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**Forge Lane, Former Steelworks,
Thornhill, Dewsbury**
Volume Two, Interpretive Report on Ground
Investigation

127001
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Client:
Kirklees Metropolitan Council
Property Services Consultancy
Kirkgate Buildings
Byram Street
Huddersfield
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Forge Lane, Former Steelworks
Thornhill, Dewsbury

127001

Volume One: Factual Report on Ground Investigation

Volume Two: Interpretive Report on Ground Investigation

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1. INTRODUCTION

It is proposed to develop the site of a former steelworks for combined residential housing and light industrial use. On the instructions of Kirklees Metropolitan Council, Property Services Consultancy, an investigation was made by Exploration Associates Limited to provide information on the ground conditions for the design and construction of the proposed works. A report to include the interpretation of quantitative soil parameters, the detailed assessment of the ground conditions and recommendations on design and construction was confirmed in a letter ref CC & C/AT/DY/CTS97-7 dated 20th January 1997.

The report is presented in two volumes. This volume, Volume Two, the Interpretive Report contains detailed assessments of the ground and groundwater conditions and recommendations on design and construction. Also included is an assessment of the ground conditions with regard to contamination. Volume One, the Factual Report contains descriptions of the fieldwork and testing carried out and results of tests measurements and descriptions made in the field and in the laboratory.

Throughout this Volume, Volume Two, the Interpretive Report, reference is made to the factual information contained in Volume One. It is recommended that the factual report is available when considering the discussion and recommendations presented in this report.

The investigation was carried out in general accordance with the relevant British Standards^(1,2). General notes on the techniques employed during site investigations carried out by Exploration Associates Limited are given in the Enclosures.

2 THE SITE

General Description

The site is located at National Grid reference SE237198 as shown on the Site Location Plan (Drawing 1).

The site layout at the time of the investigation and the Exploratory Hole Locations are indicated on Drawing 2. The site is approximately rectangular and elongated from north west to south east with maximum dimensions of approximately 350m by 200m. The north western edge of the site is bounded by Forge Lane. The north eastern edge of the site is bounded by the Calder and Hebble Navigation Long Cut. The eastern edge of the site is bounded by a fence, separating it from an adjacent factory site, and the south western boundary is formed by housing, gardens and allotments.

The site generally decreases in level from Forge Lane towards the south east. Forge Lane is at an approximate level of 44.50m AOD. The site boundary adjacent to Forge Lane generally comprises a steep bank up to 7m high.

A series of terraces and concrete ramps occupy the northwestern area of the site, these terraces reduce in level from 41.34m AOD at the location of Borehole 15 to 38.40m AOD at the location of Borehole 2. An extensive area of concrete hardstanding extends towards the south east, at a general level of about 38.40m AOD. Numerous H section steel stanchions in concrete bases were noted in this area. The extent of this area is roughly delineated by a line from Borehole 2 to Trial Pit 7, however it was noted that individual stanchion bases also exist in the area of Borehole 6, and Trial Pit 5.

An open drain runs onto the site from a point some 60m west of the southern corner, and flows northwards across the site, towards the location of Trial Pit 10, where it swings through approximately 90° towards the northwest for some 90m to a circular concrete culvert. The base of the drain, where it enters the site, is approximately 37.00m AOD. The invert level of the culvert is approximately 36.35m AOD.

An abandoned gravel pit is located towards the centre of the southwestern side boundary. At the time of levelling of the boreholes the water level in the gravel pit was at 37.25m AOD. The area around the gravel pit is generally elevated above the overall site, with levels varying from 37.52m (Trial Pit 13) to 39.60m (Borehole 8). An embankment runs along the northeastern side of the gravel pit at a level of about 39.00m.

The central site area between the gravel pit and the drain is generally level although piles of tipped material occupied the west central area of the site towards the drain. Large concrete and sandstone blocks were noted within this tipped material.

The area between the drain and the eastern site boundary is generally level at an elevation of about 37.40m AOD.

At the time of the investigation the site was occupied by rough grass, saplings and occasional mature trees.

Site History

Historical Ordnance Survey plans of the site (see enclosure A) for 1893 record "Thornhill Iron Works" and "The Original Glass Works" on the northern and eastern areas of the site respectively, with associated railway lines extending towards the southeast. The plan for 1907 indicates a similar extent of industrial development with the addition of a gravel pit. Plans for 1912 and 1922 indicate a similar level of development, with an extended gravel pit, although the glass works appears to have been omitted from the plan for 1912.

The plan for 1933 indicates that the glass works no longer existed although the Iron and Steel works, railway lines and gravel pit are still operational. A docking basin is evident on the plans, adjacent to the iron and steel works, directly connected to the canal.

Historical plans are attached to this report.

It is understood from local hearsay that the iron and steelworks was demolished prior to 1985.

Proposed Development

At the time of the investigation the proposed development comprised five light industrial units located adjacent to Forge Lane. The proposed development for the remainder of the site comprises mixed tenure housing with associated service roads and open spaces. The proposed development extends beyond the eastern boundary of the site.

3. THE INVESTIGATION

The investigation comprised a period of site works followed by a period of geotechnical and analytical testing.

The fieldwork was carried out during the period 20th January to 28th January 1997. The fieldwork comprised fifteen cable percussive boreholes and thirteen mechanically excavated trial pits with associated sampling testing and measurements.

Geotechnical and analytical testing was carried out on samples obtained during the fieldworks.

Details of the fieldwork and laboratory tests together with full records and results are presented in Volume One, the Factual Report.

4. GROUND CONDITIONS

4.1 Published Geology

Geological records⁽³⁾ indicate that the site is underlain by made ground overlying drift deposits. The drift deposits are indicated to comprise Alluvium beneath the majority of the site with "Brickearth of Valleys" along the south western edge.

The bedrock beneath the site comprises sandstones, siltstone and mudstones of the Coal Measures of Upper Carboniferous age.

4.2 Strata Encountered

General

The strata encountered across the site may be summarised as the following units:-

Made Ground
Alluvial Clay
Peat
Sand/gravel/cobbles
Glacial Till
Bedrock

The distribution of these units and their general characteristics are outlined below. In general, beneath an average of 2.00m of loose granular fill at a level of around 36.0mOD, soft alluvial, occasionally organic, clays are present across approximately half the site parallel to the Calder and Hebble Navigation. The approximate lateral extent of these deposits is indicated on Drawing 3. The alluvial deposits thicken from approximately 0.60m to around 5.00m at the Northern site boundary. The alluvial deposits are typically underlain by medium dense sand and gravels (possibly fluvio glacial) which rest on mudstone bedrock although cohesive glacial till was also encountered at the location of Borehole 15 and occasionally as a basal layer between the sand and gravels and bedrock. The rock surface appears to dip toward the south and east from approximately 32.0mOD to 28.0mOD. Removal of the fluvio-glacial sand and gravel deposits where they would originally have been encountered at the surface, has taken place along the central southern site area. The resulting pit appears to have been infilled predominantly with very soft silt, possibly dredgings from the Calder and Hebble Navigation.

General schematic sections across the site are given on Drawings 4 to 10. The section lines are indicated on Drawing 3.

Made Ground

Made ground was encountered in Boreholes 1 to 7, 9, 10, 14 and 15 and Trial Pits 1 to 5, 8 to 10 and 13. With the exception of Trial Pit 13 the thickness of made ground varied from 0.80m (Borehole 10) to 3.90m (Borehole 1).

The made ground may be broadly subdivided into rubble fill, sandstone fill, ash/slag fill and black clayey silt fill.

General rubble fill was encountered in Boreholes 1, 3 and 5 and Trial Pits 1, 2, 4 and 9 to depths of between 0.60m (Borehole 15) and 2.20m (Trial Pit 9). Mudstone fill was encountered in Boreholes 1 and 3, and Trial Pit 1, beneath rubble fill and in Trial Pit 8 beneath clayey silt fill, to depths of between

3.10m (Trial Pit 8) and 4.20m (Trial Pit 1). A maximum thickness of mudstone fill of 3.00m was encountered in Trial Pit 1. Ash and ash/slag fill was encountered, locally beneath topsoil, in Boreholes 2, 4, 5, 6 and 7 and Trial Pits 3 and 5 to depths of between 1.00m (Borehole 6) and 2.75m (Borehole 2). Peaty ash was encountered in Borehole 14 to a depth of 0.80m. Black clayey silt fill was encountered in Trial Pit 8 to a depth of 2.30m. A similar deposit was encountered in Borehole 8 and Trial Pit 6 to depths of 2.60m and 1.55m respectively, although it was unclear whether this was made ground.

Borehole 10 and Trial Pit 9 encountered clayey fill to 0.80m and 1.90m respectively. This may represent reworked locally derived natural deposits.

Trial Pit 13 was excavated in the backfilled gravel pit and encountered very soft black clayey silt to a depth of approximately 5.00m. The base of the gravel pit was not proven.

Alluvial Clay

Alluvial clay was encountered in Boreholes 1, 2, 3, 6, 7 and 9 and Trial Pits 1, 2, 3, 4, 7, 9, 10 and 11, generally beneath made ground. The thickness of the Alluvium was greatest along the north east site boundary, adjacent to the Calder and Hebble Navigation. The thickness varied from 0.25m (Borehole 2) to >3.50m (Trial Pit 7). The Alluvium generally comprised soft silty clay with local peaty horizons.

Peat

Peat was encountered in Borehole 9 and Trial Pit 4 adjacent to the Calder and Hebble Navigation. A thickness of 1.20m and 0.50m was proved in Borehole 9 and Trial Pit 4 respectively.

Sand/Gravel/Cobbles

The majority of the drift encountered across the site comprised variably graded granular deposits including sand, gravel and cobbles.

Granular strata was encountered in all exploratory holes, with the exception of Trial Pit 7, and generally increased in thickness towards the south and east. Boreholes 3 and 9 encountered only 0.70m and 0.30m of granular strata respectively. A maximum of 9.00m was encountered in Borehole 8.

Within the granular strata, lenses/layers of clay were encountered. These may represent clay matrix within the gravel/cobbles or locally, sandy clay layers.

Glacial Till

Borehole 15 encountered stiff clay between 1.30m and 7.60m, softening from 7.60m to 8.00m adjacent to the confined water level observed in the underlying gravels at this location.

Boreholes 3 and 9 encountered, stiff and very stiff clay from 5.40m to 7.30m, 4.90m to 7.10m respectively. This may in part represent glacially reworked and/or weathered mudstone bedrock.

Bedrock

Bedrock was encountered in all boreholes except Borehole 6, at depths between 6.30m (Borehole 5) and 11.60m (Borehole 8). Bedrock was not encountered in the trial pits. With the exception of Borehole 15, the bedrock encountered across the site comprised mudstone. The bedrock encountered in Borehole 15 comprised sandstone.

Boreholes 2, 4, 5, 7, 10, 11 and 14 encountered a thin layer of clay, overlying mudstone. This may represent a thin weathered mantle or partial glacial reworking and lodgement deposition.

4.3 Groundwater

Groundwater was encountered in all exploratory holes at depths ranging from 1.10m (Trial Pit 12) to 9.00m (Borehole 14) in made ground, alluvial deposits and granular strata. The presence of confined water within the gravel sequence indicates that the clay horizons noted are laterally extensive.

The groundwater encountered was generally confined.

Monitoring of the standpipes subsequent to site works indicate that the phreatic surface across the site varies only slightly between 36.20m AOD (Borehole 12) and 36.70m AOD (Boreholes 4, 7 and 9).

The water level in the canal and gravel pit at the time of site works was 37.76m AOD and 37.26m AOD respectively. The water in the drain entered the site at a level of about 37.40m AOD and was measured at about 36.40m AOD at its exit point into the culvert.

5. ENGINEERING ASSESSMENT

5.1 General

The development proposals at the time of the investigation were understood to comprise five light industrial units, occupying a strip approximately 70m wide, adjacent and parallel to Forge Lane. Access is indicated from the southern end of Forge Lane. The remainder of the site will be occupied by mixed tenure housing with associated roadways, gardens and open spaces.

This assessment is based on the proposed development. Any significant change in the type of development may be beyond the scope of this assessment.

The western part of the site is currently occupied by extensive areas of hardstanding with stanchion bases and ground beams evident. Prior to development it is recommended that the areas of hardstanding are removed and stanchion bases are grubbed up and replaced with suitable compacted granular fill. Trial pit 4 was excavated adjacent to a stanchion base which extended to a depth of 1.40m. This depth may be used as a guide although it may be exceeded in depth by bases on other parts of the site.

The docking bay, noted adjacent to the Thornhill Iron and Steelworks, is no longer evident on site. The nature of backfill and degree of hydraulic continuity with the canal is not known. The bay was located some 150m south-east of Forge Lane Bridge and encroached into the site by some 12m. It was not investigated during this programme of works due to the possibility of breaching the canal banks. It is likely that the extent and nature of the bay should become evident when the existing concrete slab has been removed. Work along the edge of the canal should be undertaken in cooperation with the British Waterways Board.

5.2 Foundations

For ease of reference the two development sub areas (industrial/residential) outlined above are discussed separately below with regard to suitable foundations. A thematic plan indicating possible foundation options is given on Drawing 3.

5.2.i Industrial Development

The area adjacent to Forge Lane, proposed for industrial development, was investigated by Boreholes 1, 2, 3, 4 and 15 and Trial Pits 1, 2 and 4.

The present ground levels across this area vary from 41.34m AOD (Borehole 15) to 38.40m AOD (Borehole 2). It is assumed for the purpose of this assessment that some regrading will be necessary in order to produce a level

formation area, thus the founding strata may in part be influenced by the nature and level of compaction of material used for regrading. In addition any importing or removal of materials with regard to contamination may influence the development.

Notwithstanding these effects general recommendations are made regarding foundations.

The foundation types considered are as follows:-

- Shallow pad or strips founding on existing made ground
- Piled Foundations

5.2.ii Industrial Units

Shallow Pads or strips

It is considered that for light design loads shallow foundations, within the made ground, will provide a suitable foundation for the proposed works. The use of shallow foundations should enable temporary works to be carried out above the water table.

Based on an average SPT 'N' value of 10, the allowable bearing pressure for strip foundations 600mm wide and 1m square pads, founded at shallow depths (<900mm) within the made ground will be about 70kN/m². The base of any foundation excavations within made ground should be closely inspected for any loose spots or deleterious materials. These should be removed and replaced with clean compacted granular fill. The base of excavations should be proof rolled prior to placing of concrete.

Piled Foundations

If loadings exceed the allowable bearing capacity at shallow depths ; made ground consideration may be given to short bored piles bearing within the underlying glacial drift deposits or on rock.

As the strata varies across the area to be occupied by the industrial bearing on soil strata may bear on either medium dense gra (Borehole 1) or very stiff clay (Borehole 3).

The allowable working loads will be lower in areas where the very stiff clay. Based on the strata profile encountered in B adopting an undrained shear strength of 150kN/m² for the cl; depth, a single bored pile of 450mm diameter installed to a

5.70m will support an estimated allowable vertical working load of 160kN. If the pile diameter is increased to 600mm the estimated allowable vertical working load increases to about 250kN. Where piles end bear onto medium dense gravel (Borehole 1) allowable working loads in the region of 245kN and 410kN respectively are estimated for 450mm and 600mm bored piles taken approximately 0.7m into the gravels (6.1m).

In order to significantly increase the allowable working load above these values it is recommended that the piles should be extended into bedrock which is likely to be encountered at between 32.0mOD (Northern Part) and 30.0mOD (Southern Part).

Based on a mean SPT 'N' value at rockhead of 100, a single bored pile of 450mm diameter and about 8.00m length should support on estimated allowable vertical load of 790kN. If the pile diameter increases to 600mm the estimated allowable vertical working load increases to about 1330kN. These values are presented as a guide and the working load should take into consideration the final project design and type of pile employed.

5.2.ii Residential Development

The area designated for residential development was investigated by Boreholes 5 to 14, and Trial Pits 3 and 5 to 13.

The general ground level across the site lies at about 38.00m AOD. The area around the gravel pit is elevated above this to about 39.00m AOD.

On the basis of the strata encountered, the area can broadly be divided into four areas in terms of available foundation options. These areas are approximately indicated on Drawing 3.

Area adjacent to canal

Along the north eastern site boundary, adjacent to the Calder and Hebble Navigation, the strata, at shallow depth, are considered unsuitable for foundation support due to the presence of soft alluvial clay and associated peat deposits to depths in the region of 5.00m. Piled foundations to houses alongside the canal are likely to be the most appropriate foundation option with piles being taken to the mudstone bedrock. Rockhead appears to dip from approximately 32.0mOD to 28.0mOD from NW to SE along the canalside. Pile lengths in the region of 7m to 10m are consequently envisaged.

Central area

In the central part of the proposed housing site, the upper 2.0m or so of material generally comprises very loose to loose granular fill resting on medium dense glacial sands and gravels at about 36.0mOD. In some areas the removal of former stanchions and foundations is likely to be necessary. The fill materials are considered marginal in their ability to directly support foundations, consequently the use of vibrocompaction may be considered in this area. Alternatively footing excavations could be taken through the made ground to the natural soils and formation levels brought up using re-compacted trench fill.

Gravel pit area

It is recommended that the material surrounding the gravel pit, forming the embankments along the north west and south east sides, is removed to reduce the area to the general site level. The material within the disused gravel pit (which may largely comprise dredged material from the canal) is not considered suitable for foundation support and is unlikely to provide sufficient lateral support to enable the construction of stone columns by vibroreplacement. The material should preferably be removed and replaced with suitable compacted granular fill. Excavations may, however, locally exceed 5.00m depth to achieve this.

In the vicinity of Borehole 6 very soft black clay, which may represent an extension of the existing gravel pit, was encountered between 1.00m and 2.85m. Again, this material will not provide a suitable founding strata and should be removed and replaced with compacted granular fill to foundation level. Following such remedial works, this area should be suitable for development with housing placed on strip foundations at shallow depths.

Should deep excavation particularly within the central part of the gravel pit be considered impractical, consideration could be given to piled foundations at this location, although it may be preferable to limit usage of this area to gardens or landscaping. If piles are adopted, they should be designed as end bearing only and an allowance made for negative skin friction within the infill material. Suspended floor slabs are likely to be required for structures in this area.

Further investigation, perhaps comprising dynamic probes may be appropriate to determine the extent of the deepest part of the pit. Generally, the removal of up to 3.00m of existing backfill and soft alluvial clays towards Trial Pit 3 should reduce the area affected by deep unsuitable ground considerably. Groundwater ingresses may be anticipated within excavations below 36.50m OD.

South eastern area

The south eastern part of the site is considered suitable for conventional foundation construction. Strip footings should be taken to depths of between 1.20m and 1.50m to bear onto the granular glacial deposits. An allowable bearing pressure in the region of 80kN/m^2 is considered appropriate for those materials.

The proposed development will need to consider re-routing or culverting of the existing open drain. Development along the edge of the Calder and Hebble Navigation, in the northern part of the site will require consideration of the existing culvert and associated drainage evidenced by manhole covers in the northern part of the site.

5.3 Excavation, Side Support and Dewatering

Excavations within the made ground and natural drift deposits revealed by this investigation should be within the capacity of conventional hydraulic plant once any concrete, hardstanding and bases have been removed.

Concrete demolition rubble was noted, tipped at surface, in the area of Trial Pit 13 and adjacent to Trial Pit 9, Borehole 10 and Trial Pit 11. This material may require breaking up prior to removal.

Regrading of material adjacent to Forge Lane may require the formation of temporary slopes. For fully drained slopes an angle of friction of about 35° is considered suitable for preliminary design in this area.

Groundwater was encountered in all exploratory holes locally at depths as shallow as 1.20m (Borehole 12). The overall phreatic surface observed in standpipes and piezometers across the site was about 36.60m AOD. Groundwater inflows were observed to be high and generally the water bearing strata should be considered free draining. For preliminary dewatering design, a permeability of about 10^{-5} is considered appropriate for the granular strata and a mass permeability of about 10^{-6} for the alluvial clays.

The stability of excavations will depend primarily on the extent and nature of groundwater control carried out. In the north western area of the site shallow excavations are unlikely to encounter groundwater and generally excavations up to 1.20m deep will require half boarding or as appropriate for safe workings. In areas where excavations are carried out below the water table dewatering, by either well points or high capacity sump pumping, with full trench support or low angle batters will be required. Support to excavations should be in accordance with the recommendations of CIRIA Report No. 97⁽⁴⁾ and should at all times ensure safe working conditions.

5.4 Road Construction

Laboratory testing indicates a range of CBR values from 12% to 30% for ash fill and granular strata at depths of about 0.5m along the line of the proposed main access road for the housing development. Consequently a capping layer is not likely to be required providing the formation is suitably prepared and any deleterious material is removed and replaced with suitable granular fill.

It is anticipated that, locally, areas of frost susceptible material will be encountered, notably in the area of Boreholes 6. This should be removed to a minimum of 450mm below the base of the road surface.

5.5 Chemical Attack on Buried Concrete

Available laboratory test results indicate that the sulphate content of 2:1 extract from the made ground materials and natural soils generally ranges from <0.01g/l for natural soils to 0.83g/l, SO₃, for made ground allied to pH values in the range 3.8 to 10. Tests on groundwater indicate a sulphate content in the range 0.05g/l to 0.39 g/l SO₃ allied to pH values in the range of 5.1 to 6.9.

On this basis it is considered that concrete could be designed in accordance with Class 1 of BRE Digest 363⁽⁵⁾.

A notable exception was the black silty clay and clayey silt fill (probable dredgings) in Borehole 6 and Trial Pit 8 which recorded elevated sulphate contents of 1.4 g/l SO₃ and 1.2g/l SO₃ respectively indicating that Class 2 conditions would apply for buried concrete in contact with such material.

6. CONTAMINATION ASSESSMENT

6.1 General

Chemical Analysis was carried out for a range of parameters on twenty five samples of soil from boreholes and forty samples of soil from trial pits. These samples were predominantly from made ground and the uppermost part of the natural strata. A sample of fibrous material from the surface was collected and tested for asbestos.

Analysis was also carried out on eleven water samples obtained from trial pits, two water samples obtained from the drainage ditch and water samples from the gravel pit and canal.

The full results of all analyses carried out are presented in Volume One, the Factual Report.

6.2 Classification of Contaminant Levels

Assessment of analytical results has been based on guidelines published by Interdepartmental Committee for the Redevelopment of Contaminated Land ⁽⁶⁾. (I.C.R.C.L).

These guidelines provide figures to aid assessment of the degree of contamination present in terms of the proposed end use of the site.

ICRCL guidance consists of threshold trigger levels for a range of contaminants associated with former coal carbonisation sites. The trigger levels referred to are:

Threshold Level: If concentrations recorded are below this level the site may be considered uncontaminated.

Action Level: If concentrations recorded exceed this level then some form of remedial work will be required to allow development to proceed.

Where no action trigger value is present, judgement is required to assess the risks that may be posed to users of the proposed development.

The ICRCL guidelines indicate threshold levels for particular determinands in relation to the proposed end use of the site. These end use categories comprise:

- Domestic gardens allotments and play areas
- Parks, playing fields and open spaces
- Landscaped areas
- Buildings and hard cover

Table 1 has been compiled based on the end use category "domestic gardens allotments and play areas".

For the purposes of this assessment, the ICRCL threshold trigger value for arsenic has not been adopted. Reference to waste management guidelines ⁽⁷⁾ indicates that arsenic concentrations of up to 30mg/kg are typical of uncontaminated soils. In addition the Geochemical Atlas of England and Wales ⁽⁸⁾ states that 95% of all soils in England and Wales have arsenic concentrations of less than 29mg/kg. On this basis a revised threshold value of 30mg/kg has been used for this assessment.

Assessment of the results has also been carried out with reference to guidelines for waste disposal ⁽⁷⁾. These guidelines provide figures that classify

materials as follows:-

- A - Uncontaminated
- B - Slightly contaminated
- C - Contaminated
- D - Heavily contaminated
- E - Unusually heavily contaminated

A classification of this type is generally adopted by Local Authorities for accepting waste materials to landfill sites.

Calorific value has been assessed on the basis of guidance figures in ICRCL 61/84 ⁽⁹⁾ which suggest a figure of 7-10 MJ/kg above which a smouldering fire may be sustained and cause a hazard.

The presence of asbestos should always be considered a hazard and is therefore assessed on a presence/absence basis.

6.3 Contamination Results

Soil Sample Analysis

Full results of all testing are presented in Volume One, the factual report.

The results have been tabulated with respect to ICRCL ⁽⁶⁾ trigger levels in Table 1 and with respect to GLC waste disposal guidelines ⁽⁷⁾ in Table 2.

With reference to table 1 it can be seen that contamination above the threshold trigger levels are present at the site in the form of arsenic (33 values), cadmium (5 values), lead (3 values), mercury (4 values), selenium (1 value), copper (4 values), nickel (1 value), zinc (1 value), polyaromatic hydrocarbons, PAH (8 values), phenols (1 value) and pH (6 values). Concentrations of sulphate have been assessed with respect to attack on concrete, (see section 5).

With reference to Table 2 it can be seen that contamination by the following contaminants is present at the site:-

Contaminant	Class		
	B	C	D
Arsenic	8	17	9
Cadmium	13	7	-
Copper *	(3)	(1)	-
Lead	2	-	-
Mercury	2	2	-
Nickel *	(12)	(1)	-
Selenium	4	1	-
Zinc *	(2)	-	-
Free Sulphur	1	1	4
Cyanide (total)	2	-	-
PAH	11	1	1
Phenols	20	4	-
pH	6	10	1

Note

* (-) Classification values only given for available (water sol) element.

Test values are for total element and may therefore be overconservative.

Calorific values exceeding 7MJ/kg were recorded in five samples:

<u>Trial Pit</u>	<u>Depth (m)</u>	<u>Calorific Value (MJ/kg)</u>
5	0.30	14
6	0.30	17
8	1.00	16
11	0.60	11
13	2.50	24

The presence of asbestos, as chrysotile (also known as "White asbestos") was recorded in Trial Pit 2 at 0.20m and in surface sample SS1.

Water Samples Analysis

The results of testing on water samples were compared to cut off values for uncontaminated leachate proposed in guidelines for waste disposal⁽⁷⁾. These values were supplemented, where necessary, by additional information from Dutch Intervention Guidelines⁽¹⁰⁾ and values presented in the water supply (Water Quality) Regulations 1989.

No samples indicated elevated contaminant levels above the "uncontaminated" boundary values except for a single pH value of 5.1 (Trial Pit 8).

Values for ammonia were compared against an upper limit for background of 200 µg/l and upper limits of 1000 µg/l and 3000 µg/l for "further information needed" and "polluted levels" respectively, proposed in the Dutch Intervention Guidelines. On this basis all values exceeded background values and seven values exceeded the limit for "further information needed". (Trial Pits 1, 3, 4, 10, DD1, gravel pit and canal).

At the time of reporting a programme of monitoring and testing of water from standpipes is ongoing. This monitoring programme will be presented as a supplement to this report.

6.4 Implications and Recommendations for Development

The analytical testing carried out has indicated three main areas of concern with regard to contaminant levels as follows:-

- i Exposure of users to contaminants
- ii Exposure of construction workers to contaminants
- iii Off site disposal of material

Exposure of end users to contaminants

With regard to end use the site may be divided into two areas.

The area adjacent to Forge Lane has been assessed based on the higher threshold trigger values presented in ICRCCL Guidelines⁽⁶⁾. These values are for less sensitive areas namely parks playing fields and open spaces (Group A metals) and buildings and hardcover (Table 4 contaminants).

On this basis the area proposed for industrial development should be considered contaminated with arsenic. If the proposed industrial development completely covers the area with hardstanding and buildings these should

adequately prevent exposure to end users.

The remainder of the site has been assessed based on the lower threshold trigger values, for more sensitive areas, namely domestic gardens, allotments and play areas.

On this basis the area proposed for housing development should be considered contaminated with arsenic with local contamination by cadmium, lead, mercury, selenium, copper, nickel, zinc, polyaromatic hydrocarbons(PAH), phenols and acid conditions.

Arsenic, cadmium, lead, mercury, selenium, PAH and phenols may pose a hazard to health. Copper, nickel and zinc contamination is unlikely to pose a hazard to health but may cause phytotoxic effects (hazardous to plants). In the area of proposed housing it is recommended that either the end users are isolated from the near surface materials by the use of capping layers and imported topsoils or the made ground and near surface materials are removed from the area of development. With respect to contamination by phenols, single elevated level was noted in Trial Pit 6 at 1.20m. The material in this area is likely to be removed as part of the site preparation. Similarly with regard to the acidic condition noted in Trial Pit 6 and Trial Pit 8 the removal of this material during site preparation should eliminate this contaminant from the site.

Exposure of construction workers to contaminants

The available data suggests that a degree of risk to the health and safety of construction workers may be associated with site development. Accordingly protective equipment (clothing, masks, eyewear etc) should be used in accordance with current legislation and good practice.

Particular attention is drawn to the presence of asbestos noted in the area of TP2 and SS1. This is present at surface as fragments of corrugated fibreboard and within the near surface soil matrix of Trial Pit 2. All material containing asbestos should be removed with regard to current legislation and the use of a specialist contractor is advised.

Off site disposal of material

If material generated by redevelopment is required to be disposed of off site the local waste regulatory authority will require the material to be classified according to the degree of contamination. On the basis of the available data, and without pre-empting any classification currently in use by the local waste regulatory authority, it is considered likely that made ground and near surface materials removed from site will be classified as contaminated (Class C and D) and as such may require disposal at a suitably licensed disposal facility.

If off site disposal is necessary the waste regulatory authority should be consulted to determine whether leachate testing of the soil samples may be carried out to re-classify materials.

The assessment of groundwater conditions will be completed as a supplement to this report at the end of the monitoring period.

6.5 Gas

The readings of gas concentrations have been assessed in accordance with guidelines incorporated in Waste Management Paper 27⁽¹¹⁾. This recommends that no housing should be built within 50m of any landfill site where gas concentrations exceed 1% by volume for methane and/or 1.5% by volume of carbon dioxide. Waste Management Paper 27 further suggests that gardens of houses should not exceed within 10m of any such landfill site whilst great care should be taken with any development within 250m of infilled waste.

BRE Report L26⁽¹²⁾ provides guidance on appropriate protective measures to buildings. It states that where carbon dioxide concentrations in the ground are above 1.5% by volume and/or methane up to 1% by volume then particular details in relation to floor construction should be considered. For construction where carbon dioxide levels exceed 5% by volume these construction details are required.

Monitoring at the site to date has not detected methane. Carbon dioxide has been detected at concentrations of 0.7% and 2.5% volume in Boreholes 1 and 5 respectively, in conjunction with reduced concentrations of oxygen.

These values are preliminary only. An on going programme of gas monitoring is underway at the site and a full report on this aspect of development will be issued in due course.

For and on behalf of Exploration Associates Limited

T.J. Downes
Project Geologist

J.P. Leavy
Principal Engineer

Exploration Associates Limited
JPL/TJD/MLK/127001/April 1997

REFERENCES

1. BS 5930 ; 1981. Code of Practice for Site Investigations. British Standards Institution.
2. BS 1377 Parts 1 to 9; 1990. Methods of Test for Soils for Civil Engineering Purposes. British Standards Institution.
3. British Geological Survey. 1:63,360 series, Sheet No 77, Huddersfield.
4. CIRIA Report No.97 1983. Trenching Practice.
5. BRE Digest 363, 1991. Sulphate and acid resistance of concrete in the ground. Building Research Establishment.
6. Interdepartmental Committee on the redevelopment of contaminated land. July 1987. Guidance note 59/87. Guidance on the assessment and redevelopment of contaminated land.
7. Kelly, 1979. Guidelines for contaminated soils. G.L.C. values for contaminated soils.
8. Webb, J.S. (Ed) et al. 1978. Woolfson Geochemical Atlas of England and Wales. Oxford University Press.
9. Interdepartmental Committee in the redevelopment of contaminated land 2nd Edition July 1986. Note 61/84. Notes on fire hazards of contaminated land.
10. Environmental program for the Netherlands 1988 to 1991. The Hague Staatsuitgeverij, 1987.
11. Waste Management paper No.27, 1989. Landfill Gas. Department of Environment.
12. BRE. L. 26 1991. Construction of new buildings on gas - contaminated land. Building Research Establishment.

HISTORICAL O.S. MAPS

1893

1907

1912

1922

1933

TABLES

TABLE 1 Summary of Analytical Test Results:
Contaminant Values Exceeding Threshold
Trigger values.

TABLE 2 Summary of Analytical Test Results:
Classified According to Kelly Guidelines.

REFERENCES

1. BS 5930 ; 1981. Code of Practice for Site Investigations. British Standards Institution.
2. BS 1377 Parts 1 to 9; 1990. Methods of Test for Soils for Civil Engineering Purposes. British Standards Institution.
3. British Geological Survey. 1:63,360 series, Sheet No 77, Huddersfield.
4. CIRIA Report No.97 1983. Trenching Practice.
5. BRE Digest 363, 1991. Sulphate and acid resistance of concrete in the ground. Building Research Establishment.
6. Interdepartmental Committee on the redevelopment of contaminated land. July 1987. Guidance note 59/87. Guidance on the assessment and redevelopment of contaminated land.
7. Kelly, 1979. Guidelines for contaminated soils. G.L.C. values for contaminated soils.
8. Webb, J.S. (Ed) et al. 1978. Woolfson Geochemical Atlas of England and Wales. Oxford University Press.
9. Interdepartmental Committee in the redevelopment of contaminated land 2nd Edition July 1986. Note 61/84. Notes on fire hazards of contaminated land.
10. Environmental program for the Netherlands 1988 to 1991. The Hague Staatsuitgeverij, 1987.
11. Waste Management paper No.27, 1989. Landfill Gas. Department of Environment.
12. BRE. L. 26 1991. Construction of new buildings on gas - contaminated land. Building Research Establishment.

HISTORICAL O.S. MAPS

1893

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1912

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1933

TABLES

TABLE 1 Summary of Analytical Test Results:
 Contaminant Values Exceeding Threshold
 Trigger values.

TABLE 2 Summary of Analytical Test Results:
 Classified According to Kelly Guidelines.

1933



 Exploration Associates	
Client:	Kirklees Metropolitan Borough
Project:	Forge Lane Former Steelworks, Thornhill, Dewsbury
Title:	O.S Map 1933
Scale:	NTS
Contract No:	127001
Based on:	Drawn by
	Date
	Drawing:

1047	1-376
1049	1-552
1050	1-227
1051	2-747
1052	2-528
1056	2-811
1058	1-632
1061	2-449
1096	2-271
1097	1-289
1098	1-492
1099	4-929
1100	1-731
1101	1-667
1102	1-727
1103	1-677
1104	1-368
1105	1-879
1106	1-343
1107	11-154
1108	1-858
1109	33-762
1110	1-570
1111	1-633
1112	2-666
1113	1-168
1114	2-773
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1116	1-449
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1122	1-184
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1249	1-286
1250	1-286

ENCLOSURE A

Drawings

Drawings

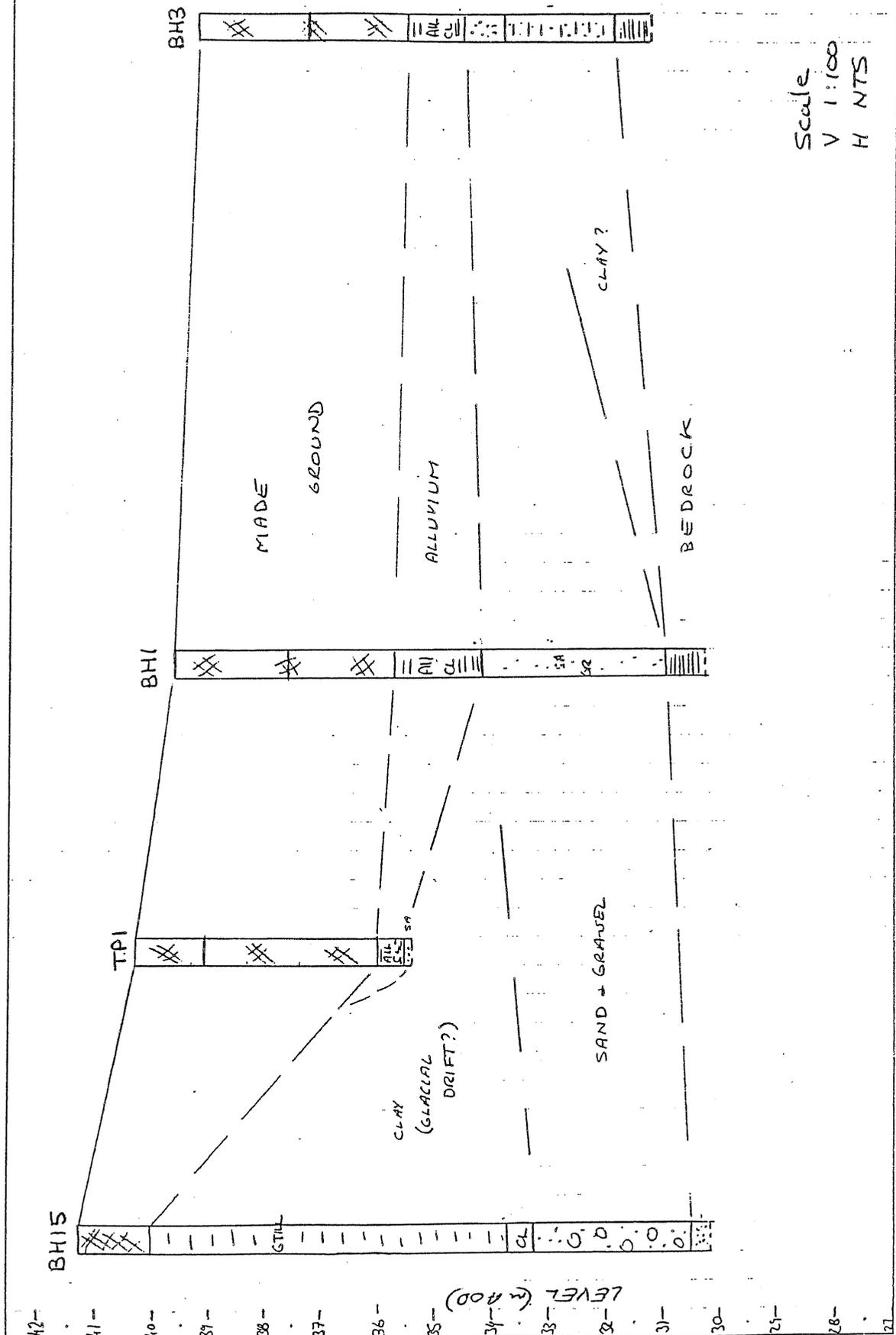
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Exploratory Hole Location Plan	2
Thematic Plan	3
Schematic Sections	4 to 10.



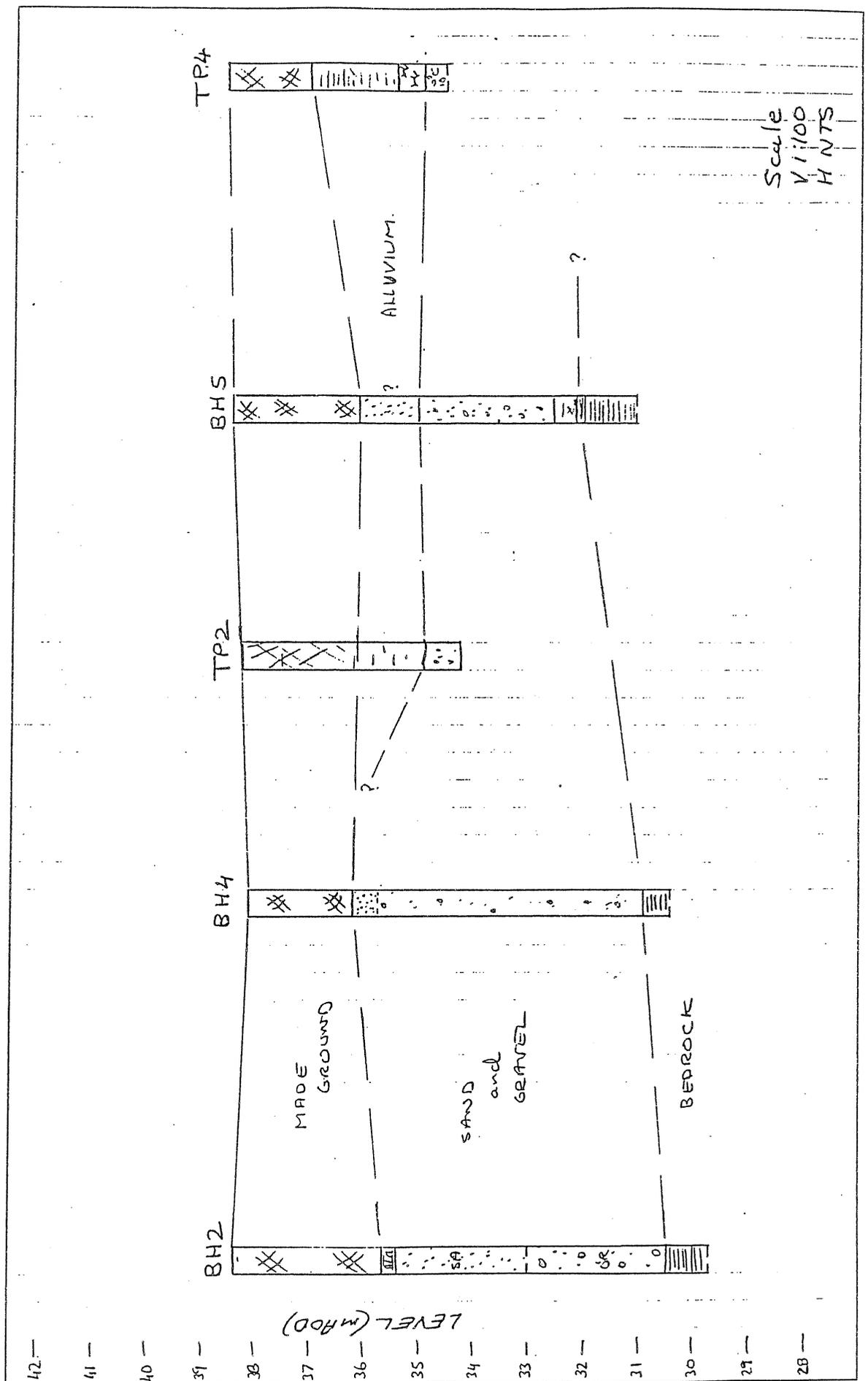
Reproduced from the Ordnance Map with the sanction of the Controller of H.M. Stationery Office. Crown Copyright Reserved. Licence No. AL815039

Scale 1:50,000

Site Location Plan	Project Forge Lane, Former Steelworks, Thornhill Dewsbury Kirklees Metropolitan Council	Contract 127001
 Exploration Associates		Drawing 1



Section A-A'	Project	Contract 127001
 Exploration Associates	Forge Lane Former Steelworks Thornhill, Dewsbury Kirklees M.B.C.	Drawing 4



Section B-B'



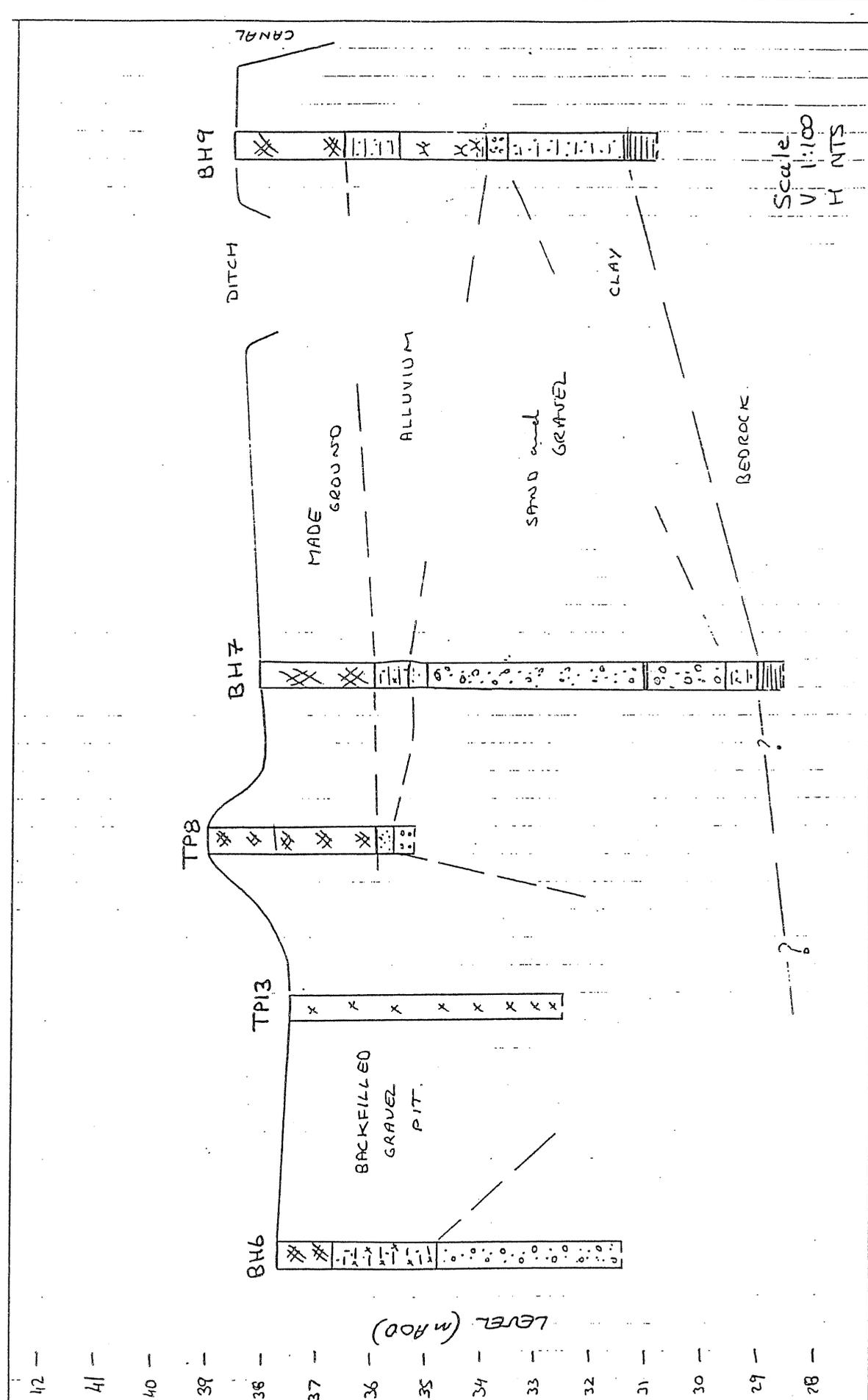
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Project

Forge Lane Former Steelworks
Thornhill, Dewsbury
Kirklees M.B.C.

Contract 127001

Drawing 5



Section C-C'

Project

Forge Lane Former Steelworks
 Thornhill, Dewsbury
 Kirklees M.B.C.

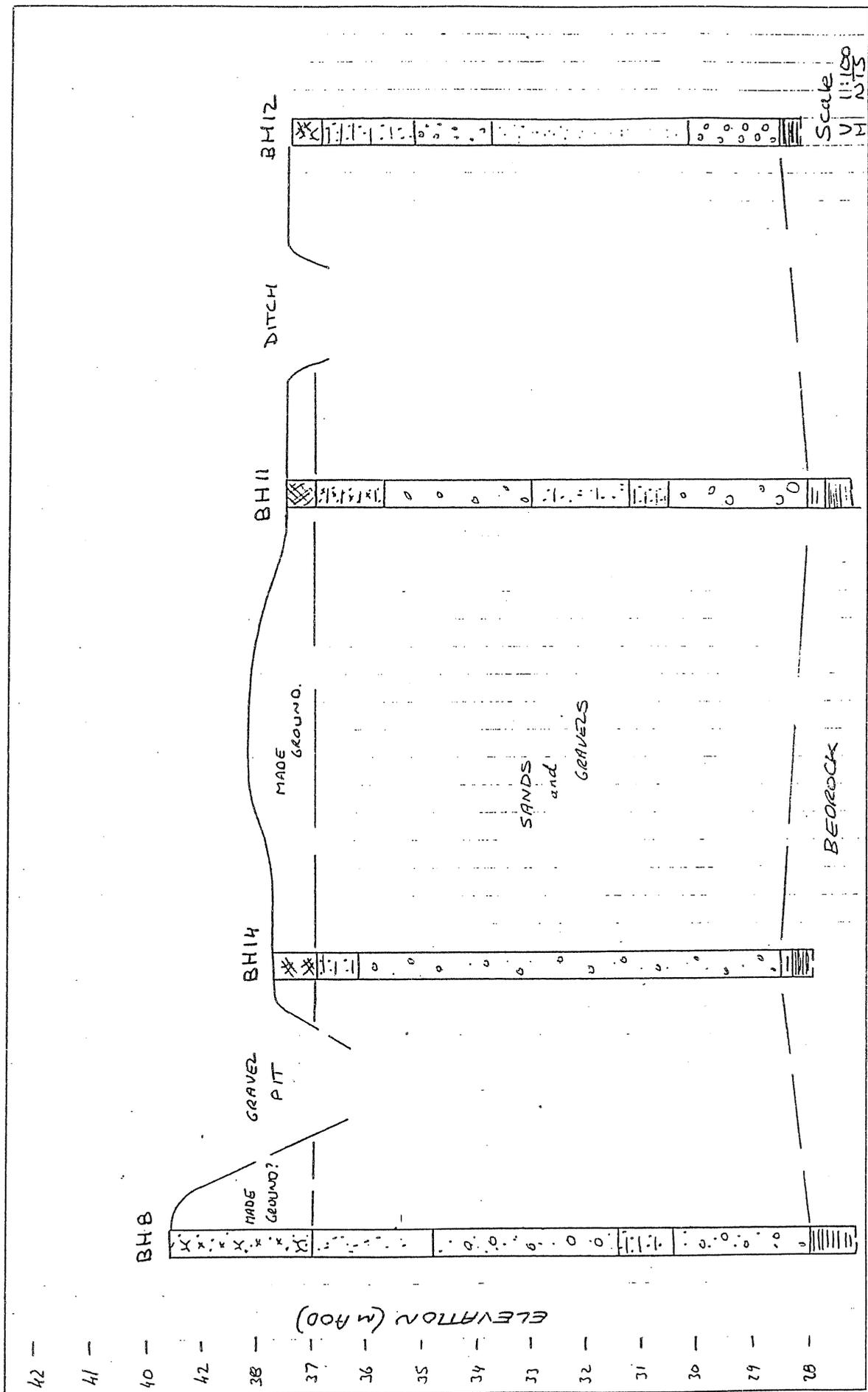
Contract

127001

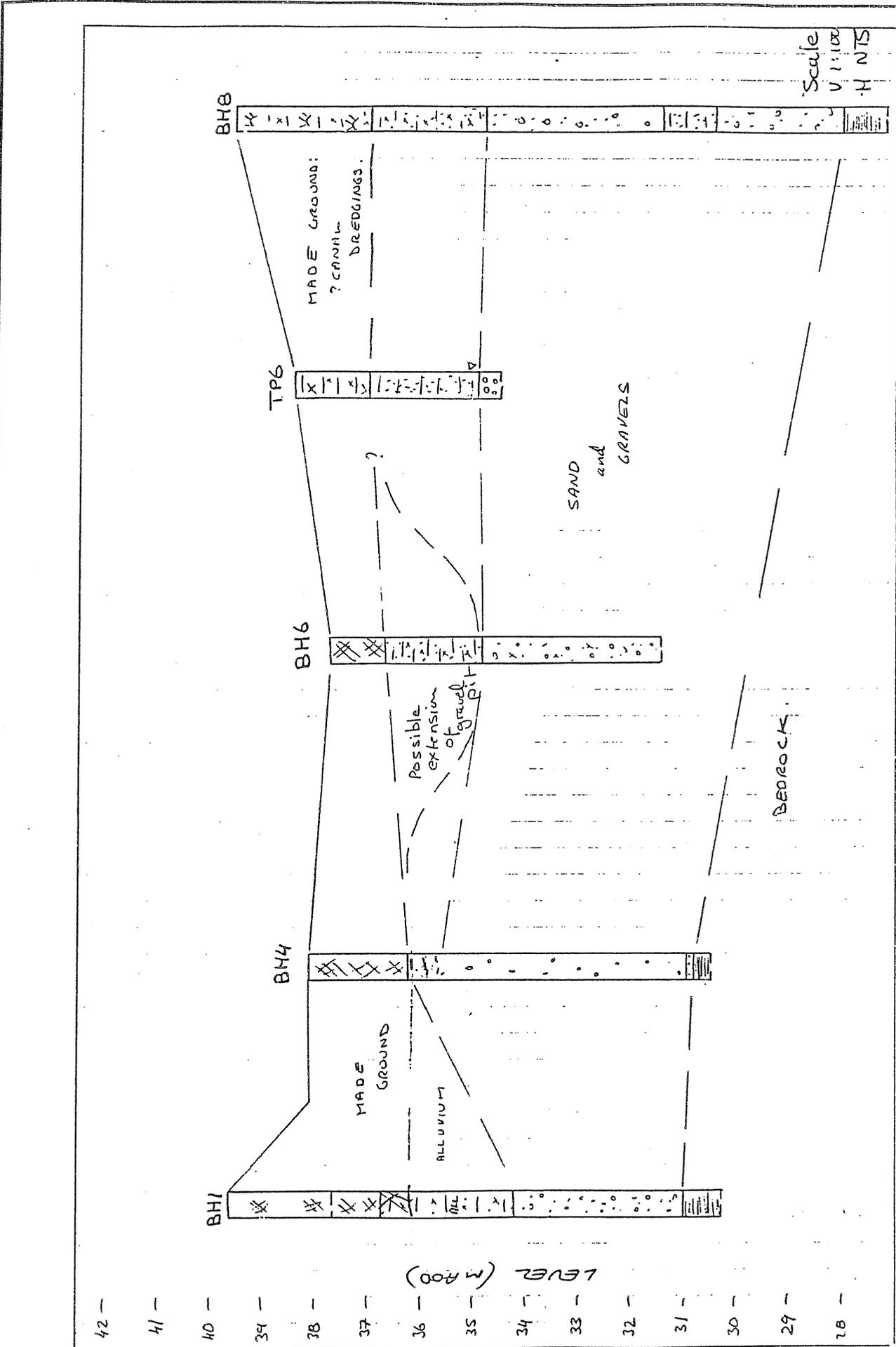


Exploration Associates

Drawing 6



Section D-D'	Project Forge Lane Former Steelworks Thornhill, Dewsbury Kirkles M.B.C.	Contract 127001
 Exploration Associates		Drawing 7



Section E-E'

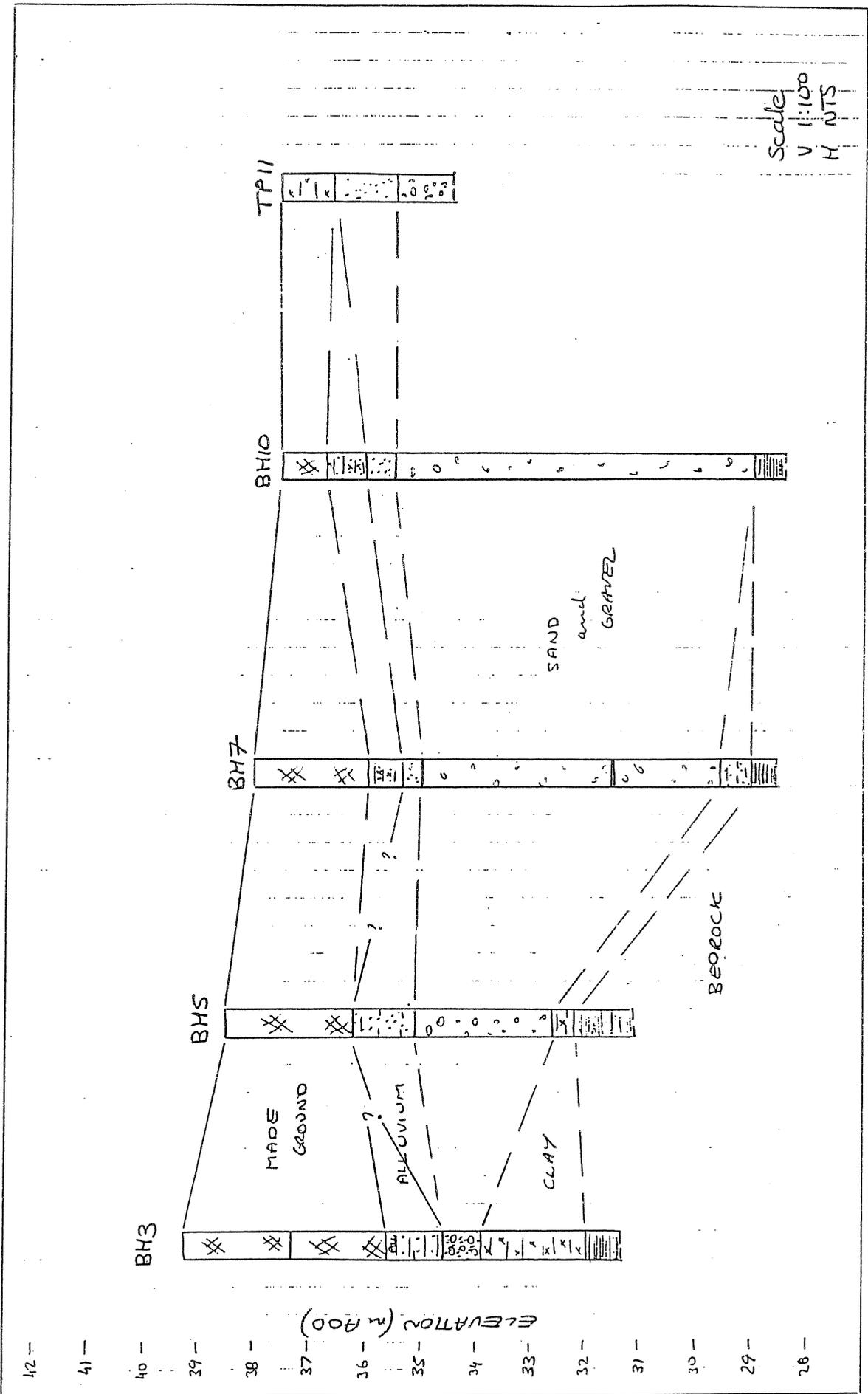
Project

Contract 127001

 Exploration Associates

Forge Lane Former Steelworks
 Thornhill, Dewsbury
 Kirklees M.B.C.

Drawing 8



Section F-F'



Exploration Associates

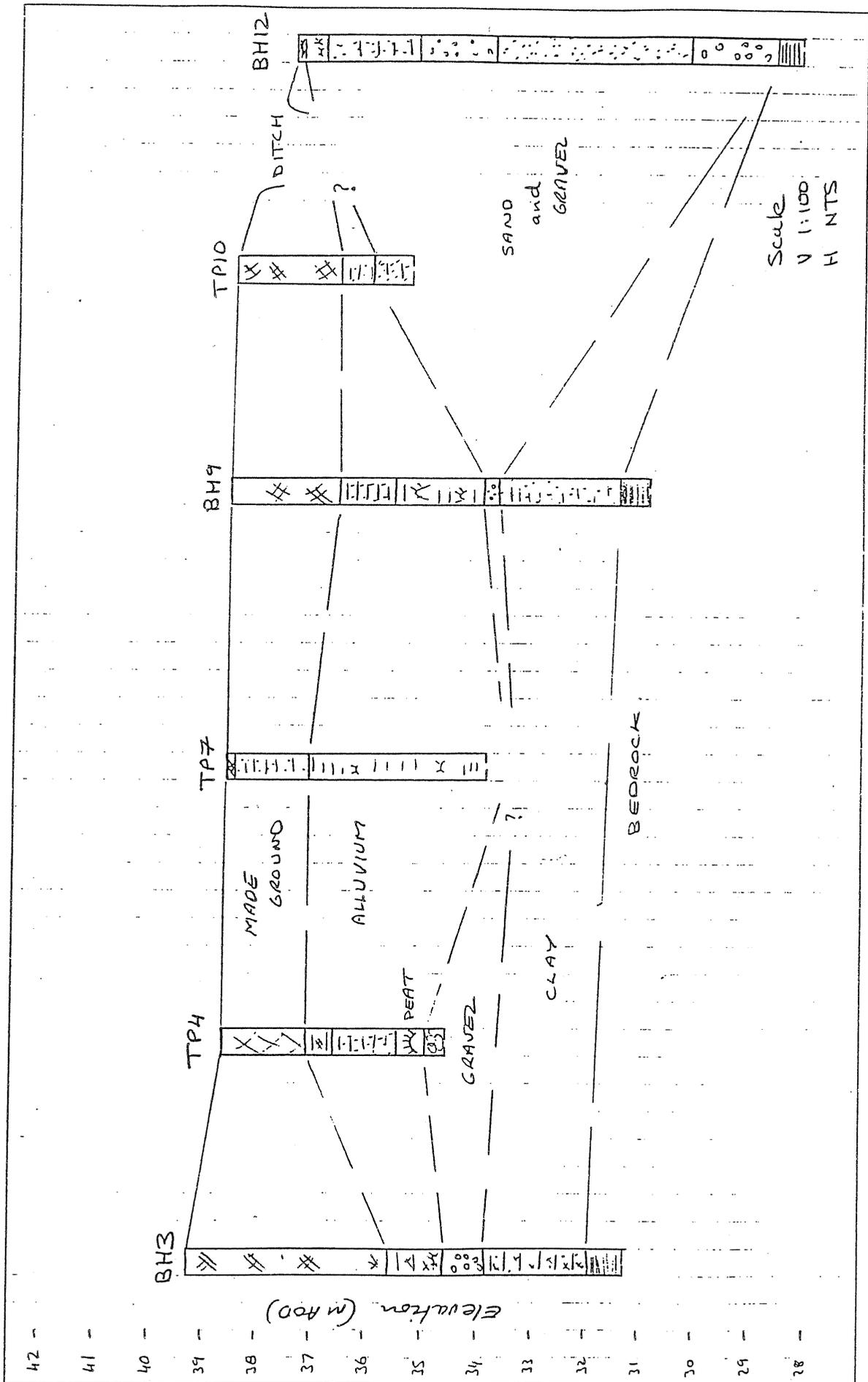
Project

Forge Lane Former Steelworks
Thornhill, Dewsbury
Kirklees M.B.C.

Contract

127001

Drawing 9



Section G-G'

Project

Contract 127001



Exploration Associates

Forge Lane Former Steelworks
 Thornhill, Dewsbury
 Kirklees M.B.C.

Drawing 10



TEST REPORT SOIL SAMPLE ANALYSIS



TESTING
No.1252
No.1411

TES Report No. CL/992494

Site: Forge Lane 129148

Exploration Associates
Unit 18
Deeside Industrial Estate
Welsh Road
Deeside
CH5 2LR

The 16 samples described in this report were scheduled for analysis by TES Bretby on Wednesday, 14 July 1999. The analysis was completed by Friday, 30 July 1999.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby laboratories.

The following tables are contained in this report:

Table 1 Sample Descriptions
Table 2 Main Analysis Results

On behalf of
TES Bretby :
J Elstak Project Co-ordinator

Date of Issue: 30/07/99

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

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TES Bretby is a division of Environmental Services Group Limited Registered in England Number 2880501

TES Bretby
Report 992494
Control Page
Sheet 1/1



TEST REPORT

SOIL SAMPLE ANALYSIS



TESTING
No.1252
No.1411

Exploration Associates
Unit 18
Deeside Industrial Estate
Welsh Road
Deeside
CH5 2LR

TES Report No. 992494

Site: Forge Lane 129148

Page No	Assessed Area	ID No. EFS/CL	Sample	Depth (m)		Description
				from	to	
1	129148	9917860	B/H / 1/A	1.50	2.00	BH1A 1.5-2.0
1	129148	9917856	B/H / 1/A	2.50	3.00	BH1A 2.5-3.0
1	129148	9917863	B/H / 2/A	0.50	1.00	BH2A 0.5-1.0
1	129148	9917868	B/H / 2/A	1.50	2.00	BH2A 1.5-2.0
2	129148	9917857	B/H / 2/A	2.50	3.00	BH2A 2.5-3.0
2	129148	9917867	B/H / 3/A	1.50	2.00	BH3A 1.5-2.0
2	129148	9917858	B/H / 3/A	3.50	4.00	BH3A 3.5-4.0
2	129148	9917862	B/H / 4/A	3.50	4.00	BH4A 3.5-4.0
3	129148	9917864	B/H / 5/A	2.50	3.00	BH5A 2.5-3.0
3	129148	9917859	B/H / 5/A	5.50	6.00	BH5A 5.5-6.0
3	129148	9917861	B/H / 5/A	6.50	7.00	BH5A 6.5-7.0
3	129148	9917865	T/P / 4/A	1.20		TP4A 1.2
4	129148	9917853	T/P / 6/A	2.00		TP6A 2.0
4	129148	9917854	T/P / 8/A	1.50		TP8A 1.5
4	129148	9917855	T/P / 9/A	0.50		TP9A 0.5
4	129148	9917866	T/P / 10/A	0.75		TP10A 0.75

Date of Issue: 30/07/99

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TES Bretby accepts no responsibility for the sampling related to the above results

TES Bretby	
Report 992494	
Table	1
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TEST REPORT

SOIL SAMPLE ANALYSIS



Exploration Associates
Unit 18
Deeside Industrial Estate
Welsh Road
Deeside
CH5 2LR

TES Report No. 992494

TESTING
No. 1252
No. 1411
No. 1253

Site: Forge Lane 129148

Customer reference	B/H	B/H	B/H	B/H
Depth (m)	1 A 1.50 to 2	1 A 2.50 to 3	2 A 0.50 to 1	2 A 1.50 to 2
Date logged	14/07/99	14/07/99	14/07/99	14/07/99
TES Bretby ID Number	CL/9917860	CL/9917856	CL/9917863	CL/9917868

UKAS accredited	Test No.	CL/9917860	CL/9917856	CL/9917863	CL/9917868
Arsenic	ICPSSS11	62	36		
Cadmium	ICPSSS11	<1	<1		
Chloride	WSLM1	17	13		
Chromium (total)	ICPSSS11	20	15		
Chromium (VI)	WSLM6	<0.1	<0.1		
Copper	ICPSSS11	35	25		
Lead	ICPSSS11	55	42		
Loss on Ignition %	CA3			13.7	
Mercury	ICPSSS11	<0.5	<0.5		
Nickel	ICPSSS11	23	19		
pH units	WSLM3	5.7	7.6		
Phenol Index	WSLM4	<0.5	<0.5		
SO4-- (H2O sol) mg/l	ICPWAS46	1600	700		
Sulphide	ICTSCN28	<1	<1		
Zinc	ICPSSS11	102	58		

not UKAS accredited		CL/9917860	CL/9917856	CL/9917863	CL/9917868
Boron.		<0.5	<0.5		
Elemental Sulphur		33	34		1.8
Organic Matter %					
Selenium (MS)		0.60	<0.50		

Results expressed as mg/kg Air Dried unless stated otherwise
SO4 Analysis not conducted in accordance with BS1377
Water Soluble Sulphate on 2:1 water:soil extract

Date of Issue: 30/07/99

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

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TES Bretby	
Report 992494	
Table	2
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TEST REPORT

SOIL SAMPLE ANALYSIS



TESTING
No.1252
No.1411
No.1253

Exploration Associates
Unit 18
Deeside Industrial Estate
Welsh Road
Deeside
CH5 2LR

TES Report No. 992494

Site: Force Lane 129148

Customer reference	B/H	B/H	B/H	B/H
Depth (m)	2 A 2.50 to 3	3 A 1.50 to 2	3 A 3.50 to 4	4 A 3.50 to 4
Date logged	14/07/99	14/07/99	14/07/99	14/07/99
TES Brethby ID Number	CL/9917857	CL/9917867	CL/9917858	CL/9917862

UKAS accredited	Test No.	CL/9917857	CL/9917867	CL/9917858	CL/9917862
Arsenic	ICPSSS11	6		27	4
Cadmium	ICPSSS11	<1		<1	<1
Chloride	WSLM1	<12		<12	37
Chromium (total)	ICPSSS11	15		12	33
Chromium (VI)	WSLM6	<0.1		<0.1	<0.1
Copper	ICPSSS11	16		13	25
Lead	ICPSSS11	25		29	42
Mercury	ICPSSS11	<0.5		<0.5	<0.5
Nickel	ICPSSS11	18		23	35
PAH (screening)	PAHSCUV		41		
pH units	WSLM3	7.3		6.8	5.9
Phenol Index	WSLM4	<0.5		<0.5	<0.5
SO4-- (H2O sol) mg/l	ICPWAS46	87.8		327	139
Sulphide	ICTSCN28	<1		<1	<1
Zinc	ICPSSS11	43		53	91

not UKAS accredited		CL/9917857	CL/9917867	CL/9917858	CL/9917862
Boron.		<0.5		<0.5	<0.5
Elemental Sulphur		<20		240	140
Organic Matter %			13.6		
Selenium (MS)		<0.50		<0.50	<0.50

Results expressed as mg/kg Air Dried unless stated otherwise
SO4 Analysis not conducted in accordance with BS1377
Water Soluble Sulphate on 2:1 water:soil extract

Date of Issue: 30/07/99

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

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TES Brethby
Report 992494
Table 2
Sheet 2/4



TEST REPORT WATER SAMPLE ANALYSIS



TESTING
No. 1252

Amended Report TES Report No. W/EXR/993625

Site: FORGE LANE

Exploration Associates
Geotechnical House
Unit 18
Deeside Industrial Estate
Deeside
Flintshire
CH5 2LR

The 7 Samples described in this report were scheduled for analysis by TES Bretby on Tuesday, 13 July 1999. The analysis was completed by Tuesday, 27 July 1999.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby laboratories.

The following tables are contained in this report:

- Table 1 Sample Descriptions
- Table 2 Main Analysis Results
- Tables of Volatile Organic Compounds (7 Pages)

On behalf of
TES Bretby :
J Elstub Project Co-ordinator

Date of Issue: 27/07/99

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory. TES Bretby accepts no responsibility for the sampling related to the above results.

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TES Bretby
Report Number
W/EXR/993625
Control Page
Sheet 1/1



TEST REPORT

WATER SAMPLE ANALYSIS



TESTING
No. 1252

Exploration Associates
Geotechnical House
Unit 18
Deeside Industrial Estate
Deeside
Flintshire
CH5 2LR

Amended Report
TES Report No. W/EXR/993625

Client: EXPLORATION ASS.
Site: FORGE LANE

Page No	ID No. W/EX/		Sample Date
1	9915867	TP 6A @ 2.80m	
1	9915868	TP 8A @ 2.70m	
1	9915869	TP 9A @ 0.00m	
1	9915870	BH 1A @ 3.00m	25/06/99
2	9915871	BH 2A @ 2.00m	24/06/99
2	9915872	BH 3A @ 2.00m	23/06/99
2	9915873	BH 5A @ 4.50m	23/06/99

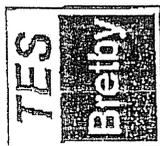
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Date of Issue: 27/07/99

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.
TES Bretby accepts no responsibility for the sampling related to the above results.

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TES Bretby	Report Number
	W/EXR/993625
	Table 1
	Sheet 1/1



Volatile Organic Compounds by PTGCMS



Matrix: Water
 Method: Purge and Trap
 Dilution: 1
 Position: 1

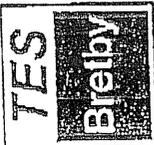
Directory: 0720VOC-MS31
 Date Booked In: 13-Jul-99
 Date Analyzed: 21-Jul-99
 Operator: AT

Customer and Site Details: Exploration Associates: Forge Lane
 BH 2A @ 2.00m
 Sample Details: EX15671
 LIMS ID Number: 993525
 Report Number:

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Styrene	100-42-5	-	< 1	-
Bromoforn	75-25-2	-	< 1	-
Isopropylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-49-4	-	< 1	-
tert-Butylbenzene	108-67-8	-	< 1	-
1,2,4-Trimethylbenzene	85-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
n-Propyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorobutadiene	87-68-3	-	< 5	-
Naophthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 5	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Dichlorodifluoromethane	75-71-6	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 1	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-4	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 1	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropane	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	78-40-5	-	< 1	-
Tetrachloroethane	127-18-4	-	< 1	-
1,3-Dichloropropane	142-28-29	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	106-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
1,1,1,2-Tetrachloroethane	639-20-8	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 1	-
o-Xylene	95-47-6	-	< 1	-

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentachlorobenzene	12.00	75	Dibromofluorobenzene	103
1,4-Difluorobenzene	13.16	76	Toluene-d8	98
Chlorobenzene-d5	17.50	76	Bromofluorobenzene	106
1,4-Dichlorobenzene-d4	20.99	82		



Volatile Organic Compounds by PTGCMS



Matrix: Water
 Method: Purga and Trap
 Dilution: 1
 Position: 2

Factory: 9720VCC.MS31
 Date Booked in: 13-Jul-99
 Date Analysed: 21-Jul-99
 Operator: AT

Customer and Site Details: Exploration Associates; Forge Lane
 BH 3A @ 2.00m
 Sample Details: EX15872
 LIMS ID Number: 993825
 Report Number:

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Flt
Dichlorodifluoromethane	75-71-8	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 1	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethane	75-35-4	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 1	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-68-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropane	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-85-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropane	10081-01-5	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans 1,3-Dichloropropane	10081-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 1	-
1,3-Dichloropropane	142-28-29	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromomethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 1	-
	95-47-6	-	< 1	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Flt
Styrene	100-42-5	-	< 1	-
Bromobenzene	75-25-2	-	< 1	-
Isopropylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	85-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	108-67-8	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 5	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorocyclopentadiene	87-68-3	-	< 5	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 5	-

Internal standards	R.T.	Area %	% Rec
Pentachlorobenzene	12.00	86	104
1,4-Difluorobenzene	13.16	88	88
Chlorobenzene-d5	17.49	86	109
1,4-Dichlorobenzene-d4	20.99	96	
Surrogates			
Dibromofluoromethane			
Toluene-d8			
Bromofluorobenzene			



Volatile Organic Compounds by PTCGMS



Customer and Site Details: Exploration Associates: Forge Lane
 BH 5A @ 4.50m
 Sample Details: EX15873
 LIMS ID Number: 933625
 Report Number:

Directory: 072DVCC.MS31
 Date Booked in: 13-Jul-99
 Date Analysed: 21-Jul-99
 Operator: AT

Matrix: Water
 Method: Purge and Trap
 Dilution: 1
 Position: 3

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Dichlorodifluoromethane	75-71-8	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 1	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-4	-	< 1	-
trans 1,2-Dichloroethene	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethene	156-59-2	-	< 1	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropane	563-50-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethane	79-01-6	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 1	-
1,3-Dichloropropane	142-28-29	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
1,1,1,2-Tetrachloroethane	530-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 1	-
o-Xylene	95-47-6	-	< 1	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Styrene	100-42-5	-	< 1	-
Bromoforn	75-25-2	-	< 1	-
Isopropylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chloroethene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
1-Chloroethane	108-43-4	-	< 1	-
tert-Butylbenzene	108-67-8	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-87-6	-	< 1	-
1,2-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-9	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorobutadiene	87-68-3	-	< 5	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 5	-

Internal standards	R.T.	Area %	Suitropates	% Rec
Pentachlorobenzene	12.00	90	Dibromofluoromethane	105
1,4-Difluorobenzene	13.16	92	Toluene-d6	97
Chlorobenzene-d5	17.50	90	Bromofluorobenzene	106
1,4-Dichlorobenzene-d4	20.99	97		



Volatile Organic Compounds by PTGCMS



Matrix: Water
Method: Purge and Trap
Dilution: 1
Position: 12

Directory: 0720VOC-MS31
Date Booked In: 13-Jul-99
Date Analysed: 20-Jul-99
Operator: AT

Customer and Site Details: Exploration Associales, Forje Laitre
Sample Details: TP 6A @ 2.80m
LIMS ID Number: EX15867
Report Number: 993625

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
Isopropylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,2,5-Trimethylbenzene	108-57-8	-	< 1	-
4-Chlorotoluene	108-43-4	-	< 1	-
tert-Butylbenzene	108-67-8	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
Isopropyltoluene	99-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-5	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorocycladiene	87-68-3	-	< 5	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 5	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Dichlorodifluoromethane	75-71-8	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 1	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethene	75-35-4	-	< 1	-
trans-1,2-Dichloroethane	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
cis-1,2-Dichloroethane	594-20-7	-	< 1	-
1,1,2-Dichloroethane	156-58-2	-	< 1	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropane	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethane	79-01-6	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis-1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans-1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 1	-
1,3-Dichloropropane	142-28-29	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-98-3/106-42-3	-	< 1	-
o-Xylene	95-47-6	-	< 1	-

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentachlorobenzene	12.00	94	Dibromofluoromethane	103
1,4-Difluorobenzene	13.16	96	Toluene-d8	99
Chlorobenzene-d5	17.50	96	Bromofluorobenzene	104
1,4-Dichlorobenzene-d4	20.99	102		



Volatile Organic Compounds by PTGCMS



Director: G720VOC.MS31
 Date Booked In: 13-Jul-99
 Date Analysed: 20-Jul-99
 Operator: AT

Matrix: Water
 Method: Purge and Trap
 Dilution: 1
 Position: 12

Exploration Associates, Foyle Lane
 TP 6A @ 2.80m
 EX15867
 983625

Customer and Site Details:
 Sample Details:
 LIMS ID Number:
 Report Number:

Target Compounds	CAS #	R.T. (min.)	Concentration (µg/l)	% Fit
Styrene	100-42-5	-	< 1	-
Bromoform	75-25-2	-	< 1	-
iso-Propylbenzene	98-82-8	-	< 1	-
1,1,2-Tetrachloroethane	79-34-5	-	< 1	-
Piopylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	86-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-57-8	-	< 1	-
1-Chlorotoluene	108-43-4	-	< 1	-
tert-Butylbenzene	108-67-8	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	99-07-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorobutadiene	87-68-3	-	< 5	-
Naphthalene	81-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 5	-

Target Compounds	CAS #	R.T. (min.)	Concentration (µg/l)	% Fit
Dibromodifluoromethane	75-71-8	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 1	-
Trichlorofluoromethane	75-89-4	-	< 1	-
1,1-Dichloroethane	75-35-4	-	< 1	-
trans 1,2-Dichloroethane	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethane	156-58-2	-	< 1	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropane	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethane	79-01-6	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-85-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans 1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethane	127-18-4	-	< 1	-
1,3-Dichloropropane	142-28-29	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 1	-
o-Xylene	95-47-6	-	< 1	-

Internal standards	R.T.	Area %	Surrogates	% Rec
Fenitluorobenzene	12.00	94	Dibromofluoromethane	103
1,4-Difluorobenzene	13.16	96	Toluene-d8	99
Chlorobenzene-d5	17.50	96	Bromofluorobenzene	104
1,4-Dichlorobenzene-d4	20.99	102		



Volatile Organic Compounds by PTGCMS



Customer and Site Details: Exploration Associates, Forge Lane
 Sample Details: TP 8A @ 2.70m
 LIMS ID Number: EX15868
 Report Number: 993625

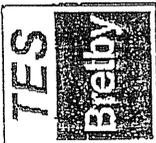
Directory: G720VCC.M531
 Date Booked In: 13-Jul-99
 Data Analysed: 20-Jul-99
 Operator: AT

Matrix: Water
 Method: Purge and Trap
 Dilution: 1
 Position: 13

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Dichlorodifluoromethane	75-71-9	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 1	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethane	75-35-4	-	< 1	-
trans 1,2-Dichloroethane	156-60-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis 1,2-Dichloroethane	156-59-2	-	< 1	-
Bromochloromethane	74-97-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloroethylene	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-6	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloromethane	75-27-4	-	< 1	-
cis 1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans 1,3-Dichloropropene	10061-02-5	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 1	-
1,3-Dichloropropane	142-28-29	-	< 1	-
Dibromochloromethane	124-46-1	-	< 1	-
1,2-Dibromoethane	106-93-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
1,1,1,2-Tetrachloroethane	630-20-6	-	< 1	-
m and p-Xylene	108-38-3/106-42-3	-	< 1	-
o-Xylene	95-47-6	-	< 1	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Styrene	100-42-5	-	< 1	-
Bromobenzene	75-25-2	-	< 1	-
Isopropylbenzene	98-82-8	-	< 1	-
1,1,2,2-Tetrachloroethane	79-34-5	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-96-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	95-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-87-8	-	< 1	-
1-Chlorotoluene	106-43-4	-	< 1	-
tert-Butylbenzene	108-67-6	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
p-Isopropyltoluene	98-97-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorobutadiene	87-68-3	-	< 5	-
Naphthalene	81-20-3	-	< 5	-
1,2,3-Trichlorobenzene	81-61-6	-	< 5	-

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	12.01	89	Dibromodifluoromethane	101
1,4-Fluorobenzene	13.16	91	Toluene-d8	98
Chlorobenzene-d5	17.50	89	Bromofluorobenzene	107
1,4-Dichlorobenzene-d4	20.99	97		



Volatile Organic Compounds by PTGCMS



Matrix: Water
 Method: Purge and Trap
 Dilution: 1
 Position: 15

Directory: C720VCC.MS21
 Date Booked In: 19-Jul-99
 Date Analysed: 21-Jul-99
 Operator: AT

Customer and Site Details: Exploration Associates, Forge Lane
 Sample Details: TP 9A @ 0.00mm
 LIMS ID Number: EX15869
 Report Number: 983625

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Styrene	100-42-5	-	< 1	-
Benzofuran	75-25-2	-	< 1	-
Isopropylbenzene	98-82-8	-	< 1	-
1,1,1,2-Tetrachloroethane	79-34-5	-	< 1	-
Propylbenzene	103-65-1	-	< 1	-
Bromobenzene	108-86-1	-	< 1	-
1,2,3-Trichloropropane	96-18-4	-	< 1	-
2-Chlorotoluene	85-49-8	-	< 1	-
1,3,5-Trimethylbenzene	108-67-8	-	< 1	-
4-Chlorotoluene	108-43-4	-	< 1	-
tert-Butylbenzene	108-67-8	-	< 1	-
1,2,4-Trimethylbenzene	95-63-6	-	< 1	-
sec-Butylbenzene	135-98-8	-	< 1	-
n-Isopropyltoluene	98-87-6	-	< 1	-
1,3-Dichlorobenzene	541-73-1	-	< 1	-
1,4-Dichlorobenzene	106-46-7	-	< 1	-
n-Butylbenzene	104-51-8	-	< 1	-
1,2-Dichlorobenzene	95-50-1	-	< 1	-
1,2-Dibromo-3-chloropropane	96-12-8	-	< 5	-
1,2,4-Trichlorobenzene	120-82-1	-	< 5	-
Hexachlorocyclopentadiene	87-88-3	-	< 5	-
Naphthalene	91-20-3	-	< 5	-
1,2,3-Trichlorobenzene	87-61-6	-	< 5	-

Target Compounds	CAS #	R.T. (min.)	Concentration µg/l	% Fit
Dichlorodifluoromethane	75-71-8	-	< 1	-
Chloromethane	74-87-3	-	< 1	-
Vinyl Chloride	75-01-4	-	< 1	-
Bromomethane	74-83-9	-	< 1	-
Chloroethane	75-00-3	-	< 1	-
Trichlorofluoromethane	75-69-4	-	< 1	-
1,1-Dichloroethane	75-35-4	-	< 1	-
trans-1,2-Dichloroethane	56-90-5	-	< 1	-
1,1-Dichloroethane	75-34-3	-	< 1	-
2,2-Dichloropropane	594-20-7	-	< 1	-
cis-1,2-Dichloroethane	156-59-2	-	< 1	-
Bromochloromethane	74-87-5	-	< 1	-
Chloroform	67-66-3	-	< 1	-
1,1,1-Trichloroethane	71-55-6	-	< 1	-
Carbon Tetrachloride	56-23-5	-	< 1	-
1,1-Dichloropropane	563-58-6	-	< 1	-
Benzene	71-43-2	-	< 1	-
1,2-Dichloroethane	107-06-2	-	< 1	-
Trichloroethene	79-01-9	-	< 1	-
1,2-Dichloropropane	78-87-5	-	< 1	-
Dibromomethane	74-95-3	-	< 1	-
Bromodichloroethane	75-27-4	-	< 1	-
cis-1,3-Dichloropropene	10061-01-5	-	< 1	-
Toluene	108-88-3	-	< 1	-
trans-1,3-Dichloropropene	10061-02-6	-	< 1	-
1,1,2-Trichloroethane	79-00-5	-	< 1	-
Tetrachloroethene	127-18-4	-	< 1	-
1,3-Dichloropropane	142-28-29	-	< 1	-
Dibromochloromethane	124-48-1	-	< 1	-
1,2-Dibromoethane	109-53-4	-	< 1	-
Chlorobenzene	108-90-7	-	< 1	-
Ethylbenzene	100-41-4	-	< 1	-
m and p-Xylene	630-20-6	-	< 1	-
o-Xylene	108-39-3/106-42-3	-	< 1	-
	95-47-6	-	< 1	-

Internal standards	R.T.	Area %	Surrogates	% Rec
Pentafluorobenzene	12.00	81	Dibromofluoromethane	106
1,4-Difluorobenzene	13.16	83	Toluene-d8	98
Chlorobenzene-d5	17.50	82	Bromofluorobenzene	106
1,4-Dichlorobenzene-d4	20.89	87		

I.C.R.C.L. 59/83 (Second Edition): TABLE 3 TENTATIVE "TRIGGER CONCENTRATIONS" FOR SELECTED INORGANIC CONTAMINANTS

CONDITIONS

1. This table is invalid if reproduced without the conditions and footnotes.
2. All values are for concentrations determined on "spot" samples based on an adequate site investigation carried out prior to development. They do not apply to analysis of averaged, bulked or composted samples, nor to sites which have already been developed. All proposed values are tentative.
3. The lower values in Group A are similar to the limits for metal content of sewage sludge applied to agricultural land. 3(b). The values in Group B are those above which phytotoxicity is possible.
4. If all sample values are below the threshold concentrations then the site may be regarded as uncontaminated as far as the hazards from these contaminants are concerned and development may proceed. Above these concentrations, remedial action may be needed, especially if the contamination is still continuing. Above the action concentrations, remedial action will be required or the form of development changed.

Contaminants	Planned Uses	Trigger Concentrations (mg/kg air dried soil)	
		Threshold	Action
Group A: Contaminants which may pose hazards to health			
Arsenic	Domestic Gardens, Allotments	10	*
	Parks, Playing Fields, Open Space	40	*
Cadmium	Domestic Gardens, Allotments	3	*
	Parks, Playing Fields, Open Space	15	*
Chromium (hexavalent)(1)	Domestic Gardens, Allotments	25	*
	Parks, Playing Fields, Open Space		
Chromium (total)	Domestic Gardens, Allotments	600	*
	Parks, Playing Fields, Open Space	1000	*
Lead	Domestic Gardens, Allotments	500	*
	Parks, Playing Fields, Open Space	2000	*
Mercury	Domestic Gardens, Allotments	1	*
	Parks, Playing Fields, Open Space	20	*
Selenium	Domestic Gardens, Allotments	3	*
	Parks, Playing Fields, Open Space	6	*
Group B: Contaminants which are phytotoxic but not normally hazards to health			
Boron (water-soluble) (3)	Any uses where plants are to be grown (2, 6)	3	*
Copper (4, 5)	Any uses where plants are to be grown (2, 6)	130	*
Nickel (4, 5)	Any uses where plants are to be grown (2, 6)	70	*
Zinc (4, 5)	Any uses where plants are to be grown (2, 6)	300	*

NOTES:

* Action concentrations will be specified in the next edition of I.C.R.C.L. 59/83.

1. Soluble hexavalent chromium extracted by 0.1M HCl at 37°C : solution adjusted to pH 1.0 if alkaline substances present.
2. The soil pH value is assumed to be about 6.5 and should be maintained at this value. If the pH falls, the toxic effects and the uptake of these elements will be increased.
3. Determined by standard ADAS method (soluble in hot water).
4. Total concentrations (extractable by $3\text{HNO}_3/\text{HClO}_4$).
5. The phytotoxic effect of copper, nickel and zinc may be additive. The trigger values given here are those applicable to the 'worst-case'; phytotoxicity may occur at these concentrations in acid, sandy soils. In neutral or alkaline soils phytotoxic effects are unlikely at these concentrations.
6. Grass is more resistant to phytotoxic effects than most other plants and its growth may not be adversely affected at these concentrations.

Extract from "Guidance on Assessment and Redevelopment of Contaminated Land". Inter-Departmental Committee on the Redevelopment of Contaminated Land. I.C.R.C.L. 59/83, Second Edition, July 1987.

Contamination Standards	Project	Contract
		Figure
 Exploration Associates		

I.C.R.C.L. 59/83 (Second Edition): TABLE 4 TENTATIVE "TRIGGER CONCENTRATIONS" FOR CONTAMINANTS ASSOCIATED WITH FORMER COAL CARBONIZATION SITES

CONDITIONS

1. This table is invalid if reproduced without the conditions and footnotes.
2. All values are for concentrations determined on "spot" samples based on an adequate site investigation carried out prior to development. They do not apply to analysis of averaged, bulked or composited samples, nor to sites which have already been developed.
3. Many of these values are preliminary and will require updating. They should not be applied without reference to the current edition of the report "Problems Arising from the Redevelopment of Gas Works and Similar Sites".
4. If all sample values are below the threshold concentrations then the site may be regarded as uncontaminated as far as the hazards from these contaminants are concerned, and development may proceed. Above these concentrations, remedial action may be needed, especially if the contamination is still continuing. Above the action concentrations, remedial action will be required or the form of development changed.

Contaminants	Planned Uses	Trigger Concentrations (mg/kg air dried soil)	
		Threshold	Action
Polycyclic aromatic hydrocarbons (1, 2)	Domestic gardens, allotments, play areas.	50	500
	Landscaped areas, buildings, hard cover.	1000	10000
Phenols	Domestic gardens, allotments.	5	200
	Landscaped areas, buildings, hard cover.	5	1000
Free cyanide	Domestic gardens, allotments, landscaped areas.	25	500
	Buildings, hard cover.	100	500
Complex cyanides	Domestic gardens, allotments.	250	1000
	Landscaped areas.	250	5000
	Buildings, hard cover.	250	NL
Thiocyanate (2)	All proposed uses.	50	NL
Sulphate	Domestic Gardens, allotments, landscaped areas.	2000	10000
	Buildings (3).	2000(3)	50000(3)
	Hard cover.	2000	NL
Sulphide	All proposed uses.	250	1000
Sulphur	All proposed uses.	5000	20000
Acidity (pH less than)	Domestic gardens, allotments, landscaped areas.	pH5	pH3
	Buildings, hard cover.	NL	NL

NOTES

NL: No limits set as the contaminant does not pose a particular hazard for this use.

- (1) Used here as a marker for coal tar, for analytical reasons. See "Problems Arising from the Redevelopment of Gasworks and Similar Sites" Annex A1.
- (2) See "Problems Arising from the Redevelopment of Gasworks and Similar Sites" for details of analytical methods.
- (3) See also BRE Digest 250: Concrete in sulphate-bearing soils and groundwater.

Extract from "Guidance on Assessment and Redevelopment of Contaminated Land". Inter-Departmental Committee on the Redevelopment of Contaminated Land. I.C.R.C.L. 59/83, Second Edition, July 1987.

Contamination Standards

Project

Contract



Exploration Associates

Figure

Guidelines for Contaminated Soils - Suggested Range of Values (mg kg⁻¹ on air dried soils, except for pH)

A B C D E

Parameter	Typical Values for Uncontaminated Soils	Slight Contamination	Contaminated	Heavy Contamination	Unusually Heavy Contamination
pH (acid)	6-7	5-6	4-5	2-4	>2
pH (alkali)	7-8	8-9	9-10	10-12	>12
Antimony	0-30	30-50	50-100	100-500	>500
Arsenic	0-30	30-50	50-100	100-500	>500
Cadmium	0-1	1-3	3-10	10-50	>50
Chromium	0-100	100-200	200-500	500-2500	>2500
Copper (available)	0-100	100-200	200-500	500-2500	>2500
Lead	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Lead (available)	0-200	200-500	500-1000	1000-5000	>5000
Mercury	0-1	1-3	3-10	10-50	>50
Nickel (available)	0-20	20-50	50-200	200-1000	>1000
Zinc (available)	0-250	250-500	500-1000	1000-5000	>5000
Zinc equivalent	0-250	250-500	500-2000	2000-1.0%	>1.0%
Boron (available)	0-2	2-5	5-50	50-250	>250
Selenium	0-1	1-3	3-10	10-50	>50
Barium	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Beryllium	0-5	5-10	10-20	20-50	>50
Manganese	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Vanadium	0-100	100-200	200-500	500-2500	>2500
Magnesium	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Sulphate	0-2000	2000-5000	5000-1.0%	1.0-5.0%	>5.0%
Sulphur (free)	0-100	100-500	500-1000	1000-5000	>5000
Sulphide	0-10	10-20	20-100	100-500	>500
Cyanide (free)	0-1	1-5	5-50	50-100	>100
Cyanide total	0-5	5-25	25-250	250-500	>500
Ferricyanide	0-100	100-500	500-1000	1000-5000	>5000
Thiocyanate	0-10	10-50	50-100	100-500	>2500
Coal Tar	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Phenol	0-2	2-5	5-50	50-250	>250
Toluene extract	0-5000	5000-1.0%	1.0-5.0%	5.0-25.0%	>25.0%
Cyclohexane extract	0-2000	2000-5000	5000-2.0%	2.0-10.0%	>10.0%

Extract from "Site Investigations and Materials Problems" -
 Proceedings of Conference on Reclamation of Contaminated Land
 Society of Chemical Industry
 R T Kelly, 1980

Contamination Standards	Project	Contract
 Exploration Associates		Figure

Standards adopted in the Netherlands for soil contaminants: A. reference value below which soils are probably uncontaminated; B. value above which there is need for further investigation; C. value above which a clean-up is indicated (from Muen et al. (ref. 5.3)).

Substance		Concentration in soil: mg/kilogram dry weight			Concentration in groundwater: µg/l		
		A	B	C	A	B	C
Metals	Cr	100	250	800	20	50	200
	Co	20	50	300	20	50	200
	Ni	50	100	500	20	50	200
	Cu	50	100	500	20	50	200
	Zn	200	500	3000	50	200	800
	As	20	30	50	10	30	100
	Mo	10	40	200	5	20	100
	Cd	1	5	20	1	2.5	10
	Sb	20	50	300	10	30	150
	Hg	0.5	2	10	0.2	0.5	2
	Pb	50	150	600	20	50	200
Inorganic pollutants	NH (as N)	-	-	-	200	1000	3000
	F (total)	200	400	2000	300	1200	4000
	CN (total free)	1	10	100	5	30	100
	CN (total complex)	5	50	500	10	50	200
	S (total)	2	20	200	10	100	300
	Br (total)	20	50	300	100	500	2000
	PO (as P)	-	-	-	50	200	700
Aromatic compounds	Benzene	0.01	0.5	5	0.2	1	5
	Ethyl benzene	0.05	5	50	0.5	20	60
	Toluene	0.05	5	30	0.5	15	50
	Xylene	0.05	5	50	0.5	20	60
	Phenols	0.02	1	10	0.5	15	50
	Aromatics (total)	0.1	7	70	1	30	100
Polycyclic aromatic compounds (PCAs)	Naphthalene	0.1	5	50	0.2	7	30
	Anthracene	0.1	10	100	0.1	2	10
	Phenanthrene	0.1	10	100	0.1	2	10
	Fluoranthene	0.1	10	100	0.02	1	5
	Pyrene	0.1	10	100	0.02	1	5
	Benzo(a)pyrene	0.05	1	10	0.01	0.2	1
	Total PCAs	1	20	200	0.2	10	40
Chlorinated organic compounds	Aliphatic chlorinated compounds (individual)	0.1	5	50	1	10	50
	Aliphatic chlorinated compounds (total)	0.1	7	70	1	15	70
	Chlorobenzenes (individual)	0.05	1	10	0.02	0.5	2
	Chlorobenzenes (total)	0.05	2	20	0.02	1	5
	Chlorophenols (individual)	0.01	0.5	5	0.01	0.3	1.5
	Chlorophenols (total)	0.01	1	10	0.01	0.5	2
	Chlorinated PCA (total)	0.05	1	10	0.01	0.2	1
	PCB (total)	0.05	1	10	0.01	0.2	1
	EOCl (total)	0.1	8	80	1	15	70
Pesticides	Organic chlorinated (individual)	0.1	0.5	5	0.05	0.2	1
	Organic chlorinated (total)	0.1	1	10	0.1	0.5	2
	Pesticides (total)	0.1	2	20	0.1	1	5
Other pollutants	Tetrahydrofuran	0.1	4	40	0.5	20	60
	Pyridine	0.1	2	20	0.5	10	30
	Tetrahydrothiophene	0.1	5	50	0.5	20	60
	Cyclohexanone	0.1	6	60	0.5	15	50
	Styrene	0.1	5	50	0.5	20	60
	Fuel	20	100	300	10	40	150
	Mineral oil	100	1000	5000	20	200	600

The Water Supply (Water Quality) Regulations 1989 list a total of 56 parameters. For each parameter a prescribed concentration or value is given. This relates to the maximum or minimum concentration which must not be exceeded. The table below should be used in conjunction with the Water Supply (Water Quality) Regulations 1989.

Parameters	Expression of results	Concentration or value (Maximum unless otherwise stated)
Colour	mg/l Pt/Co scale	20
Turbidity (including suspended solids)	Formazin turbidity units	4
Odour (including hydrogen sulphide)	Olfaction number	3 at 25°C
Taste	Olfaction number	3 at 25°C
Temperature	°C	25
Hydrogen ion activity	pH value	9.5 (5.5 minimum)
Hardness	°d/cm	1500 at 20°C
Calcium	Ca mg/l	400
Total hardness	Ca mg/l	250
Alkalinity	Ca mg/l	20 (minimum)
Sulphate	HCO ₃ mg/l	20 (minimum)
Magnesium	SO ₄ mg/l	250
Sodium	Mg mg/l	50
Potassium	Na mg/l	150
Dry residues	κ mg/l	12
Nitrate	mg/l	1500 (after drying at 180°C)
Nitrite	NO ₂ mg/l	50
Ammonium (ammonia and ammonium ions)	NO ₃ mg/l	0.1
Kjeldahl nitrogen	NH ₄ mg/l	0.5
Oxidizability (permanganate value)	N mg/l	1
Total organic carbon	C ₂ mg/l	5
Disolved or emulsified hydro-carbons (after extraction with petroleum ether): mineral oils	C mg/l	No significant increase over that normally observed
Phenols	µg/l	10
Substances (as laurylsulphate)	C ₆ H ₅ OH µg/l	0.5
Aluminium	µg/l	200
Iron	Fe µg/l	200
Manganese	Mn µg/l	50
Copper	Cu µg/l	3000
Zinc	Zn µg/l	5000
Phosphorus	P µg/l	2500
Fluoride	F µg/l	1500
Mercury	Hg µg/l	10
Cadmium	Cd µg/l	50
Cyanide	CN µg/l	5
Chromium	Cr µg/l	50
Mercury	Hg µg/l	1
Nickel	Ni µg/l	50
Lead	Pb µg/l	50
Antimony	Sb µg/l	10
Selenium	Se µg/l	10
Boron	B µg/l	2000
Barium	Ba µg/l	1000
Pesticides and related products:		
a) individual substances	µg/l	0.1
b) total substances (i)	µg/l	0.5
Polycyclic aromatic hydrocarbons (ii)	µg/l	0.2
benzo 3,4 pyrene	ng/l	10
Tetrachloroethane	µg/l	3
Trichloroethene	µg/l	30
Tetrachloroethene	µg/l	10
Substances extractable in chloroform	mg/l dry residue	1
Total coliforms	number/100 ml	0
Faecal coliforms	number/100 ml	0
Faecal streptococci	number/100 ml	0
Sulphite-reducing clostridia	number/20 ml	<1
Colony counts	number/l ml at 22°C or 37°C	No significant increase over that normally observed

(i) The sum of the detected concentrations of individual substances

(ii) The sum of the detected concentrations of fluoranthene, benzo 3,4 fluoranthene,

benzo 1,1,12 fluoranthene, benzo 3,4 pyrene, benzo 1,1,2 perylene and indeno (1,2,3-cd) pyrene

Standards for drinking water quality

Contamination Standards

Project

Contract

Exploration Associates

Guidelines for Contaminated Soils - Suggested Range of Values (mg kg^{-1} on air dried soils, except for pH)

A B C D E

Parameter	Typical Values for Uncontaminated Soils	Slight Contamination	Contaminated	Heavy Contamination	Unusually Heavy Contamination
pH (acid)	6-7	5-6	4-5	2-4	>2
pH (alkali)	7-8	8-9	9-10	10-12	>12
Antimony	0-30	30-50	50-100	100-500	>500
Arsenic	0-30	30-50	50-100	100-500	>500
Cadmium	0-1	1-3	3-10	10-50	>50
Chromium	0-100	100-200	200-500	500-2500	>2500
Copper (available)	0-100	100-200	200-500	500-2500	>2500
Lead	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Lead (available)	0-200	200-500	500-1000	1000-5000	>5000
Mercury	0-1	1-3	3-10	10-50	>50
Nickel (available)	0-20	20-50	50-200	200-1000	>1000
Zinc (available)	0-250	250-500	500-1000	1000-5000	>5000
Zinc equivalent	0-250	250-500	500-2000	2000-1.0%	>1.0%
Boron (available)	0-2	2-5	5-50	50-250	>250
Selenium	0-1	1-3	3-10	10-50	>50
Barium	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Beryllium	0-5	5-10	10-20	20-50	>50
Manganese	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Vanadium	0-100	100-200	200-500	500-2500	>2500
Magnesium	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Sulphate	0-2000	2000-5000	5000-1.0%	1.0-5.0%	>5.0%
Sulphur (free)	0-100	100-500	500-1000	1000-5000	>5000
Sulphide	0-10	10-20	20-100	100-500	>500
Cyanide (free)	0-1	1-5	5-50	50-100	>100
Cyanide total	0-5	5-25	25-250	250-500	>500
Ferricyanide	0-100	100-500	500-1000	1000-5000	>5000
Thiocyanate	0-10	10-50	50-100	100-500	>2500
Coal Tar	0-500	500-1000	1000-2000	2000-1.0%	>1.0%
Phenol	0-5	2-5	5-50	50-250	>250
Toluene extract	0-5000	5000-1.0%	1.0-5.0%	5.0-25.0%	>25.0%
Cyclohexane extract	0-2000	2000-5000	5000-2.0%	2.0-10.0%	>10.0%

Extract from "Site Investigations and Materials Problems" -
 Proceedings of Conference on Reclamation of Contaminated Land
 Society of Chemical Industry
 R T Kelly, 1980

Contamination Standards	Project	Contract
 Exploration Associates		Figure

Standards adapted in the Netherlands for soil contaminants: A. reference value below which soils are probably uncontaminated; B. value above which there is need for further investigation; C. value above which a clean-up is indicated (from Muen et al. (ref. 5.31))

Substance		Concentration in soil: mg/Kilogram dry weight			Concentration in groundwater: µg/l		
		A	B	C	A	B	C
Metals	Cr	100	250	800	20	50	200
	Co	20	50	300	20	50	200
	Ni	50	100	500	20	50	200
	Cu	50	100	500	20	50	200
	Zn	200	500	3000	50	200	800
	As	20	30	50	10	30	100
	Mo	10	40	200	5	20	100
	Cd	1	5	20	1	2.5	10
	Sn	20	50	300	10	30	150
	Ba	200	400	2000	50	100	500
	Hg	0.5	2	10	0.2	0.5	2
	Pb	50	150	600	20	50	200
Inorganic pollutants	NH (as N)	-	-	-	200	1000	3000
	F (total)	200	400	2000	300	1200	4000
	CN (total free)	1	10	100	5	30	100
	CN (total complex)	5	50	500	10	50	200
	S (total)	2	20	200	10	100	300
	Br (total)	20	50	300	100	500	2000
	PO (as P)	-	-	-	50	200	700
Aromatic compounds	Benzene	0.01	0.5	5	0.2	1	5
	Ethyl benzene	0.05	5	50	0.5	20	60
	Toluene	0.05	5	30	0.5	15	50
	Xylene	0.05	5	50	0.5	20	60
	Phenols	0.02	1	10	0.5	15	50
	Aromatics (total)	0.1	7	70	1	30	100
	Polycyclic aromatic compounds (PCAs)	Naphthalene	0.1	5	50	0.2	7
Anthracene		0.1	10	100	0.1	2	10
Phenanthrene		0.1	10	100	0.1	2	10
Fluoranthene		0.1	10	100	0.02	1	5
Pyrene		0.1	10	100	0.02	1	5
Benzo(a)pyrene		0.05	1	10	0.01	0.2	1
Total PCAs		1	20	200	0.2	10	40
Chlorinated organic compounds	Aliphatic chlorinated compounds (individual)	0.1	5	50	1	10	50
	Aliphatic chlorinated compounds (total)	0.1	7	70	1	15	70
	Chlorobenzenes (individual)	0.05	1	10	0.02	0.5	2
	Chlorobenzenes (total)	0.05	2	20	0.02	1	5
	Chlorophenols (individual)	0.01	0.5	5	0.01	0.3	1.5
	Chlorophenols (total)	0.01	1	10	0.01	0.5	2
	Chlorinated PCA (total)	0.05	1	10	0.01	0.2	1
	PCB (total)	0.05	1	10	0.01	0.2	1
	EOCI (total)	0.1	8	80	1	15	70
Pesticides	Organic chlorinated (individual)	0.1	0.5	5	0.05	0.2	1
	Organic chlorinated (total)	0.1	1	10	0.1	0.5	2
	Pesticides (total)	0.1	2	20	0.1	1	5
Other pollutants	Tetrahydrofuran	0.1	4	40	0.5	20	60
	Pyridine	0.1	2	20	0.5	10	30
	Tetrahydrothiophene	0.1	5	50	0.5	20	60
	Cyclohexanone	0.1	6	60	0.5	15	50
	Styrene	0.1	5	50	0.5	20	60
	Fuel	20	100	800	10	40	150
	Mineral oil	100	1000	5000	20	200	600

The Water Supply (Water Quality) Regulations 1989 list a total of 56 parameters. For each parameter a prescribed concentration or value is given. This relates to the maximum or minimum concentration which must not be exceeded. The table below should be used in conjunction with the Water Supply (Water Quality) Regulations 1989.

Parameter	Expression of result	Concentration or value (Maximum unless otherwise stated)
Colour	mg/l Pt/Co scale	5
Turbidity (including suspended solids)	Formazin turbidity units	5
Odour (including hydrogen sulphide)	Odour number	3 at 25°C
Taste	Odour number	3 at 25°C
Temperature	°C	25
Hydrogen ion activity	pH value	9.5 (5.5 minimum)
Hardness	°d/cm	1500 at 20°C
Calcium	Ca mg/l	400
Total hardness	Ca mg/l	250
Alkalinity	Ca mg/l	50 (minimum)
Sulphate	SO ₄ mg/l	30 (maximum)
Magnesium	Mg mg/l	250
Sodium	Na mg/l	50
Potassium	K mg/l	150
Dry residue	mg/l	12
Nitrate	NO ₃ mg/l	150 (after drying at 180°C)
Nitrite	NO ₂ mg/l	50
Ammonium (ammonia and ammonium ions)	NH ₄ mg/l	0.1
Kjeldahl nitrogen	N mg/l	0.1
Oxidizability (permanganate value)	O ₂ mg/l	1
Total organic carbon	C mg/l	5
Dissolved or emulsified hydro-carbons (after extraction with petroleum ether); mineral oils	µg/l	No significant increase over times normally observed
Phenols	C ₆ H ₅ OH µg/l	10
Substances	µg/l (as benzophenolone)	0.5
Aluminium	Al µg/l	200
Iron	Fe µg/l	300
Manganese	Mn µg/l	50
Copper	Cu µg/l	1000
Zinc	Zn µg/l	5000
Phosphorus	P µg/l	1500
Fluoride	F µg/l	10
Antimony	Sb µg/l	50
Cadmium	Cd µg/l	5
Cyanide	CN µg/l	50
Chromium	Cr µg/l	50
Mercury	Hg µg/l	1
Nickel	Ni µg/l	50
Lead	Pb µg/l	50
Arsenic	As µg/l	10
Selenium	Se µg/l	1000
Boron	B µg/l	1000
Barium	Ba µg/l	1000
Pesticides and related products:		
a) individual substances	µg/l	0.1
b) total substances (i)	µg/l	0.5
Polycyclic aromatic hydrocarbons (ii)	µg/l	0.2
Benzo [a,] p yrene	µg/l	10
Tetrachloroethane	µg/l	5
Trichloroethene	µg/l	50
Tetrachloroethene	µg/l	10
Substances extractable in chloroform	mg/l dry residue	1
Total coliforms	number/100 ml	0
Faecal coliforms	number/100 ml	0
Faecal streptococci	number/100 ml	0
Sulphite-reducing clostridia	number/20 ml	<1
Colony counts	number/1 ml at 22°C or 37°C	No significant increase over times normally observed

- (i) The sum of the detected concentrations of individual substances
(ii) The sum of the detected concentrations of fluoranthene, benzo 3,4 fluoranthene, benzo 1,12 fluoranthene, benzo 3,4 pyrene, benzo 1,12 perylene and indeno (1,2,3-cd) pyrene

Standards for drinking water quality

Contamination Standards

Project

Contract

Exploration Associates