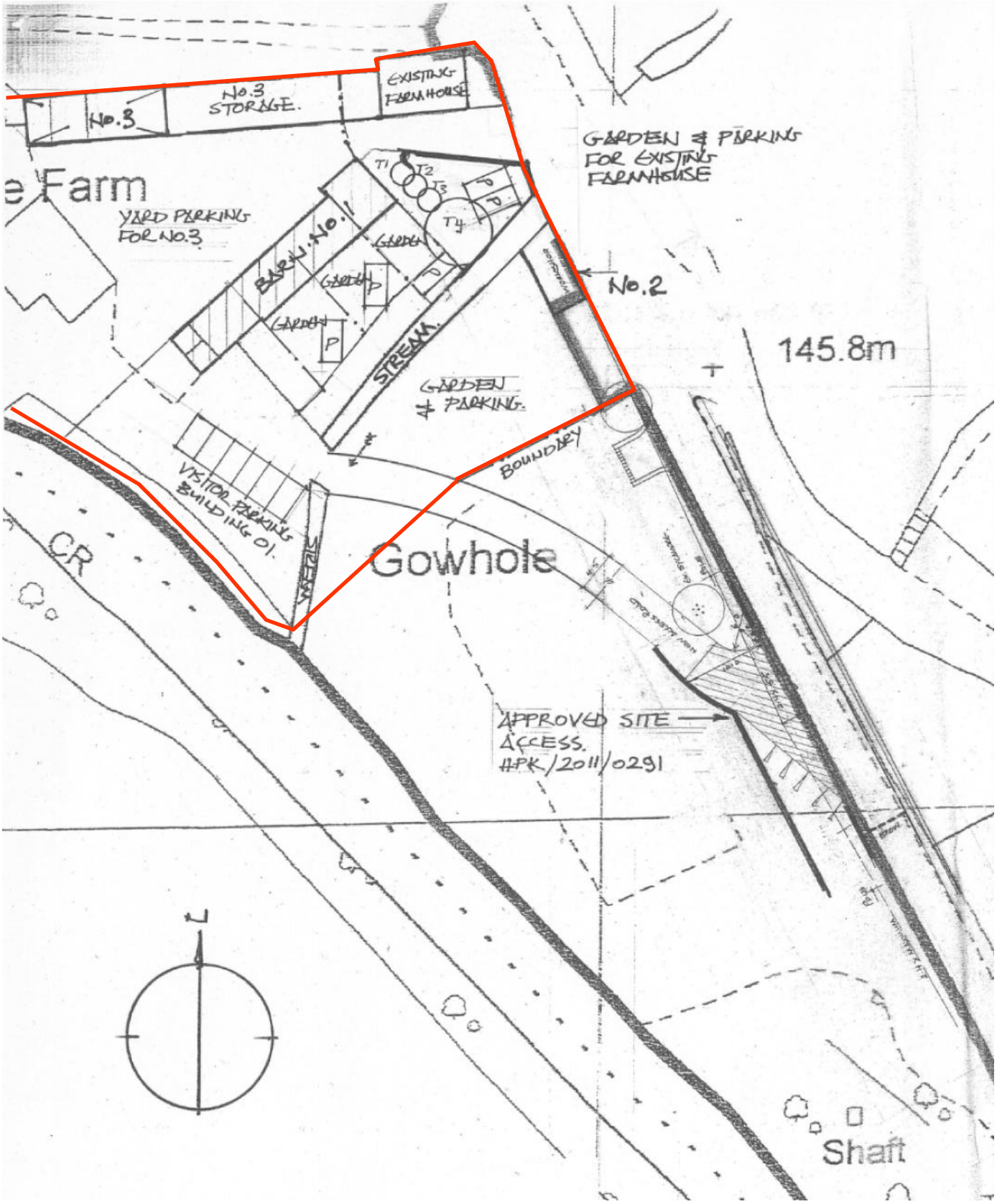

Approximate boundary

Figure 3	**Proposed Site Layout Plan**	**Scale: Not to scale**
41694	**Gow Hole Farm, Gowhole, Furness Vale**	

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APPENDICES

APPENDIX A

LIMITATIONS AND EXCEPTIONS OF ASSESSMENT

LIMITATIONS AND EXCEPTIONS OF ASSESSMENT

Mr J Wood (the Client) has requested that a Phase 1 Site Investigation (the 'Project') be performed at the site. The report (and any copies of it) have been prepared for the sole use and reliance of the Client. This report s (and any copies of it) shall not be relied upon or transferred to any other parties without the express written authorisation of Peak Environmental Solutions limited. If an unauthorised third party comes into possession of this report, (and any copies of it) they rely on it at their peril and the authors owe them no duty of care and skill. Findings and opinions conveyed in the services should only be used by competent persons acting on the behalf of the Client and the findings and opinions conveyed in the services should only be used for the intended use. Copyright of reports & documents remains with Peak Environmental Solutions Limited. The project and report are subject to Peak Environmental Solutions standard terms and conditions.

Authorised or unauthorised copies of this document may come into the possession of organisations that are designated under the Freedom of Information Act 2000 ("the Act"). Such organisations that are designated in the Act are requested by Peak Environmental Solutions to respect the above statements relating to confidentiality and copyright.

The findings and opinions conveyed via this report are based on information obtained from a variety of sources as detailed within this report, and which Peak Environmental Solutions Limited believes are reliable. Nevertheless, Peak Environmental Solutions Limited cannot and does not guarantee the authenticity or reliability of the information it has relied upon. The report represents the findings and opinions of experienced geo-environmental consultants. Peak Environmental Solutions Limited does not provide legal advice and the advice of lawyers may also be required.

The opinions presented in this report are based on a review of records, available investigation reports and historical sources. Peak Environmental Solutions Limited has found indicators that suggest that geo-environmental hazards may exist at the site and these may warrant mitigation or consideration appropriate to the end use stated by the Client. Not finding such indicators does not mean that geo-environmental hazards do not exist at the site. In addition, the Risk Assessment did not include any enquiry with respect to substances not included within the substances of concern.

The Client is advised that the geo-environmental conditions stated within reports supplied to Peak Environmental Solutions Limited are subject to change. Certain indicators of the presence of geo-environmental hazards may have been latent at the time of the most recent site reconnaissance and may subsequently have become observable. It is possible that Peak Environmental Solutions research, while fully appropriate for the Project, failed to indicate the existence of important information sources. Assuming such sources actually exist, their information could not have been considered in the formulation of Peak Environmental Solutions findings and opinions.

Certain indicators or evidence of geo-environmental hazards may have been outside the very limited portion of the subsurface investigated or monitored, latent at the time of this work or only partially intercepted by the works and thus their full significance could not have been appreciated. Groundwater levels are particularly susceptible to variations due to seasonal or other effects. Accordingly, it is possible that Peak Environmental Solutions work, whilst fully appropriate for the Project failed to indicate the presence or significance of geo-environmental hazards. Assuming the presence of a hazard, it could not have been considered in the formulation of Peak Environmental Solutions findings and opinions. The subsurface geological profiles and other descriptions are generalised by necessity and have been based on the information found at the locations of the exploratory holes and depths sampled and tested.

The geotechnical comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of geotechnical and analytical tests made in the field and laboratory. However, there may be special geotechnical conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report. Accordingly, a careful watch should be maintained in any future groundworks and the geotechnical findings and recommendations of this report reviewed, if necessary as work proceeds.

Any interpretation of the results of the Project have been based on the proposed site usage and the findings are not valid should the proposed land use and/or the regulatory regime/guidance change. Where interpretation is based on public domain guidance/protocols/models/software/code, Peak Environmental Solutions is not liable for errors in the guidance/protocols/models/software/code.

Peak Environmental Solutions Limited believes that providing information about limitations is essential to help the Client identify and thereby manage their risks. These risks can be mitigated, but they cannot be eliminated, through additional research. Peak Environmental Solutions Limited will on request, advise the client of the additional research opportunities available, their impact on risk, and their cost.

In preparing this report, it has been assumed that all past and present occupants have provided all relevant and other information, especially relating to known or potential geo-environmental hazards. This report is not required to identify insufficiencies or mistakes in the information provided by the user/owner or from any other source, but has sought to compensate for these where obvious in the light of other information.

APPENDIX B

SITE PHOTOGRAPHS

1	Gow Hole Farmhouse and site entrance viewed from Marsh Lane

2	Two storey engineering workshop viewed from Marsh Lane
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3	**The northern shippon to the rear of the farmhouse**

4	**The southern shippon and central yard area**
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5	Looking across the central yard area towards the open sided barn

6	Proposed garden area to the rear of the southern shippon
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7	Surface water course and retaining wall crossing the site

8	Garden area at the south of the site looking towards the River Goyt at the southern site boundary
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9	Former diesel storage area adjacent to the open sided barn

10	Yard and proposed garden area to the rear of the engineering workshop
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