

STAGE 2 CONTAMINATION ASSESSMENT

Former Coal Yard, Lloyd's Lane, Chirk

For: Messers A & B Roberts

March 2018

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1. Introduction

- 1.1. Smith Grant LLP (SGP) was instructed by Messer A & B Roberts to undertake a Stage 2 Contamination Assessment for the former coal yard off Lloyd's Lane, Chirk. A Stage 1 Contamination Assessment for the site was produced by SGP in November 2017 (ref. R2280-R01) and included recommendations for a Stage 2 intrusive site investigation to confirm contamination risks and outline remediation requirements in connection with the proposed residential redevelopment of the site. Site details are:

Table 1.1: Site Details

Address	Former Coal Yard, Lloyds Lane, Chirk, LL14 5PU
National Grid Reference	329354, 338270
Local Authority	Wrexham County Borough Council
Site Area	3,150m ²
Current Nature of Site	Vacant land
Site Access	Off Lloyds Lane
Proposed use	Erection of four pairs of semi-detached and one detached properties with private garden area and formation of vehicular access
Planning ref	P/2017/0459

Figure 1.1: Site Location



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- 1.2. The site presently consists of a vacant irregular shaped parcel of land with a slight slope from east to west. Several small buildings are present across the site with two material storage areas with associated partitioning walls along the northern boundary of the site.

- 1.3. This report describes the Stage 2 Contamination Assessment (site investigation) undertaken by SGP as part of due diligence prior to the sale of the site in order to identify any potential constraints to the proposed development with relation to ground contamination. The report methodology follows the framework described in the EA/DEFRA Contaminated Land Report 11: "Model Procedures for the Management of Land Contamination 2004". This report should be read in conjunction with the Stage 1 Contamination Assessment (ref. R2280-R01).
- 1.4. The report comprises descriptions of the intrusive site investigation including the collection and analysis of representative soil samples for a suite of contaminants consistent with the former and surrounding land use, risk assessments, review of remediation requirements and options and outline recommendations for remedial measures.
- 1.5. Geotechnical assessment and potential construction design issues fall outside the scope of this report and are not considered further.

2. Information Sources

- 2.1. The principle sources of information consulted in the preparation of this report are outlined in the stage 1 desk study in addition to the site investigation works undertaken as part of this report.
- 2.2. Site Inspection
 - 2.2.1. A site inspection was carried out by P Magraw (Consultant) of SGP on 1st January 2017 as part of the Stage 1 Contamination Assessment Report.
- 2.3. Previous Investigations
 - 2.1.1. SGP understand that no previous intrusive site investigation has taken place at the site.
 - 2.1.2. A preliminary ecological appraisal and bat survey undertaken by Gerald Longley Ecological Consultants and a stage 1 tree survey & preliminary arboricultural plans undertaken by Tree Solutions Ltd are known to have been undertaken at the site.
- 2.4. Proposed Investigation
 - 2.4.1. SGP produced a detailed methodology for intrusive investigation (Stage 2 Contaminated Land Assessment) within the recommendations outlined within the Stage 1 Contamination Assessment Report. Proposed works included:
 - excavation of an appropriate number of trial-pits to a maximum depth of 3m bgl;

- logging and sampling of soil strata by a suitably experienced and qualified Environmental Consultant;
- submission of soil samples to MCERTS / UKAS accredited laboratories for specified analysis to include pH, metals, PAHs, TPHCWG, BTEX and asbestos;
- provision of a comprehensive Stage 2 Contamination Assessment Report including:
 - Interpretation and revised CSM
 - Quantitative risk assessment for impacts on receptors as appropriate
 - Remedial options review and provision of outline recommendations

2.4.2. The above investigations have now been completed with the findings of the intrusive investigation, together with the factual information from the previous reporting utilised to produce an updated site characterisation, risk assessment and recommendations for remedial works.

3. Investigation Methodology

3.1. Preliminary Conceptual Site Model

- 3.1.1. The identified previous use of the site and historical features identified within the Stage 1 reporting indicated the potential for soil contamination. The site was occupied by a coal yard from sometime prior to 1961 mapping before its closure in 2016. Potential on-site sources of contamination were identified as the widespread covering of made ground which may contain elevated contaminants associated with urban soils, and potential hotspot areas associated with spills or leaks of fuels, oils and/or lubricants. Two of the remaining buildings have been observed to contain suspected asbestos cement sheeting.
- 3.1.2. The site is located within a predominantly residential setting with land to the east, south and west being occupied with residential development. Land adjacent to the north consists of a playing field associated with a primary school. The Brynkinalt Colliery with associated shafts and open pit mining was present approximately 200m to the south east of the site which has subsequently been infilled. The potential for off-site contamination to migrate laterally onto the site is considered unlikely due to the distance from the Colliery, the cohesive nature of the surrounding strata at the site and the age of the infilling.
- 3.1.3. The proposed residential redevelopment of the site will include 9 dwellings with associated infrastructure. This change of land use and construction results in the addition of new receptors (construction workers and future site occupants / visitors) which are considered highly sensitive with respect to human health risks.
- 3.1.4. The site is in an area of low environmental sensitivity as far as groundwater is concerned with the underlying bedrock of Lower Pennine Coal Measures supporting a Secondary A aquifer, although this is not located within a water abstraction zone and substantial protection to the

aquifer will be afforded by the mapped low-permeability drift deposits. The controlled water risk is considered negligible at the site.

3.2. Objectives and Rationale

3.2.1. The proposed redevelopment of the site for residential occupancy is of high sensitivity. Intrusive investigations have therefore been undertaken to:

- confirm the ground conditions underlying the site;
- determine the presence, extent and nature of made ground and soil contamination;
- confirm the presence, if any, of residual contamination from fuel leakage on site or from migration of off-site sources;
- Inform the remedial requirements necessary for the development to remove any contamination risks identified and allow the proposed redevelopment to take place without risks to human health or the wider environment.

3.2.2. Soil sample collection was designed to:

- Include samples representative of the various types of made ground present in each trial pit for human health risk assessment;
- Include any soils having contamination indicators.

3.3. Fieldwork

3.3.1. The site investigation utilised trial pits to permit inspection and logging of strata, to obtain samples from the made ground and natural strata. Trial pit locations are shown on Drawing 01.

3.3.2. The investigation was undertaken on 15th February under the supervision of SGP Consultants Cezary Salwa and Phillip Magraw.

3.3.3. Works involved:

- excavation of 8 trial pits (TP1- TP8) using an excavator to a maximum depth of 3.3m bgl;
- inspection and logging of ground conditions;
- Collection of 10 soil samples for a range of laboratory analyses (see Table 5.1).

3.3.4. Intrusive entries were slightly constrained due to the presence of remaining buildings. However, the buildings only covered modest areas and a number of entries were located adjacent to the buildings to provide information on the local underlying ground conditions.

3.3.5. It is considered that sufficient coverage of entries across the site have been achieved to provide a sufficient spatial coverage for the purposes of the investigation.

3.4. Chemical Analysis

3.4.1. Chemical analysis of soils were carried out by Concept Life Sciences Laboratories, Manchester, working where possible to MCERTS and / or ISO 17025 accreditation. Soil samples were stored in appropriate containers as advised by the laboratory, placed in a chilled cool box, and delivered to the laboratory within 24 hours. Chain of custody documentation was completed and is retained by SGP.

3.4.2. Representative soil samples were taken from the following horizons and submitted for a standard contaminant suite (pH, SOM, metals, PAH 16, TPHCWG and an asbestos screen). Information pertaining to the sampled strata, soil description and submitted analytical suite is detailed in the table below:

Table 3.1: Summary of Soil Chemical Analysis

Strata	description	sample ref	depth (m bgl)
Made Ground	Reddish brown sandy angular GRAVEL with occasional cobbles of brick	TP1-1	0.3
Made Ground	Blackish grey clayey GRAVEL of brick	TP 6-1 TP 7-1 TP 8-1	0.2 0.2 0.2
Made Ground (Relict topsoil)	Dark grey sandy slightly gravelly silty CLAY with frequent rootlets	TP1-2 TP7-1 TP 2-1	1.0 0.2 1.0
Made Ground	Blackish grey slightly clayey GRAVEL with fragments of wood, glass, metal and brick (diesel odour)	TP 3-1 TP 4-1	0.5 0.8
Natural	Firm to stiff light grey locally orange brown mottled (weathered) slightly sandy CLAY with occasional rounded gravel and cobbles of mixed lithology – BOULDER CLAY	TP 3-2 TP 5-1	1.2 0.3

4. Investigation Observations

4.1. Physical Observations

4.1.1. The trial pit logs are presented in Appendix A and are accompanied by a photographic record of trial-pit entries. Stratigraphy across the site was generally uniform with entries comprising of made ground of gravel with inclusions of brick fragments in a sandy or clayey matrix within areas covered by concrete slab. TP3 and TP4 identified material under the concrete slab with a similar composition along with fragments of wood, glass, metal and brick with a diesel odour.

Boulder clay deposits were encountered below made ground deposits in all entries. All entries penetrated the full depth of made ground and into the underlying natural deposits.

Topsoil

- 4.1.2. Relict topsoil material was present within TP1 and TP2, described as a dark grey sandy silty clay soil with frequent rootlets. Topsoil extended to depths of 1.1m bgl (TP1) and 1.2m bgl (TP2).

Made Ground

- 4.1.3. Concrete slabs were present at the surface with an average thickness of 0.2m within 5 entries (TP1, TP2, TP3, TP4 and TP6) in the northern and western ends of the site which were formally used as a coal storage area.
- 4.1.4. Four distinct types of made ground were encountered, a reddish brown gravel of brick, blackish grey gravel of brick, dark sandy silty clay (relict topsoil) and a blackish grey clayey gravel with inclusions of waste material and a diesel odour.

Natural Deposits

- 4.1.5. Natural deposits of boulder clay consisting of light grey clay with occasional cobbles, gravels, sands and silts inclusions. The clay was locally mottled reddish orange colour in the shallower portions of the deposits consistent with natural weathering processes. The clay was soft to stiff becoming firmer with depth.
- 4.1.6. Rockhead was not encountered within any entry.
- 4.1.7. The strata encountered in the investigation can be summarised as follows:

Table 4.1: Summary of Principal Ground Conditions

depth (m bgl)	thickness (m)	strata	description	comment
0.0 – 0.2	0.2	Hardstanding	Reinforced concrete	Recorded within entries: TP1, TP2, TP3, TP4 and TP6
0.2 - 0.9	0.7	Made Ground: subbase for hardstanding	Reddish brown sandy angular GRAVEL with occasional cobbles of brick	Recorded within entries: TP1, TP2, TP3, TP4 and TP5
0.2 – 0.4	0.2	Made Ground	Blackish grey clayey gravel of brick	Recorded within entries: TP6, TP7 and TP8
0.9-1.1	0.2	Made Ground: Relict topsoil	Dark grey sandy silty slightly gravelly clay with frequent rootlets	Re-worked natural soil possibly associated with former land use as garden nurseries recorded within entries TP1 and TP2 in the west of the site only
0.7-1.1	0.4	Made Ground	Blackish grey slightly clayey gravel with fragments of wood, glass, metal and brick	Recorded within entries: TP3 and TP4. A diesel odour associated with the horizon was noted in TP3 and TP4 and a sheen was noted on water in TP4
1.1-2.7	1.6	Natural: Boulder Clay	Firm to stiff light grey locally orange brown mottled (weathered) slightly sandy clay with occasional rounded gravels and cobbles of mixed lithology	Recorded within all entries

4.1.8. The reported ground conditions are generally consistent with the anticipated geology with limited made ground present overlying boulder clay deposits. Underlying bedrock was not encountered. The full depth of made ground was penetrated in all entries.

4.1.9. The above evidence of stratigraphy is taken from discrete locations. Given the broadly similar ground conditions between many of the entries, it appears reasonable to infer that similar conditions may extend between these locations across the majority of the site, although caution should always be exercised in extrapolating between locations.

4.2. Contamination Indicators

4.2.1. Granular made ground including waste materials, brick (50%), wood (30%), glass (10%) and metal (10%) was observed within entries at the central west of the site (TP3 and TP4) with an associated diesel odour.

4.2.2. No waste materials of suspected ACM were observed within the made ground.

- 4.2.3. No free product was observed during the intrusive works; however, an oily sheen was observed upon water ingress from within the made ground at TP4.
- 4.2.4. No significant presence of degradable organic material other than minor pieces of wood at TP3 and TP4 during the investigation.

5. Investigation Results

5.1. Results of Soil Chemical Analysis

- 5.1.1. The complete soil analytical data are presented in Appendix B.
- 5.1.2. The results of the soil analyses are compared to human health critical values (CVs) for initial screening purposes. The CVs adopted are appropriate to the environmental setting and proposed future residential use of the site and are taken primarily from the LQM / CIEH Suitable for Use Levels (S4ULs) which are used to define land that is 'not contaminated'. The S4UL are derived for a sandy loam soil; reference is initially made to the S4ULs derived for a soil with 1% organic matter as a conservative assumption for screening purposes.
- 5.1.3. The Defra Category 4 Screening Level (C4SL) for lead in soils under residential land-use has been utilised to allow an initial screening for risk to human health. This is intended to demonstrate that land is definitively not 'Contaminated Land' as defined under Part IIA of the Environmental Protection Act. The adoption of the C4SL in a planning scenario has not been universally accepted, however in the absence of other generic screening criteria for lead following the withdrawal of the SGV by the EA it is considered appropriate to utilise the screening criterion.
- 5.1.4. Given the high sensitivity of the planned residential development, the presence of any detectable asbestos in shallow soils is unlikely to be acceptable so the limit of detection has been adopted as a screening value.
- 5.1.5. Results are summarised below:

Table 5.1: Summary of Soils Analysis

Contaminant	Number of Samples	Range of Concentrations (mg/kg or indicated)	Soil standard adopted for a residential scenario (mg/kg or indicated)	Exceedances
Asbestos screen	10	<0.001%	<0.001%	None
Arsenic	10	4 - 36	S4UL 37	None

Contaminant	Number of Samples	Range of Concentrations (mg/kg or indicated)	Soil standard adopted for a residential scenario (mg/kg or indicated)	Exceedances
Cadmium	10	<1 - 9	S4UL 11	None
Chromium (total)	10	16 - 59	S4UL 910	None
Chromium VI	10	<1	S4UL 6	None
Copper	10	19 - 270	S4UL 2400	None
Lead	10	26 - 480	C4SL 200	TP4-1
Mercury	10	<1	S4UL 1.2	None
Nickel	10	17 - 44	S4UL 180	None
Zinc	10	50 - 790	S4UL 3700	None
Naphthalene	10	<0.1 – 6.8	S4UL 2.3 (13, if SOM 6%)	TP4-1
Acenaphthylene	10	<0.1	S4UL 170	None
Acenaphthene	10	<0.1 – 3.1	S4UL 210	None
Fluorene	10	<0.1 – 2.5	S4UL 170	None
Phenanthrene	10	<0.1 – 9.0	S4UL 95	None
Anthracene	10	<0.1 – 2.3	S4UL 2400	None
Fluoranthene	10	<0.1 - 16	S4UL 280	None
Pyrene	10	<0.1 - 17	S4UL 620	None
Benzo(a)anthracene	10	<0.1 – 5.5	S4UL 7.2	None
Chrysene	10	<0.1 – 7.1	S4UL 15	None
Benzo(b)fluoranthene	10	<0.1 – 8.1	S4UL 2.6 (3.7, if SOM 6%)	TP4-1, TP7-1
Benzo(k)fluoranthene	10	<0.1 – 4.6	S4UL 77	None
Benzo(a)pyrene	10	<0.1 – 7.4	S4UL 2.2 (3.0, if SOM 6%)	TP4-1, TP7-1
Indeno(123cd)pyrene	10	<0.1 – 5.9	S4UL 27	None
Dibenzo(ah)anthracene	10	<0.1 – 2.4	S4UL 0.24 (0.3, if SOM 6%)	TP4-1, TP7-1
Benzo(ghi)perylene	10	<0.1 – 8.3	S4UL 320	None
Aliphatic C5-C6	10	<0.1	S4UL 42	None
Aliphatic C6-C8	10	<0.1 - 29	S4UL 100	None
Aliphatic C8-C10	10	<0.1 - 660	S4UL 27 (150, if SOM 6%)	TP4-1
Aliphatic C10-C12	10	<1.0 – 3600.0	S4UL 130 (760, if SOM 6%)	TP3-1, TP4-1
Aliphatic C12-C16	10	<1.0 – 6000.0	S4UL 1100 (4300, if SOM 6%)	TP4-1
Aliphatic C16-C21	10	<1.0 – 4800.0	S4UL 5000	None
Aliphatic C21-C35	10	<2 – 11000.0	S4UL 5000 (110000, if SOM 6%)	TP3-1, TP4-1
Aromatic C6-C7	10	<0.1	S4UL 70	None
Aromatic C7-C8	10	<0.1	S4UL 130	None
Aromatic C8-C10	10	<0.1 – 68.0	S4UL 34 (190, if SOM 6%)	TP4-1
Aromatic C10-C12	10	<2.0 - 820.0	S4UL 74 (380, if SOM 6%)	TP3-1, TP4-1
Aromatic C12-C16	10	<1.0 – 290.0	S4UL 140 (660, if SOM 6%)	TP3-1, TP4-1
Aromatic C16-C21	10	<1.0 – 840.0	S4UL 260 (930, if SOM 6%)	TP3-1, TP4-1

Contaminant	Number of Samples	Range of Concentrations (mg/kg or indicated)	Soil standard adopted for a residential scenario (mg/kg or indicated)	Exceedances
Aromatic C21-C35	10	<1.0 – 320.0	S4UL 1100	None
Benzene	10	<0.010	S4UL 0.087	None
Toluene	10	<0.010	S4UL 130	None
Ethylbenzene	10	<0.010 – 0.038	S4UL 47	None
m/p-xylene	10	<0.010 - 2.400	S4UL 59/56	None
o-xylene	10	<0.010	S4UL 60	None

Notes to table:

S4UL: Suitable For Use Levels published by Chartered Institute of Environmental Health and Land Quality Management Ltd, residential with plant uptake scenario (1% SOM); copyright Land Quality Management Ltd reproduced with permission publication number S4UL3102. All rights reserved.

C4SL: Category 4 Screening Levels published by CL:AIRE (C4SLs); 'residential without home grown produce land use' (at 1% SOM)

5.1.6. A single exceedance of lead was reported within the TP4-1 sample of made ground with a concentration of 480 mg/kg compared to the criteria of 200 mg/kg.

5.1.7. Several PAH compound exceedances were reported including naphthalene (TP4-1), Benzo(b)fluoranthene (TP4-1, TP7-1), Benzo(a)pyrene (TP4-1, TP7-1) and Dibenzo(ah)anthracene (TP4-1, TP7-1) based on samples having 1% soil organic matter (SOM) as an initial screening value. As SOM is more than 6% in TP4-1 and TP7-1, the screening values are increased therefore there is no longer an exceedance for naphthalene, but the other PAH exceedances remain.

5.1.8. Aliphatic and aromatic hydrocarbon exceedances were also observed including aliphatic C8-C10 (TP4-1), C10-C12 (TP3-1, TP4-1), C12-16 (TP4-1), C21-C35 (TP3-1, TP4-1) and aromatic C8-C10 (TP4-1), C10-C21 (TP3-1, TP4-1) based on samples having 1% SOM. If the greater screening values are considered i.e. for samples with SOM 6%, there is no longer exceedances for aliphatic C21-C35 and aromatic C16-21.

5.1.9. No exceedances for asbestos and BTEX compounds were observed within the 10 samples across the site.

6. Revised Conceptual Model and Risk Assessment

6.1. Methodology

6.1.1. Information from the current site investigation has been used to refine the likely source-pathway-target relationships identified in the preliminary Conceptual Site Model (CSM). Tier 1 risk assessment has been undertaken by comparison of contaminant concentrations in soil to generic screening criteria. These are values appropriate to the intended residential end-use of the site and indicate whether potentially unacceptable risks to receptors are likely to exist,

requiring either more detailed site-specific risk assessment or remediation to break the potential contaminant linkage.

6.2. Sources

- 6.2.1. Made ground consisting of a blackish grey clayey gravel with fragments of wood, glass, metal and brick with a diesel odour has been encountered in the central west of the site with a maximum depth of 1.1m bgl at TP04 and a maximum thickness of 0.5m at TP03. Exceedances of lead, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(ah)anthracene, aliphatic C8-C16 and aromatic C8-C16 are associated with samples taken of this material. Analysis of PAH ratios of the TP3-1 sample indicate hydrocarbons of a petroleum combustion product origin i.e. diesel fuel and the TP4-1 sample indicate hydrocarbons of a coal tar origin.
- 6.2.2. Material consisting of a blackish grey gravelly clay with occasional rootlets was encountered at TP07 in the south east corner of the site. This material is thought to be natural, possibly representing a relict topsoil with a maximum depth of 0.4m bgl and a thickness of 0.25m. Exceedances of benzo(b)fluoranthene, benzo(a)pyrene and dibenzo(ah)anthracene were reported in the TP7-1 sample. Analysis of PAH ratios indicates hydrocarbons of a coal tar origin.
- 6.2.3. Further to this, the site is located within an area where 10-30% of homes are above the Radon Action Level therefore full radon protection measures are required to be installed in all new residential properties.

6.3. Potential Receptors

- 6.3.1. The principal vulnerable receptors, following residential development of the site will be:
- construction workforce;
 - future site users (residents);
 - on-site building structures and infrastructure (buildings; roadways; services);
 - soft landscaping areas (gardens); and,
 - neighbouring residential properties.

6.4. Human Health Risk Assessment

- 6.4.1. Contaminants which have been identified which could pose a risk to long-term human health comprise of lead, non-volatile PAHs and semi-volatile aliphatic & aromatic hydrocarbons within the made ground and suspected relict topsoil.
- 6.4.2. The single elevated lead concentration within the made ground could be attributed to the presence of inclusions of ash, clinker and/or natural lead minerals.
- 6.4.3. The sporadic occurrence of hydrocarbon exceedances is anticipated to be the result of possible historical minor spills and/or leaching treated timber materials at the site. Railway

- sleepers are known to be present at the site, used to form retaining walls for coal stores in the north west corner of the site.
- 6.4.4. Concentrations of hydrocarbons and VOCs are above human health criteria within the made ground and relict topsoil and visual and olfactory contamination indicators were noted at TP03 and TP04. Direct contact between source and receptor is possible but the potential risk of vapour inhalation and accumulation in proposed residential properties is considered low due to the moderate concentrations of volatile fractions of hydrocarbons and PAHs only being associated with sporadic and relative thin horizons of made ground and relict topsoil.
- 6.4.5. The potential risks posed to construction workers and surrounding land users are considered minimal as direct contact of the material is unlikely providing normal occupational hygiene measures are adhered to and adequate environmental controls are implemented during the proposed development.
- 6.4.6. Migration of bulk, or permanent ground gases (methane, carbon dioxide and depleted oxygen) is considered unlikely due to the limited extent of made ground, sources of ground gas are considered minimal due to made ground principally comprising inert materials. No other potential on-site or off-site sources of ground gas have been identified. The underlying natural strata consists of a cohesive clay deposit which would inhibit any potential sources of ground gas beyond the site. The site is located within an area where 10-30% of homes are above the Radon Action Level and full radon protection measures are required to be installed in all new residential properties and would add further protection from ground gases.
- 6.5. Revised Conceptual Site Model
- 6.5.1. The revised CSM is summarised overleaf.

Table 9.1: Revised Conceptual Site Model

Receptor	Source / Contaminant	Pathway / Exposure	Pollutant Linkage (in absence of mitigation)	Further Investigation / Remediation
1. humans – construction and maintenance workers	Presence of lead, PAHs and hydrocarbons within made ground and relict topsoil	dermal contact / ingestion / inhalation – short term exposure	Unlikely – the presence of contaminants at moderately elevated concentrations within the shallow, sporadic and thin horizons of made ground and relict topsoil are unlikely to pose an acute short-term risk to site workers.	Standard levels of occupational hygiene and environmental controls on dust and other emissions to be maintained.
	Hydrocarbon vapours within made ground and relict topsoil	accumulation within voids, confined spaces and service runs – short term exposure	Unlikely – the presence of volatile hydrocarbon fractions and PAHs at moderately elevated concentrations within shallow, sporadic and thin horizons of made ground and relict topsoil are unlikely to pose a vapour inhalation and accumulation risk.	During the earthworks stage of the proposed development, observation in the areas of TP03 and TP04 to confirm the presence/absence of hydrocarbon contamination should be undertaken. If visual hydrocarbon contamination is observed, this should be removed from site as waste and validation samples taken in the area(s) of removal to confirm removal of contamination.
2. humans – future site users (residents)	Presence of lead, PAHs and hydrocarbons within made ground and relict topsoil	dermal contact / ingestion / inhalation	Possible – the presence of contaminants at moderately elevated concentrations within the shallow, sporadic and thin horizons of made ground and relict topsoil may pose a long-term health risk if located within areas absent from hard-standing (gardens or landscaping)	The concentrations of lead, PAHs and hydrocarbons within the made ground and relict topsoil preclude the reuse within the development of garden soils. Removal of made ground and relict topsoil in areas of contaminant exceedances and application of a clean imported soil within areas absent from hardstanding to reduce human exposure to a safe level.

Receptor	Source / Contaminant	Pathway / Exposure	Pollutant Linkage (in absence of mitigation)	Further Investigation / Remediation
	Hydrocarbon vapours within made ground and relict topsoil	dermal contact / ingestion / inhalation	Unlikely – the presence of volatile hydrocarbon fractions and PAHs at moderately elevated concentrations within shallow, sporadic and thin horizons of made ground and relict topsoil are unlikely to pose a vapour inhalation and accumulation risk.	During the earthworks stage of the proposed development, observation in the areas of TP03 and TP04 to confirm the presence/absence of hydrocarbon contamination should be undertaken. If visual hydrocarbon contamination is observed, this should be removed from site as waste and validation samples taken in the area(s) of removal to confirm removal of contamination.
	Ground gas (methane, carbon dioxide, depleted oxygen)	accumulation within voids, confined spaces and service runs	Very unlikely – No significant gas generation potential has been identified on the site or nearby offsite, made ground deposits are sporadic, thin and laterally limited.	Full radon protection measures and cohesive underlying natural strata will provide adequate protection from potential ground gases.
	Radon gas from natural geology	accumulation within voids, confined spaces and service runs	Likely – site is identified as being in area where 10-30% of properties contain radon above the action level	Full radon protection measures are required in all proposed residential dwellings.
3. property / services	ground gas (methane, carbon dioxide)	accumulation within voids, confined spaces and service runs	Very unlikely – No significant gas generation potential has been identified on the site or nearby offsite, made ground deposits are sporadic, thin and laterally limited.	Full radon protection measures and cohesive underlying natural strata will provide adequate protection from potential ground gases.
	pH, sulphate and organic contaminants	Chemical attack of buried concrete and plastic materials	Unlikely – No samples have been taken for sulphate concentrations, although low pH has been observed in the 10 samples and hydrocarbon contaminants are at moderate concentrations in sporadic and thin horizons at the site.	No further action required.

Receptor	Source / Contaminant	Pathway / Exposure	Pollutant Linkage (in absence of mitigation)	Further Investigation / Remediation
4. vegetation / landscaping	leachable metals / metalloids	Plant uptake	Unlikely – Low concentrations of phytotoxic metals have been recorded within the made ground and natural strata	Made ground and relict topsoil is not suitable for reuse as topsoil due to elevated lead, PAH and hydrocarbon concentrations in any case. A clean soil is required within private garden and landscaped areas
5. ecosystems / protected species & habitats	n/a – no ecosystems / protected habitats in immediate vicinity			
6. Controlled Waters	leachable contaminants	Controlled waters	Negligible – low concentration of contaminants, no water abstraction zones or water bodies in the vicinity of the site and low permeability boulder clay deposits across the site and surrounding area.	No further action required.

7. Conclusions and Recommendations

7.1. Conclusions

7.1.1. Ground conditions across the site are generally uniform with concrete hardstanding underlain with varying made ground overlying natural boulder clay deposits (Devensian Till). The site is predominantly covered by hardstanding, consisting of concrete slab with mixed gravel placed in the eastern portion of the site to raise the ground level. Areas of topsoil cover were limited to the site boundaries and the south east corner of the site.

7.1.2. Made ground generally comprised, a reddish brown sandy gravel used as a subbase for the concrete hardstanding, a blackish grey gravel of brick, a dark grey sandy gravelly clay with frequent rootlets thought to be a relict topsoil and a blackish grey clayey gravel with fragments of wood, glass metal and brick with a diesel odour. The maximum depth to which made ground was proved was to 1.2m bgl within TP02. Natural strata of clays were encountered within all entries.

7.1.3. A single elevated concentration of lead was reported within one of the samples of made ground. Elevated PAH compounds and hydrocarbons were reported in three samples including one sample of suspected relict topsoil. Concentrations exceeded the assessment criteria for residential soils. The made ground and relict topsoil is therefore not suitable for reuse within the development as a topsoil.

7.1.4. Visual and olfactory indicators of moderate hydrocarbon contamination were observed within the made ground arisings of TP03 and TP04 from 0.2-0.7m bgl and 0.7-1.1m bgl respectively within an area of possible spillage, leak and/or leaching of hydrocarbons. No visual and/or olfactory indicators of contamination were noted at TP07 however PAH exceedances were limited to non-volatile compounds.

7.1.5. The site is located within an area where 10-30% of homes are above the radon action level; therefore, full radon protection measures are required in new buildings.

7.2. Recommendations

7.2.1. Contamination within the shallow soils have not been encountered at concentrations which would preclude the planned re-development of the site and the levels and distribution of contamination identified is only considered to present a low-moderate risk to human health and no significant risk to controlled water. A number of further precautionary mitigation measures are recommended in order to reduce the potential risk and exposure to on-site receptors.

7.2.2. Further investigation should be carried out within the vicinity of TP04 and TP07 to identify the presence/absence of hydrocarbon contamination through visual and olfactory observations within the area. Additional investigation works will allow determination as to whether an

appropriate remedial procedure needs to be implemented, typically requiring removal of impacted soils or free product. This may also include additional validation sampling to confirm removal of impacted ground, if present. This activity could be carried out contemporaneously with the works required to physically prepare the site for development (demolition and breaking out of hardstanding and foundations). A watching brief for similar conditions should be maintained during these works.

7.2.3. Due to the presence of sporadic moderate lead, PAHs and hydrocarbon exceedances within the made ground and relict topsoil, all garden and landscaped areas are required to have a clean soil cover applied.

7.2.4. The above requirements should be set out in a remediation strategy for the site, which should be agreed by the local planning authority in advance of works commencing.

7.3. Limitations

Stratigraphy

7.3.1. The evidence of stratigraphy is taken from discrete trial pit locations. Whilst it is usually reasonable to infer that similar conditions may extend between these locations, caution should be exercised.

Contamination

7.3.2. The site investigation involved sampling at discrete locations, and it should be recognised that further areas or types of contamination may exist between investigation positions. The analyses performed are drawn from a typical suite of tests used to screen potentially contaminated land and specified to fall within the available budget. It is always possible that other substances may be present that have not been included within the standard range of tests.

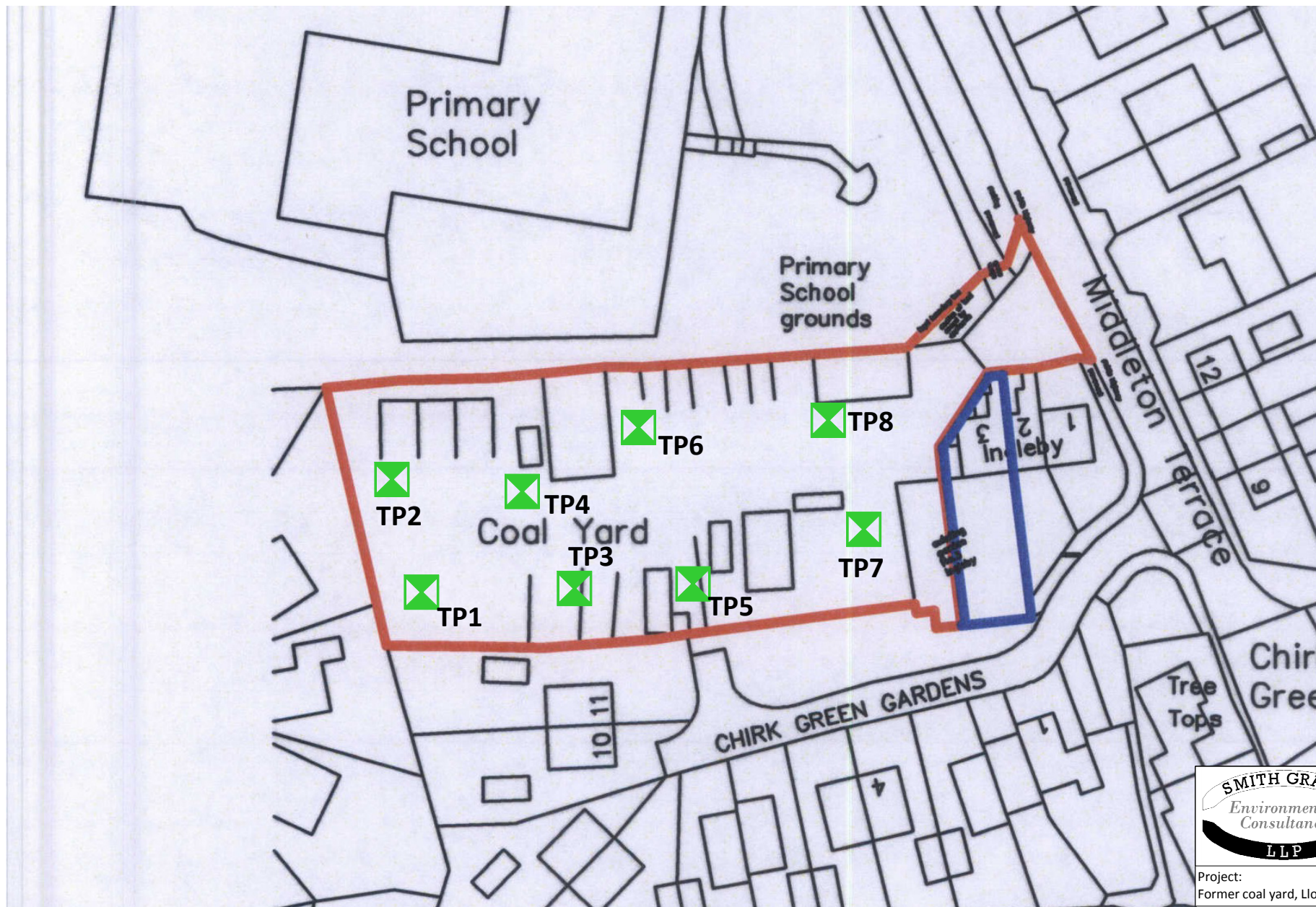
General

7.3.3. This report has been prepared by SGP for the sole and exclusive use of Messers A & B Roberts. Reasonable skill, care and diligence has been exercised within the budget available, and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet undetected may exist. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context.

7.3.4. SGP reserves the right to alter any of the foregoing information in the event of new information being disclosed or provided and in the light of changes to legislation, guidelines and responses by the statutory and regulatory authorities.

7.3.5.

DRAWINGS



 Trial pit location



Project:
 Former coal yard, Lloyd's Lane

Drawing:
 Trial pit location plan

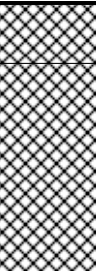
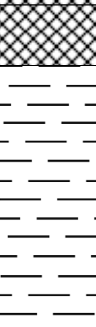
Drawn: PRM	Checked: DW
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Date: 22.02.18	Scale: 1:300
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Project No: R2280	Drawing No: D01
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APPENDIX A

Site Investigation Logs

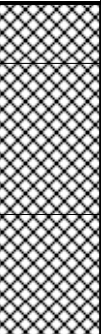
SHEET: 1 of 1	LOCATION: Chirk	PROJECT: Former Coal Yard, Lloyd's Lane	ENGINEER: PRM	JOB NO. R2280	TRIAL PIT NO. TP01
		EXCAVATED BY: Excavator	CLIENT: Messers A & B Roberts	DATE: 15/02/2018	
DEPTH (m)	SAMPLES/ TESTING	FIELD RECORDS	DEPTH (m)	DESCRIPTION OF STRATA	LEGEND
0.3	TP1-1		0.00	MADE GROUND: Concrete slab	
			0.2	MADE GROUND: Reddish brown sandy angular gravel with occasional angular cobbles of brick	
			0.9		
1	TP1-2		1.00	MADE GROUND: Dark grey sandy slightly gravelly silty clay with frequent rootlets	
			1.1	Firm to stiff light grey locally orange brown mottled (weathered) slightly sandy CLAY with occasional rounded gravel and cobbles of mixed lithology	
			2.00	Trial pit ended at 2.0m; due to water ingress	
			3.00		
			4.00		
			5.00		

 Smith Grant LLP Station House, Station Road, Ruabon, Wrexham LL146DL Tel: 01978822367 Fax: 019788247182 www.smithgrant.co.uk email: consult@smithgrant.co.uk	GROUND WATER: Water seepage at 1.6m	
	REMARKS: Trial pit walls stable	
	SCALE: 1:250	LOGGED BY: PRM

SHEET: 1 of 1	LOCATION: Chirk	PROJECT: Former Coal Yard, Lloyd's Lane	ENGINEER: PRM		JOB NO. R2280	TRIAL PIT NO. TP02
		EXCAVATED BY: Excavator	CLIENT: Messers A & B Roberts		DATE: 15/02/2018	
DEPTH (m)	SAMPLES/ TESTING	FIELD RECORDS	DEPTH (m)	DESCRIPTION OF STRATA		LEGEND
1	TP2-1		0.00	MADE GROUND: Concrete slab with steel rebar		
			0.3	MADE GROUND: Reddish brown sandy angular gravel with occasional angular cobbles of brick		
			0.8	MADE GROUND: Dark grey slightly gravelly clay with occasional roots		
			1.00	Firm to stiff light grey locally orange brown mottled (weathered) slightly sandy CLAY with occasional rounded gravel and cobbles of mixed lithology		
			1.2			
2.00	Trial pit ended at 2.3m; due to water ingress					
2.3						
3.00						
4.00						
5.00						
 Smith Grant LLP Station House, Station Road, Ruabon, Wrexham LL146DL Tel: 01978822367 Fax: 019788247182 www.smithgrant.co.uk email: consult@smithgrant.co.uk		GROUND WATER: Water seepage at 2.2m				
		REMARKS: Trial pit walls stable				
		SCALE: 1:250	LOGGED BY: PRM	FIGURE NO. 1		

SHEET: 1 of 1	LOCATION: Chirk	PROJECT: Former Coal Yard, Lloyd's Lane	ENGINEER: PRM	JOB NO. R2280	TRIAL PIT NO. TP03
		EXCAVATED BY: Excavator	CLIENT: Messers A & B Roberts	DATE: 15/02/2018	
DEPTH (m)	SAMPLES/ TESTING	FIELD RECORDS	DEPTH (m)	DESCRIPTION OF STRATA	LEGEND
0.5	TP3-1		0.00 0.1 0.2	MADE GROUND: Concrete slab MADE GROUND: Reddish brown sandy angular gravel with occasional angular cobbles of brick MADE GROUND: Dark grey slightly clayey gravel with occasional fragments of wood, glass, metal and brick (diesel odour)	
1.2	TP3-2		0.7 1.00	Firm to stiff light grey locally orange brown mottled (weathered) slightly sandy CLAY with occasional rounded gravel and cobbles of mixed lithology	
			2.00 2	Trial pit ended at 2.0m; due to water ingress	
			3.00		
			4.00		
			5.00		

 Smith Grant LLP Station House, Station Road, Ruabon, Wrexham LL146DL Tel: 01978822367 Fax: 019788247182 www.smithgrant.co.uk email: consult@smithgrant.co.uk	GROUND WATER: Water seepage at 0.5m		
	REMARKS: Trial pit walls stable		
	SCALE: 1:250	LOGGED BY: PRM	FIGURE NO. 1

SHEET: 1 of 1	LOCATION: Chirk	PROJECT: Former Coal Yard, Lloyd's Lane	ENGINEER: PRM		JOB NO. R2280	TRIAL PIT NO. TP04
		EXCAVATED BY: Excavator	CLIENT: Messers A & B Roberts		DATE: 15/02/2018	
DEPTH (m)	SAMPLES/ TESTING	FIELD RECORDS	DEPTH (m)	DESCRIPTION OF STRATA		LEGEND
0.8	TP4-1		0.00	MADE GROUND: Concrete slab		
			0.2	MADE GROUND: Reddish brown sandy angular gravel with occasional angular cobbles of brick		
			0.7	MADE GROUND: Dark grey slightly clayey gravel with occasional fragments of wood, glass, metal and brick (diesel odour)		
			1.00	Firm to stiff light grey locally orange brown mottled (weathered) slightly sandy CLAY with occasional rounded gravel and cobbles of mixed lithology		
			1.1	Trial pit ended at 2.0m; due to water ingress		
2.00						
3.00						
4.00						
5.00						



Smith Grant LLP
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Ruabon, Wrexham LL146DL

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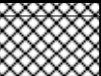
GROUND WATER:
Water seepage at 1.0m; oily sheen present

REMARKS:
Trial pit walls stable

SCALE: **1:250**

LOGGED BY: **PRM**

FIGURE NO. **1**

SHEET: 1 of 1	LOCATION: Chirk	PROJECT: Former Coal Yard, Lloyd's Lane	ENGINEER: PRM	JOB NO. R2280	TRIAL PIT NO. TP05
		EXCAVATED BY: Excavator	CLIENT: Messers A & B Roberts	DATE: 15/02/2018	
DEPTH (m)	SAMPLES/ TESTING	FIELD RECORDS	DEPTH (m)	DESCRIPTION OF STRATA	LEGEND
0.3	TP5-1		0.00 0.05	MADE GROUND: Tarmacadam	
			0.25	MADE GROUND: Reddish brown sandy angular gravel with occasional angular cobbles of brick	
				Soft to firm light grey locally orange brown mottled (weathered) slightly sandy CLAY with occasional rounded gravel and cobbles of mixed lithology	
			1.00		
			1.5	Trial pit ended at 1.5m; due to water ingress	
			2.00		
			3.00		
			4.00		
			5.00		



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Ruabon, Wrexham LL146DL

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Fax: 019788247182

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email: consult@smithgrant.co.uk

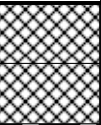
GROUND WATER:
Water seepage at 0.25m

REMARKS:
Trial pit walls stable

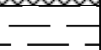
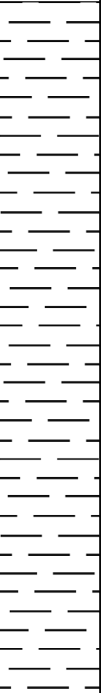
SCALE:
1:250

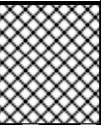
LOGGED BY:
PRM

FIGURE NO.
1

SHEET: 1 of 1	LOCATION: Chirk	PROJECT: Former Coal Yard, Lloyd's Lane	ENGINEER: PRM	JOB NO. R2280	TRIAL PIT NO. TP06
		EXCAVATED BY: Excavator	CLIENT: Messers A & B Roberts	DATE: 15/02/2018	
DEPTH (m)	SAMPLES/ TESTING	FIELD RECORDS	DEPTH (m)	DESCRIPTION OF STRATA	LEGEND
0.2	TP6-1		0.00	MADE GROUND: Concrete slab	
			0.2	MADE GROUND: Blackish grey clayey gravel of brick	
			0.4	Firm light grey locally orange brown mottled (weathered) slightly sandy CLAY with occasional rounded gravel and cobbles of mixed lithology	
			1.00		
2.00		2	Trial pit ended at 2.0m; due to water ingress		
3.00					
4.00					
5.00					

 Smith Grant LLP Station House, Station Road, Ruabon, Wrexham LL146DL Tel: 01978822367 Fax: 019788247182 www.smithgrant.co.uk email: consult@smithgrant.co.uk	GROUND WATER: Not encountered		
	REMARKS: Trial pit walls stable		
	SCALE: 1:250	LOGGED BY: PRM	FIGURE NO. 1

SHEET: 1 of 1	LOCATION: Chirk	PROJECT: Former Coal Yard, Lloyd's Lane	ENGINEER: PRM		JOB NO. R2280	TRIAL PIT NO. TP07
		EXCAVATED BY: Excavator	CLIENT: Messers A & B Roberts		DATE: 15/02/2018	
DEPTH (m)	SAMPLES/ TESTING	FIELD RECORDS	DEPTH (m)	DESCRIPTION OF STRATA		LEGEND
0.2	TP7-1		0.00	MADE GROUND: Dark grey to grey sandy rounded gravel of mixed lithology		
			0.25	Dark grey slightly gravelly CLAY with occasional rootlets		
			0.4	Firm to stiff light grey locally orange brown mottled (weathered) slightly sandy CLAY with occasional rounded gravel and cobbles of mixed lithology		
			1.00			
			2.00			
			2.7	Trial pit ended at 2.7m; due to water ingress		
			3.00			
			4.00			
			5.00			
 Smith Grant LLP Station House, Station Road, Ruabon, Wrexham LL146DL Tel: 01978822367 Fax: 019788247182 www.smithgrant.co.uk email: consult@smithgrant.co.uk		GROUND WATER: Water seepage at 0.4m				
		REMARKS: Trial pit walls stable				
		SCALE: 1:250	LOGGED BY: PRM	FIGURE NO. 1		

SHEET: 1 of 1	LOCATION: Chirk	PROJECT: Former Coal Yard, Lloyd's Lane	ENGINEER: PRM	JOB NO. R2280	TRIAL PIT NO. TP08
		EXCAVATED BY: Excavator	CLIENT: Messers A & B Roberts	DATE: 15/02/2018	
DEPTH (m)	SAMPLES/ TESTING	FIELD RECORDS	DEPTH (m)	DESCRIPTION OF STRATA	LEGEND
0.2	TP8-1		0.00	MADE GROUND: Dark grey gravel and cobbles of brick	
			0.4	Firm light grey to brown with depth, locally orange brown mottled (weathered) slightly sandy CLAY with occasional rounded gravel and cobbles of mixed lithology	
			1.00		
			2.00		
			2.5	Trial pit ended at 2.5m; due to stiffness of clay	
			3.00		
			4.00		
			5.00		
 Smith Grant LLP Station House, Station Road, Ruabon, Wrexham LL146DL Tel: 01978822367 Fax: 019788247182 www.smithgrant.co.uk email: consult@smithgrant.co.uk		GROUND WATER: Not encountered			
		REMARKS: Trial pit walls stable			
		SCALE: 1:250	LOGGED BY: PRM	FIGURE NO. 1	

APPENDIX B

Chemical Analytical Results

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 716492-1

Date of Report: 02-Mar-2018

Customer: Smith Grant LLP
Station House
Station Road
Ruabon
Wrexham
LL14 6DL

Customer Contact: Mr Philip Magraw

Customer Job Reference: R2280

Customer Site Reference: Lloyds Lane, Chirk

Date Job Received at Concept: 16-Feb-2018

Date Analysis Started: 19-Feb-2018

Date Analysis Completed: 02-Mar-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual



Report checked
and authorised by :
Aleksandra Pacula
Customer Service Advisor

Issued by :
Aleksandra Pacula
Customer Service Advisor

Concept Reference: 716492									
Project Site: Lloyds Lane, Chirk									
Customer Reference: R2280									
Soil					Analysed as Soil				
MCERTS Preparation									
Concept Reference					716492 001	716492 002	716492 003	716492 004	716492 005
Customer Sample Reference					TP1-1	TP1-2	TP2-1	TP3-1	TP3-2
Bottom Depth					0.3	1.0	1.0	0.5	1.2
Date Sampled					15-FEB-2018	15-FEB-2018	15-FEB-2018	15-FEB-2018	15-FEB-2018
Matrix Class					Sandy Soil	Clay	Clay	Clay	Sandy Soil
Determinand	Method	Test Sample	LOD	Units					
Moisture @105C	T162	AR	0.1	%	10	21	23	9.1	12
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 716492									
Project Site: Lloyds Lane, Chirk									
Customer Reference: R2280									
Soil					Analysed as Soil				
MCERTS Preparation									
Concept Reference					716492 006	716492 007	716492 008	716492 009	716492 010
Customer Sample Reference					TP4-1	TP5-1	TP6-1	TP7-1	TP8-1
Bottom Depth					0.8	0.3	0.2	0.2	0.2
Date Sampled					15-FEB-2018	15-FEB-2018	15-FEB-2018	15-FEB-2018	15-FEB-2018
Matrix Class					Sandy Soil	Clay	Sandy Soil	Sandy Soil	Clay
Determinand	Method	Test Sample	LOD	Units					
Moisture @105C	T162	AR	0.1	%	33	15	26	6.6	14
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 716492									
Project Site: Lloyds Lane, Chirk									
Customer Reference: R2280									
Soil Analysed as Soil									
Smith Grant Standard Suite 1									
Concept Reference					716492 001	716492 002	716492 003	716492 004	716492 005
Customer Sample Reference					TP1-1	TP1-2	TP2-1	TP3-1	TP3-2
Bottom Depth					0.3	1.0	1.0	0.5	1.2
Date Sampled					15-FEB-2018	15-FEB-2018	15-FEB-2018	15-FEB-2018	15-FEB-2018
Matrix Class					Sandy Soil	Clay	Clay	Clay	Sandy Soil
Determinand	Method	Test Sample	LOD	Units					
Arsenic	T6	M40	2	mg/kg	36	14	18	15	10
Asbestos ID	T27	AR			N.D.	N.D.	N.D.	N.D.	N.D.
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	17	29	29	48	26
Chromium VI	T6	A40	1	mg/kg	<1	<1	<1	<1	<1
Copper	T6	M40	1	mg/kg	25	31	33	170	27
Lead	T6	M40	1	mg/kg	31	150	84	180	41
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	34	25	33	36	27
pH	T7	A40			7.5	7.4	8.1	8.5	7.5
Soil Organic Matter	T287	A40	0.1	%	1.6	7.5	4.1	12	1.3
Zinc	T6	M40	1	mg/kg	50	170	150	410	63

Concept Reference: 716492
Project Site: Lloyds Lane, Chirk
Customer Reference: R2280
Soil
TPH (CWG) with MTBE, BTEX
Analysed as Soil

Concept Reference: 716492 Project Site: Lloyds Lane, Chirk Customer Reference: R2280	
Soil PAH US EPA 16 (B and K split)	
Analysed as Soil	

Concept Reference:	716492
Project Site:	Lloyds Lane, Chirk
Customer Reference:	R2280
Soil	Analysed as Soil
PAH US EPA 16 (B and K split)	

Concept Reference					716492 006	716492 007	716492 008	716492 009	716492 010
Customer Sample Reference					TP4-1	TP5-1	TP6-1	TP7-1	TP8-1
Bottom Depth					0.8	0.3	0.2	0.2	0.2
Date Sampled					15-FEB-2018	15-FEB-2018	15-FEB-2018	15-FEB-2018	15-FEB-2018
Matrix Class					Sandy Soil	Clay	Sandy Soil	Sandy Soil	Clay
Determinand	Method	Test Sample	LOD	Units					
Napthalene	T207	M105	0.1	mg/kg	6.8	<0.1	0.2	(9) <1.0	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	(9) <1.0	<0.1	<0.1	(9) <1.0	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	3.1	<0.1	<0.1	(9) <1.0	<0.1
Fluorene	T207	M105	0.1	mg/kg	2.5	<0.1	<0.1	(9) <1.0	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	9.0	<0.1	<0.1	(9) <1.0	<0.1
Anthracene	T207	M105	0.1	mg/kg	2.3	<0.1	<0.1	(9) <1.0	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	16	<0.1	<0.1	6.2	<0.1
Pyrene	T207	M105	0.1	mg/kg	17	<0.1	<0.1	7.0	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	5.5	<0.1	<0.1	4.2	<0.1
Chrysene	T207	M105	0.1	mg/kg	7.1	<0.1	<0.1	4.9	<0.1
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	7.0	<0.1	<0.1	8.1	<0.1
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	4.3	<0.1	<0.1	4.6	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	4.3	<0.1	<0.1	7.4	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	3.1	<0.1	<0.1	5.9	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	1.2	<0.1	<0.1	2.4	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	3.8	<0.1	<0.1	8.3	<0.1
PAH(total)	T207	M105	0.1	mg/kg	92	<0.1	0.2	59	<0.1

Index to symbols used in 716492-1

Value	Description
AR	As Received
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
A40	Assisted dried < 40C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
N.D.	Not Detected
110	LOD raised due to low internal standard recovery.
100	LOD determined by sample aliquot used for analysis
13	Results have been blank corrected.
9	LOD raised due to dilution of sample
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Value	Description
AR	As Received
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
A40	Assisted dried < 40C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
N.D.	Not Detected
110	LOD raised due to low internal standard recovery.
100	LOD determined by sample aliquot used for analysis
13	Results have been blank corrected.
9	LOD raised due to dilution of sample
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos.

Method Index

Value	Description
T287	Calc TOC/0.58
T2	Grav
T6	ICP/OES
T207	GC/MS (MCERTS)
T27	PLM
T7	Probe
T909	GCxGC
T162	Grav (1 Dec) (105 C)
T209	GC/MS (Head Space)(MCERTS)

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Arsenic	T6	M40	2	mg/kg	M	001-010
Asbestos ID	T27	AR			SU	001-010
Cadmium	T6	M40	1	mg/kg	M	001-010
Chromium	T6	M40	1	mg/kg	M	001-010
Chromium VI	T6	A40	1	mg/kg	N	001-010
Copper	T6	M40	1	mg/kg	M	001-010
Lead	T6	M40	1	mg/kg	M	001-010
Mercury	T6	M40	1	mg/kg	M	001-010
Nickel	T6	M40	1	mg/kg	M	001-010
pH	T7	A40			M	001-010
Soil Organic Matter	T287	A40	0.1	%	N	001-010
Zinc	T6	M40	1	mg/kg	M	001-010
Benzene	T209	M105	10	µg/kg	M	001-010
Toluene	T209	M105	10	µg/kg	M	001-010
EthylBenzene	T209	M105	10	µg/kg	M	001-010
M/P Xylene	T209	M105	10	µg/kg	M	001-010
O Xylene	T209	M105	10	µg/kg	M	001-010
Methyl tert-Butyl Ether	T209	M105	10	µg/kg	M	001-010
TPH (C5-C6 aliphatic)	T209	M105	0.100	mg/kg	N	001-010
TPH (C6-C8 aliphatic)	T209	M105	0.10	mg/kg	N	001-010
TPH (C8-C10 aliphatic)	T209	M105	0.10	mg/kg	N	001-010
TPH (C10-C12 aliphatic)	T909	M105	1	mg/kg	M	001-010
TPH (C12-C16 aliphatic)	T909	M105	1	mg/kg	M	001-010
TPH (C16-C21 aliphatic)	T909	M105	1	mg/kg	M	001-010
TPH (C21-C35 aliphatic)	T909	M105	2	mg/kg	M	001-010
TPH (C6-C7 aromatic)	T209	M105	0.10	mg/kg	N	001-010
TPH (C7-C8 aromatic)	T209	M105	0.10	mg/kg	N	001-010
TPH (C8-C10 aromatic)	T209	M105	0.10	mg/kg	N	001-010
TPH (C10-C12 aromatic)	T909	M105	2	mg/kg	M	001-010
TPH (C12-C16 aromatic)	T909	M105	1	mg/kg	M	001-010
TPH (C16-C21 aromatic)	T909	M105	1	mg/kg	M	001-010
TPH (C21-C35 aromatic)	T909	M105	1	mg/kg	M	001-010
Naphthalene	T207	M105	0.1	mg/kg	M	001-010
Acenaphthylene	T207	M105	0.1	mg/kg	U	001-010
Acenaphthene	T207	M105	0.1	mg/kg	M	001-010
Fluorene	T207	M105	0.1	mg/kg	M	001-010
Phenanthrene	T207	M105	0.1	mg/kg	M	001-010
Anthracene	T207	M105	0.1	mg/kg	U	001-010
Fluoranthene	T207	M105	0.1	mg/kg	M	001-010
Pyrene	T207	M105	0.1	mg/kg	M	001-010
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	001-010
Chrysene	T207	M105	0.1	mg/kg	M	001-010
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	001-010
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	001-010
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	001-010
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	001-010
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	001-010
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	001-010
PAH(total)	T207	M105	0.1	mg/kg	U	001-010
Moisture @105C	T162	AR	0.1	%	N	001-010
Retained on 10mm sieve	T2	M40	0.1	%	N	001-010

APPENDIX C

Service Plans

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ES&WEST
UTILITIES

ES&WEST
UTILITIES

ES&WEST
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UTILITIES

Scale	1 : 500@A3
User ID	Kimberly.Nicholls
Date	07/02/2018
Grid Ref:	Easting: 329351 Northing: 338271
NRSWA Response	

— Low Pressure

- - - Medium Pressure

- . . Intermediate Pressure

- . . High Pressure

IGT/Other Polygon

Contact Zones

NTS Pipeline

012.525

Meters

Some examples of Plant Items:

Valve

Depth of Cover

Syphon

Diameter Change

Material Change

TITLE:

The plan shows those pipes owned by Wales & West Utilities (WU) in its role as a Licensed Gas Transporter (GT). The information shown on this plan is derived from historic information and may have involved re-scaling plans, and the accuracy of it cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc. may not be shown but their presence should be anticipated. No warranties are therefore given in respect of it. WU its employees and contractors do not accept any liability for any inaccuracy or incompleteness in it.

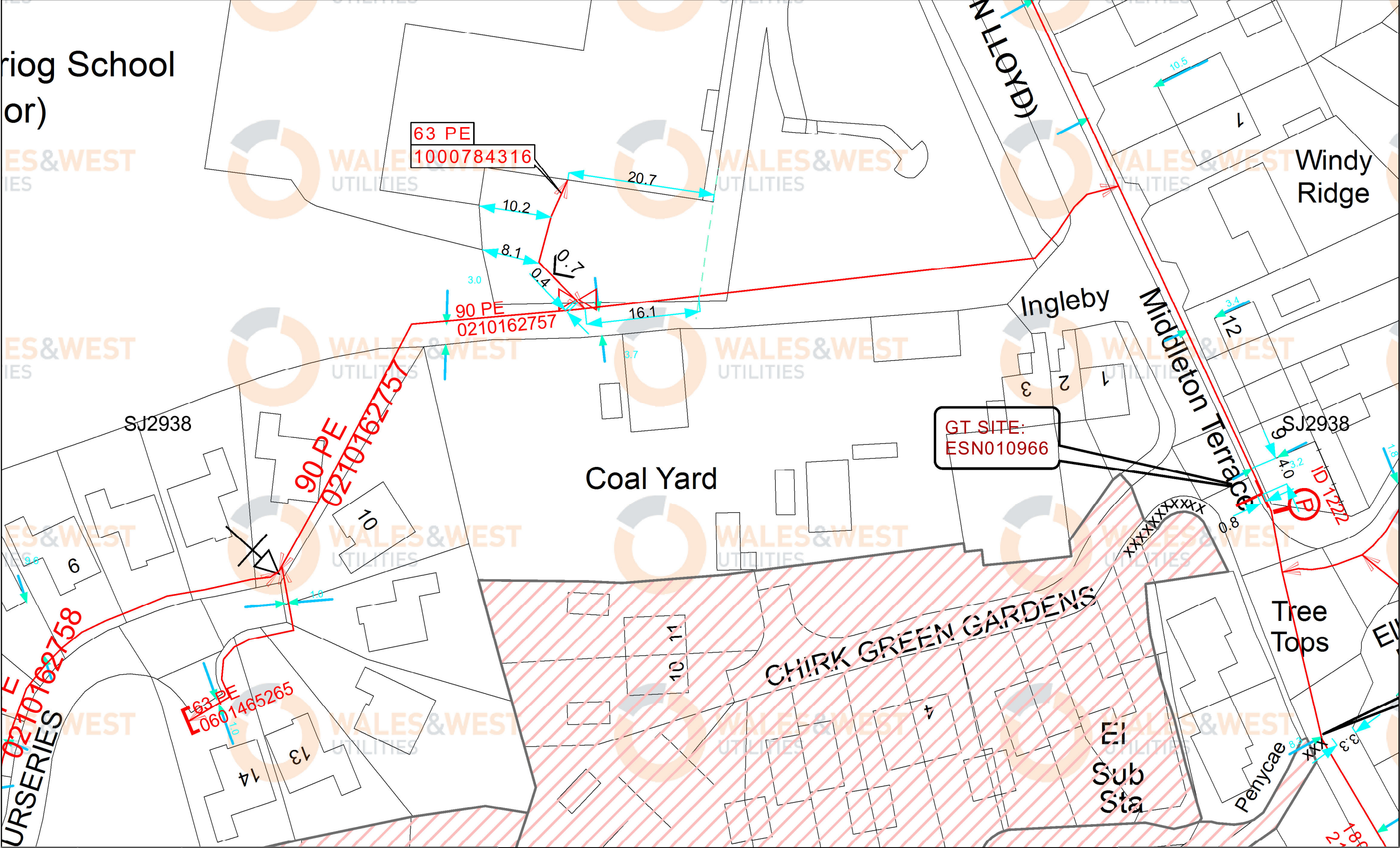
You must use safe digging practices, in accordance with HS(G)47, to establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you or near gas apparatus. The information shown on this plan should not be used beyond 28 days from the date of issue of this plan as it is subject to updating.

The plan also provides indications of gas pipes owned by other GTs, or otherwise privately owned, which may be present in this area. This information is not information of WU and WU is unable to verify this information or to confirm whether it is accurate or complete. It is supplied voluntarily to assist the user in determining whether to make contact with other GTs or others. The user must obtain such information from the other GT or person concerned. WU, its employees and contractors do not accept any liability for this information or any inaccuracy or incompleteness in it.

WALES&WEST
UTILITIES

Wales and West Utilities Ltd., Wales and West House, Spooner Close, Celtic Springs, Coedkernew, Newport, NP10 8FZ

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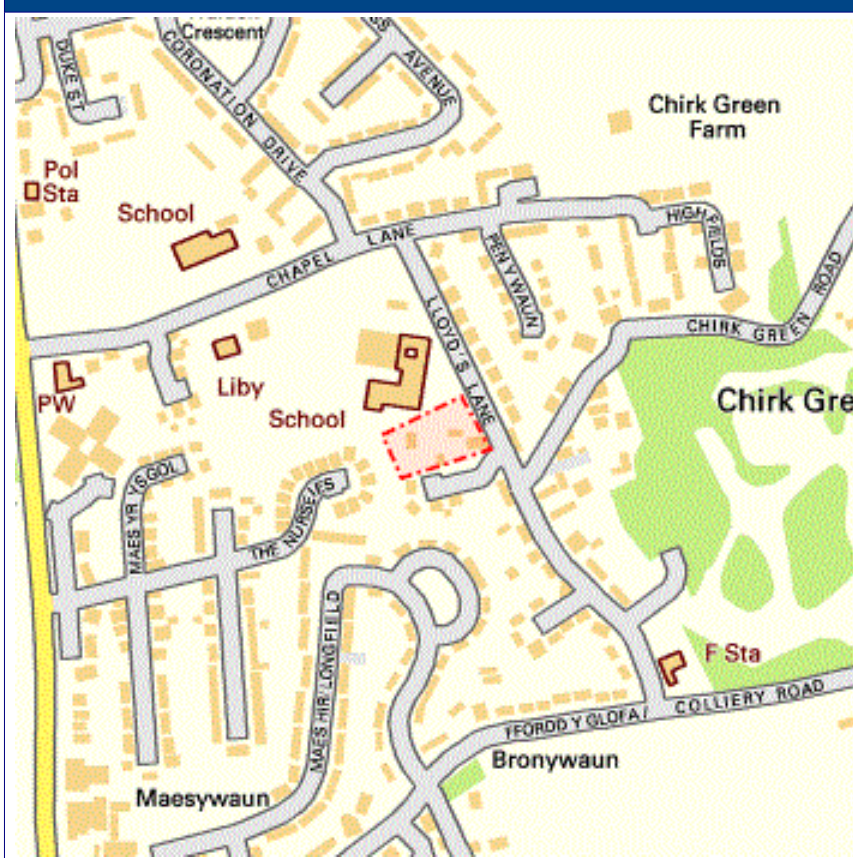
Enquirer

Name	Mr Scott Miller	Phone	01978 822367
Company	Smithgrant LLP	Mobile	07593882686
		Fax	Not Supplied
Address	Station House Station Road Ruabon Wrexham LL14 6DL		
Email	scott.miller@smithgrant.co.uk		
Notes	Please ensure your contact details are correct and up to date on the system in case the LSBUD Members need to contact you.		

Enquiry Details

Scheme/Reference	R2280		
Enquiry type	Initial Enquiry	Work category	Excavations Non Utility
Start date	05/02/2018	Work type	Multiple excavations site
End date	06/02/2018	Site size	3419 metres square
Searched location	XY= 329360, 338271 Easting/Northing	Work type buffer*	25 metres
Confirmed location	329364 338278		

* The WORK TYPE BUFFER is a distance added to your search area based on the Work type you have chosen.

Site Map


Asset Owners

Terms and Conditions. Please note that this enquiry is subject always to our standard terms and conditions available at www.lineasearchbeforeudig.co.uk ("Terms of Use") and the disclaimer at the end of this document. Please note that in the event of any conflict or ambiguity between the terms of this Enquiry Confirmation and the Terms of Use, the Terms of Use shall take precedence.

Validity and search criteria. The results of this enquiry are based on the confirmed information you entered and are valid only as at the date of the enquiry. It is your responsibility to ensure that the Enquiry Details are correct, and LineasearchbeforeUdig accepts no responsibility for any errors or omissions in the Enquiry Details or any consequences thereof. LSBUD Members update their asset information on a regular basis so you are advised to consider this when undertaking any works. It is your responsibility to choose the period of time after which you need to resubmit any enquiry but the maximum time (after which your enquiry will no longer be dealt with by the LSBUD Helpdesk and LSBUD Members) is 28 days. If any details of the enquiry change, particularly including, but not limited to, the location of the work, then a further enquiry must be made.

Asset Owners & Responses. Please note the enquiry results include the following:

1. "LSBUD Members" who are asset owners who have registered their assets on the LSBUD service.
2. "Non LSBUD Members" are asset owners who have not registered their assets on the LSBUD service but LSBUD is aware of their existence. Please note that there could be other asset owners within your search area.

Below are three lists of asset owners:

1. **LSBUD Members who have assets registered within your search area. ("Affected")**
 - a. These LSBUD Members will either:
 - i. Ask for further information ("Email Additional Info" noted in status). The additional information includes: Site contact name and number, Location plan, Detailed plan (minimum scale 1:2500), Cross sectional drawings (if available), Work Specification.
 - ii. Respond directly to you ("Await Response"). In this response they may either send plans directly to you or ask for further information before being able to do so, particularly if any payments or authorisations are required.
2. **LSBUD Members who do not have assets registered within your search area. ("Not Affected")**
3. **Non LSBUD Members who may have assets within your search area.** Please note that this list is not exhaustive and all details are provided as a guide only. It is your responsibility to identify and consult with all asset owners before proceeding.

National Grid. Please note that the LSBUD service only contains information on National Grid's Gas above 7 bar asset, all National Grid Electricity Transmission assets and National Grid's Gas Distribution Limited above 2 bar asset.

For National Grid Gas Distribution Ltd below 2 bar asset information please go to www.beforeyoudig.nationalgrid.com

LSBUD Members who have assets registered on the LSBUD service within the vicinity of your search area.

List of affected LSBUD members

Asset Owner	Phone/Email	Emergency Only	Status
ESP Utilities Group	01372227560	01372227560	Await response

LSBUD Members who do not have assets registered on the LSBUD service within the vicinity of your search area. Please be aware that LSBUD Members make regular changes to their assets and this list may vary for new enquiries in the same area.

List of not affected LSBUD members

AWE Pipeline	Gateshead Energy Company	Prysmian Cables & Systems Ltd (c/o Western Link)
BOC Limited (A Member of the Linde Group)	Gigaclear PLC	Redundant Pipelines - LPDA
BP Exploration Operating Company Limited	Humbly Grove Energy	RWEpower (Little Barford and South Haven)
BPA	IGas Energy	SABIC UK Petrochemicals
Carrington Gas Pipeline	INEOS FPS Pipelines	Scottish Power Generation
CATS Pipeline c/o Wood Group PSN	INEOS Manufacturing (Scotland and TSEP)	Seabank Power Ltd
Cemex	INOVYN Enterprises Limited	SGN
Centrica Storage Ltd	Intergen (Coryton Energy or Spalding Energy)	Shell (St Fergus to Mossmorran)
CLH Pipeline System Ltd	Mainline Pipelines Limited	Shell Pipelines
Concept Solutions People Ltd	Manchester Jetline Limited	SSE (Peterhead Power Station)
ConocoPhillips (UK) Ltd	Manx Cable Company	Total (Colnbrook & Colwick Pipelines)
DIO (MOD Abandoned Pipelines)	Marchwood Power Ltd (Gas Pipeline)	Total Finaline Pipelines
E.ON UK CHP Limited	Melbourn Solar Limited	Transmission Capital
EirGrid	National Grid Gas (Above 7 bar), National Grid Gas Distribution Limited (Above 2 bar) and National Grid Electricity Transmission	UK Power Networks
Electricity North West Limited	Northumbrian Water Group	Uniper UK Ltd
ENI & Himor c/o Penspen Ltd	NPower CHP Pipelines	Vattenfall
EnQuest NNS Limited	Oikos Storage Limited	Veolia ES SELCHP Limited
EP Langage Limited	Ørsted	Western Power Distribution
ESSAR	Perenco UK Limited (Purbeck Southampton Pipeline)	Westminster City Council
Esso Petroleum Company Limited	Petroineos	Wingas Storage UK Ltd
Fulcrum Pipelines Limited	Phillips 66	Zayo Group UK Ltd c/o JSM Group Ltd
Gamma	Premier Transmission Ltd (SNIP)	

The following Non-LSBUD Members may have assets in your search area. It is **YOUR RESPONSIBILITY** to contact them before proceeding. Please be aware this list is not exhaustive and it is your responsibility to identify and contact all asset owners within your search area.

Non-LSBUD members (Asset owners not registered on LSBUD)			
Asset Owner	Preferred contact method	Phone	Status
BT	https://www.swns.bt.com/pls/mbe/welcome.home	08009173993	Not Notified
CityFibre	asset.team@cityfibre.com	033 3150 7282	Not Notified
Colt	plantenquiries@catelecomuk.com	01227768427	Not Notified
Dee Valley Water	www.digdat.co.uk	01978833228	Not Notified
Dwr Cymru Welsh Water	ndcenquiries@dwrcymru.com	0800 917 2652	Not Notified
Energetics Electricity	plantenquiries@energetics-uk.com	01698404646	Not Notified
ENGIE	nrsua@cofely-gdfsuez.com	01293 549944	Not Notified
GTC	https://pe.gtc-uk.co.uk/PlantEnqMembership	01359240363	Not Notified
GTT (formerly Hibernia Networks)	owen.maguire@gtt.net	01704 322 300	Not Notified
Interoute	interoute.enquiries@plancast.co.uk	02070259000	Not Notified
KPN (c/-Instalcom)	kpn.plantenquiries@instalcom.co.uk	n/a	Not Notified
Level 3 Communications UK Ltd (C/-Instalcom)	plantenquiries@instalcom.co.uk	02087314613	Not Notified
Mobile Broadband Network Limited	mbnl.plant.enquiries@turntown.com	01212 621 100	Not Notified
Scottish Power (South)	requestforplansmanweb@sppowersystems.com	01516092373	Not Notified
Tata (c/-McNicholas)	plantenquiries@mcnicholas.co.uk	03300558469	Not Notified
Utility assets Ltd	assetrecords@utilityassets.co.uk		Not Notified
Verizon Business	osp-team@uk.verizonbusiness.com	01293611736	Not Notified
Virgin Media	http://www.digdat.co.uk	08708883116	Not Notified
Vodafone	osm.enquiries@atkinsglobal.com	01454662881	Not Notified
Vtesse Networks	https://plant.interoute.com/plant-enquiries/	01992532100	Not Notified
Wales and The West Utilities	www.wuutilities.co.uk/login.aspx	02920278912	Not Notified

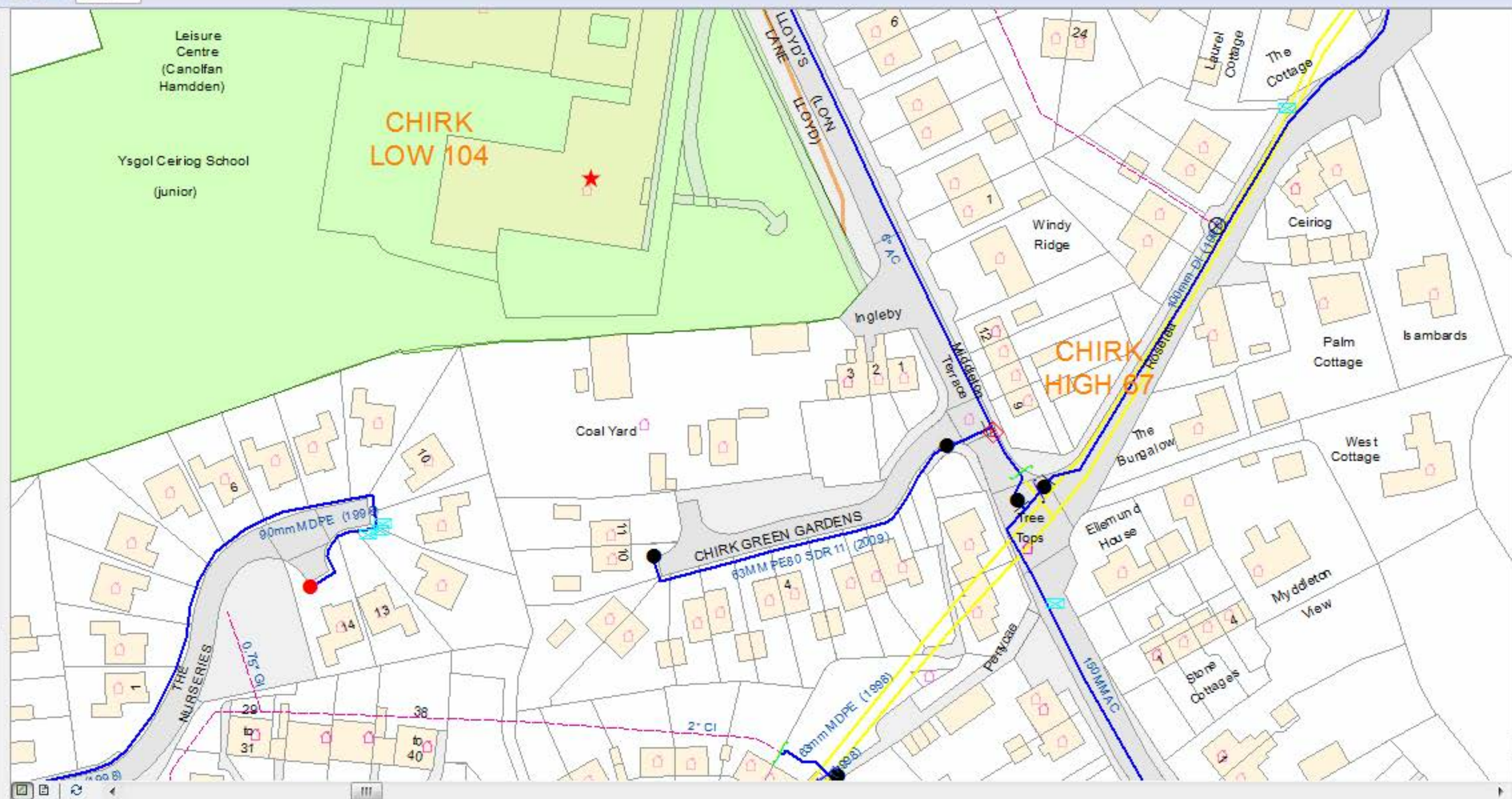
Disclaimer

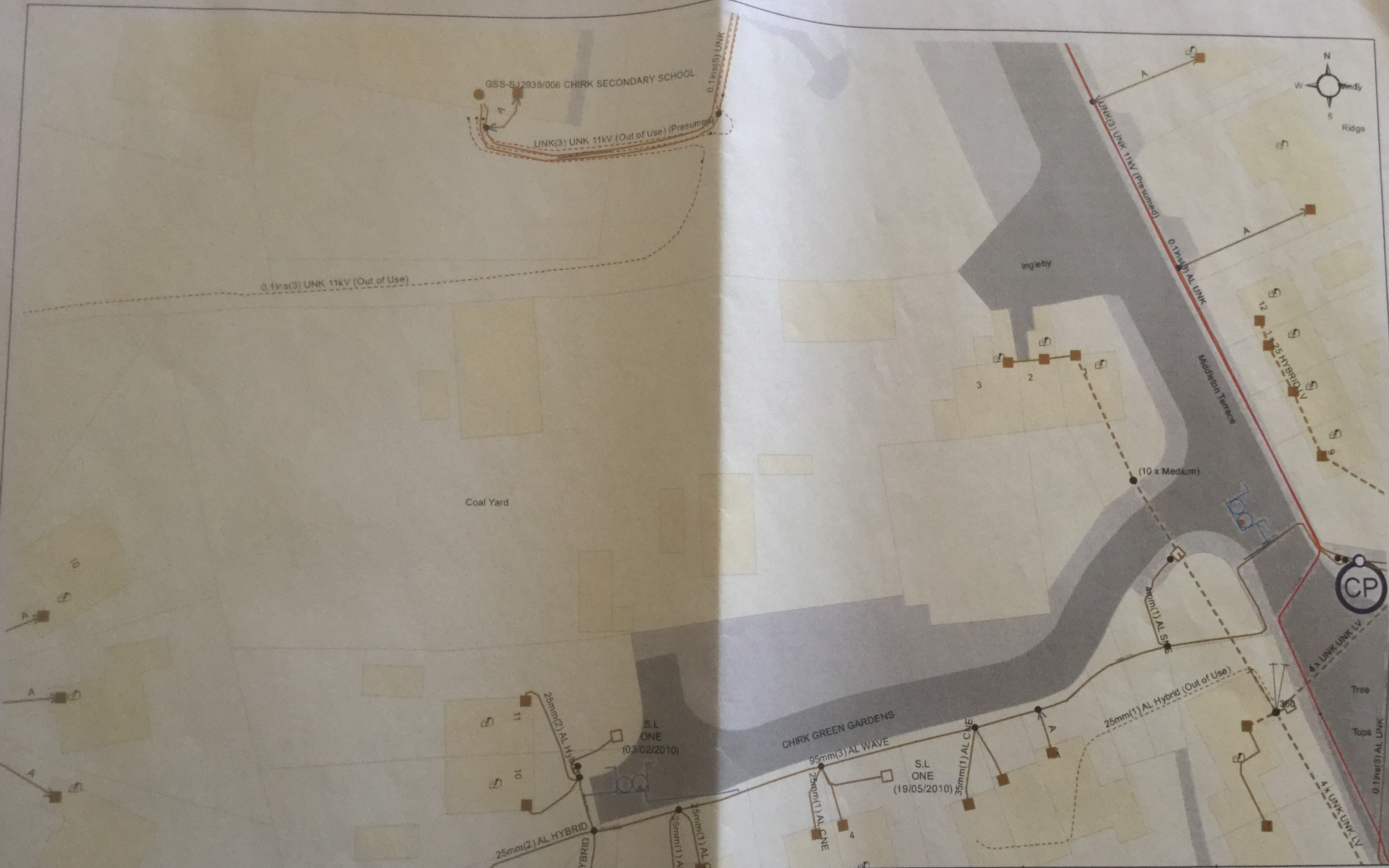
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The results of this Enquiry are personal to the Enquirer and shall not be shared with or relied upon by any other party. The asset information on which the Enquiry results are based has been provided by LSBUD Members, therefore LineasearchbeforeUdig will provide no guarantee that such information is accurate or reliable nor does it monitor such asset information for accuracy and reliability going forward. There may also be asset owners which do not participate in the enquiry service operated by LineasearchbeforeUdig, including but not exclusively those set out above. Therefore, LineasearchbeforeUdig cannot make any representation or give any guarantee or warranty as to the completeness of the information contained in the enquiry results or accept any responsibility for the accuracy of the mapping images used. LineasearchbeforeUdig and its employees, agents and consultants accept no liability (save that nothing in this Enquiry Confirmation excludes or limits our liability for death or personal injury arising from our negligence, or our fraud or fraudulent misrepresentation, or any other liability that cannot be excluded or limited by English law) arising in respect thereof or in any other way for errors or omissions including responsibility to any person by reason of negligence.



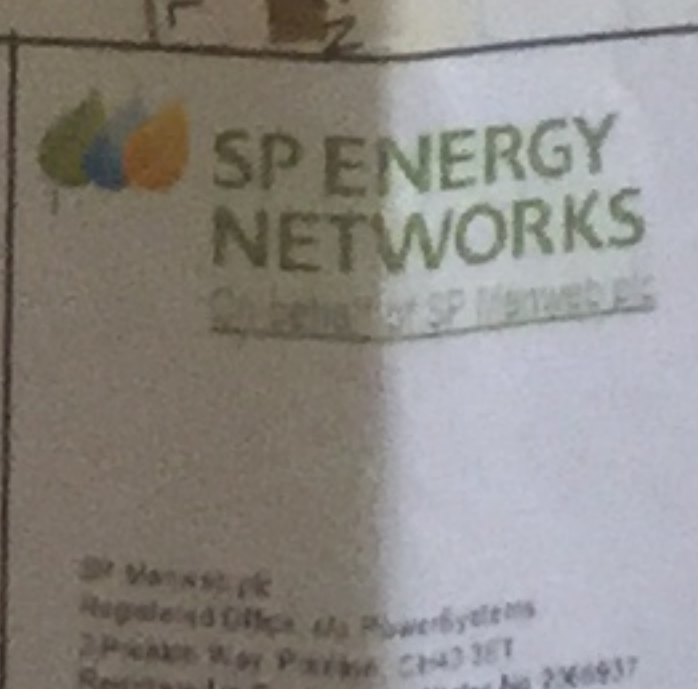
- Layers**
- ☒ DVW_Sites
 - Site_Type
 - ☒ Service Reservoir
 - ☒ Impounding Reservoir
 - ☒ Booster Station
 - ☒ Pump Station
 - ☒ Works
 - ☒ Radio Mast
 - ☒ Head Office
 - ☐ Photos
 - ☐ QuarterSheet
 - ☒ Annotation
 - ☒ Water Distribution
 - ☒ Flow_Loggers
 - ☒ Pressure_Loggers
 - ☒ Meter
 - ☒ Pump
 - ☒ Control Valve
 - ☒ System Valve
 - ☒ Stop Tap
 - ☒ Fitting
 - ☒ Hydrant
 - ☒ Customer Management
 - ☒ Incident Management
 - ☒ Pipes
 - ☒ Decommissioned Assets
 - ☐ DTM_Lines
 - ☒ OSM
 - ☒ Functional Site
 - ☐ <all other values>
- SITETHEME





The position and depths of underground and overhead apparatus as indicated on this plan are approximate and are intended for guidance only. The details may have changed if the land surface levels have altered. You are also informed that the plan may not show, or may inaccurately show, individual property services and services to street lighting installations. The object of locating the apparatus precisely is to recommend any excavation or other work in the immediate vicinity of the apparatus, solely under the person undertaking to recommend the work. Before any such work is undertaken, the precise location of the apparatus and cables should therefore be ascertained by suitable means. In the event of an emergency or for further assistance please contact 0800-023-286 (Electric Power) or 0800-06-13400 (SP Networks) 24hrs.

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<u>OVERHEAD LINE</u>		-----	
<u>UNDERGROUND CABLES</u>			
In Use	—————		
Out of Use	-----		
Assumed route	<—————>		
<u>VOLTAGE COLOUR KEY</u>			
EHV	132kV	—————	R
	22kV	—————	G
HV		—————	R
LV		—————	B

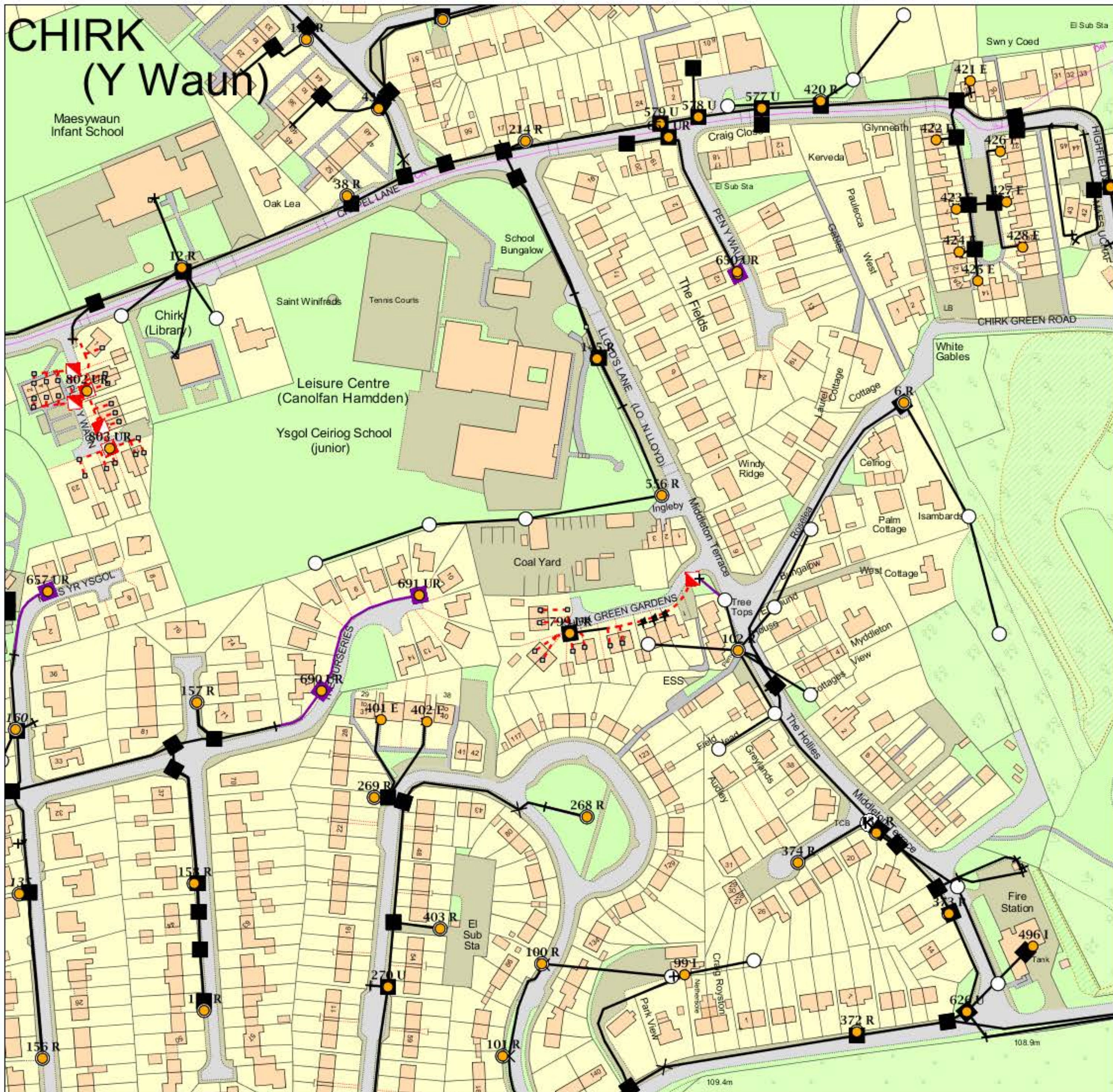
Where cables have been laid SINCE 1 OCTOBER 1988, the following depths in mm apply (to the tops of cables or ducts) UNLESS OTHERWISE SHOWN, but see comments (TO TOP OF CABLE, ADD 75mm FOR BOTTOM OF TRENCH)

	EHV	HV	LV
IN FOOTPATHS	775	600	450
ACROSS ROADS	775	700	600
ALONG ROADS	775	700	600
AGRICULTURAL	910	910	810

Your attention is drawn to the Health and Safety Ditch line Booklet H-SGAT, available from HSE.

DATE	12/01/2016
SCALE	1 : 352
MAP REFERENCE	329,368 338,264
0 1 2 4 6 8 Metres	

Maps by email Plant Information Reply



IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy.

It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.



openreach

CLICK BEFORE YOU DIG

FOR PROFESSIONAL FREE ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS INCLUDING LOCATE AND MARKING SERVICE

email cbyd@openreach.co.uk

ADVANCE NOTICE REQUIRED
(Office hours: Monday - Friday 08.00 to 17.00)
www.openreach.co.uk/cbyd

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KEY TO BT SYMBOLS

DP		Pole	
Planned DP		Planned Pole	
PCP		Joint Box	
Planned PCP		Change Of State	
Built		Split Coupling	
Planned		Duct Tee	
Inferred		Planned Box	
Building		Manhole	
Kiosk		Planned Manhole	
Hatchings		Cabinet	
		Planned Cabinet	

Other proposed plant is shown using dashed lines.
BT Symbols not listed above maybe disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation

BT Ref : VLH11481Y
Map Reference : (centre) SJ2935438270
Easting/Northing : (centre) 329354,338270
Issued : 01/02/2018 11:49:04

WARNING: IF PLANNED WORKS FALL INSIDE HATCHED AREA IT IS ESSENTIAL BEFORE PROCEEDING THAT YOU CONTACT THE NATIONAL NOTICE HANDLING CENTRE. PLEASE SEND E-MAIL TO: nnhc@openreach.co.uk