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SUPPLEMENTARY REPORT

PHASE 2

SITE INVESTIGATION

OF

SITE A, RONDIN ROAD, ARDWICK, MANCHESTER

CTI REF: 40330-3

APRIL 2008

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EXECUTIVE SUMMARY

This report contains details of supplementary monitoring work undertaken to support the Phase 2 investigation report issued in November 2004 at Site A in the Rondin Road development, Ardwick, Manchester (Cti Ref: 38045). The purpose of the work was to obtain further information on ground conditions for the proposed site development and planning application, including:

- the existing contamination status of soil and groundwater to enable a site-specific risk assessment to be undertaken in regard to the proposed land use and site drainage arrangements.

The supplementary monitoring work consisted of:

Two sets of groundwater samples from boreholes BH 1, BH 2 and BH 5

Ground gas samples of volatile organic compounds from boreholes BH1, BH 2 and BH 3

Section 4 of this report describes the rationale for the sampling programme undertaken, the sampling and analysis techniques employed, and quality assurance aspects. Section 5 contains summaries of the results, which are reported in full in Appendix I. The results were analysed using statistical techniques to establish baseline concentration data for the site and to identify locations where elevated concentrations exist. Section 6 contains the further recommendations relating to potential risks during site development and the future use.

A Conceptual Model for the site is provided in Table 1 and Figures 1 and 2, following this Executive Summary.

Report Prepared by:

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Bill Green
Senior Environmental Consultant

Reviewed by:

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Jon Donohoe
Manager: Cti environmental

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Date

TABLE 1. Conceptual Model for Bill Howarth Metals Relocation Site: "Site A", Rondin Road, Ardwick, Manchester

Site Summary

Site A in the Rondin Road development is a brownfield site historically within a railway goods depot and mineral yard that was in use for ~100 years from the second half of the 19th century.

The main sources of contamination in the site area arise from the former rail activities and handling of goods, along with the subsequent unrecorded disposal of solid waste onto the site and fly tipping in the last 10 to 15 years. The main types of contaminants found in the soil were metals/metal oxides, persistent organic compounds, sulphur compounds and petroleum hydrocarbons. No asbestos was found at the site. Trace concentrations of some metals, sulphates and chlorides were measured in perimeter wells, with an elevated pH and trace dissolved hydrocarbons in the northeast corner of the site.

Potential receptors include site development workers, future users, shallow groundwater and surface waters.

Potentially significant pathways include ingestion, dermal contact and soil inhalation, leaching/migration into shallow groundwater and discharge of groundwater via future site drainage systems.

Site Description

The site occupies an area of ~ 1.4 ha and is roughly rectangular with the longer axis in a north-south orientation. There are no structures on the site at present. Historically only a few minor buildings are known to have been present, the site being mainly covered by multiple railway tracks running in an east-west orientation. However, substantial sub-surface obstructions and concrete surfaces were found during the intrusive investigation, particularly in the east and south areas of the site.

The site is covered with vegetation consisting of mature trees along the boundary embankments, bog species in the north quarter and a mixture of grassy and moisture tolerant species, with some clusters of shrubs and trees, across the rest of the site. The vegetation appears to be generally healthy and a substantial invertebrate population is present.

The surrounding area is currently being redeveloped for mixed industrial/commercial use. Railway land still exists to the south, while a waste transfer station is situated across Rondin Road to the north.

Geology, Hydrogeology and Hydrology

Surface deposits consist of ~2 m of made ground, consisting of much coarse material in a matrix of sandy clay with ash, clinker, brick, etc. Inclusions such as road kerbs suggest that the made ground is of relatively recent origin and may derive from unrecorded disposal of solid waste. This has raised the land surface by ~2 m above the adjacent land to the west. Substantial concrete obstructions of unknown origin are also present between 1.4 to 3.0 m below the surface in the east and south areas of the site.

The made ground overlies at least 10 m of glacial till, which may contain lenses of permeable sands and silts. In the southwest corner of the site, this overlies Permian Manchester Marl over Collyhurst Sandstone, the solid strata immediately below the clay over the remainder of the site area. The Sandstone, up to 50 m thick, lies unconformably over Carboniferous strata below consisting of the 'Ardwick Group' (mudstones with limestone and sandstone beds) over Carboniferous Coal Measures. All of the strata are heavily faulted and dip towards the southwest. Former workings below the site consist of four pre-1958 coal seams at depths of 310 to 1080 m, but no mineshafts are recorded in the area.

The Collyhurst Sandstone is classified as a major aquifer, but no groundwater source protection zones exist near the site. Shallow groundwater is present, perched within the made ground over the glacial till. Some standing water present in the northeast of the site. Three monitoring wells were installed, but the direction of groundwater flow is disturbed and could not be conclusively established.

The nearest surface watercourse is the Corn Brook, which flows through a culvert from northeast to southwest ~100 m to the south of the site. The site is not in a flood risk zone.

Source Characterisation (Based on the desk study & walkover survey)	
On-Site Sources:	
Natural:	None identified.
Historic:	Former land use as railway sidings and goods yard, subsequent clearance and re-grading. Likely use of site for solid waste disposal (mainly construction and demolition wastes) in relatively recent times.
Current:	Fly tipping, although the boundary embankments and dense tree cover along most edges of the site should act as a deterrent.
Off-site Sources:	
Historic:	Potential sources of contamination in the vicinity include:- - railway sidings and goods yard for coal, mineral and cattle around the site. - former iron foundry 150 m to the south. - other historic industrial operations further away from the site.
Current:	Fugitive dust emissions from the McGuinness waste transfer station directly north of the site, where an extremely large external stockpile of soil/aggregate material is present. Potential releases of petroleum hydrocarbons on railway land adjacent to the site on the south, which could migrate into the site via shallow groundwater.

Potential Pathways Considered

- Deposition of air-borne emissions and fugitive dusts from adjacent sites onto ground surfaces.
- Leaching/migration of hydrocarbons and water-soluble contaminants present in the made ground into shallow groundwater.
- Mobilisation of existing hydrocarbon contamination into shallow groundwater during site development.
- Surface water run-off into road drains on Rondin Road.
- Future direct drainage of groundwater from the site to surface water or foul water sewers.
- Migration of contaminated shallow groundwater into Collyhurst Sandstone major aquifer.
- Soil ingestion, inhalation and dermal contact by site development workers and future users of site.

Potential Receptors Considered

On-site:
- Shallow groundwater
- Site development workers
- Future users of the site

Off-site:
- Corn Brook
- Other unidentified surface waters
- People in the vicinity

Significant Pollutant Linkages Based on Phase 1 Assessment *where:* ✓ *= significant until proven otherwise* X *= not considered significant & will not be investigated further*	
Groundwater Receptor:	
υ Contaminant migration/leaching into shallow groundwater.	✓
υ Mobilisation of existing hydrocarbon contamination during site development.	✓
υ Migration of contaminated shallow groundwater into Collyhurst Sandstone major aquifer *(unlikely due to substantial protection from glacial till).*	X
Surface Water Receptors:	
υ Surface water run off of contaminants into off-site drains *(prevented by boundary embankments).*	X
υ Seepage of contaminants into Corn Brook via shallow groundwater *(unlikely as brook is channeled through a culvert).*	X
υ Future discharge of contaminated groundwater from site drainage to surface water receptor.	✓
Human Receptors:	
υ On- and off-site via ingestion, inhalation & dermal contact with soils during re-development.	✓
υ On-site via ingestion, inhalation & dermal contact with soils during future industrial use.	✓

Limitations and Uncertainties

Historic use of site for solid waste disposal.

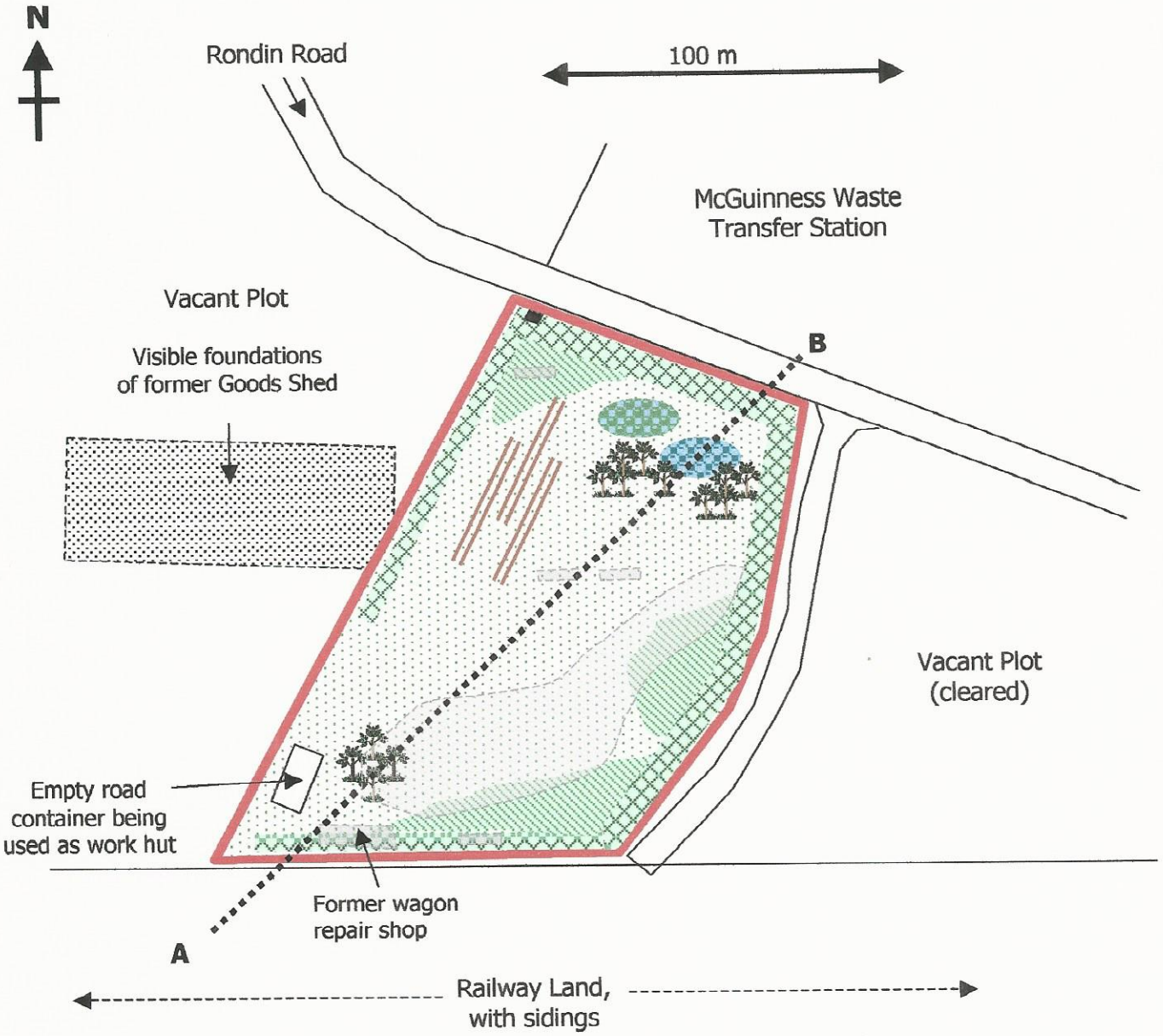
Seasonal variations in groundwater quality and height of water table.

Direction of groundwater flow.

Extent and origin of significant sub-surface obstructions and concrete surfaces.

Potential instability effects from historic coal mining below the site.

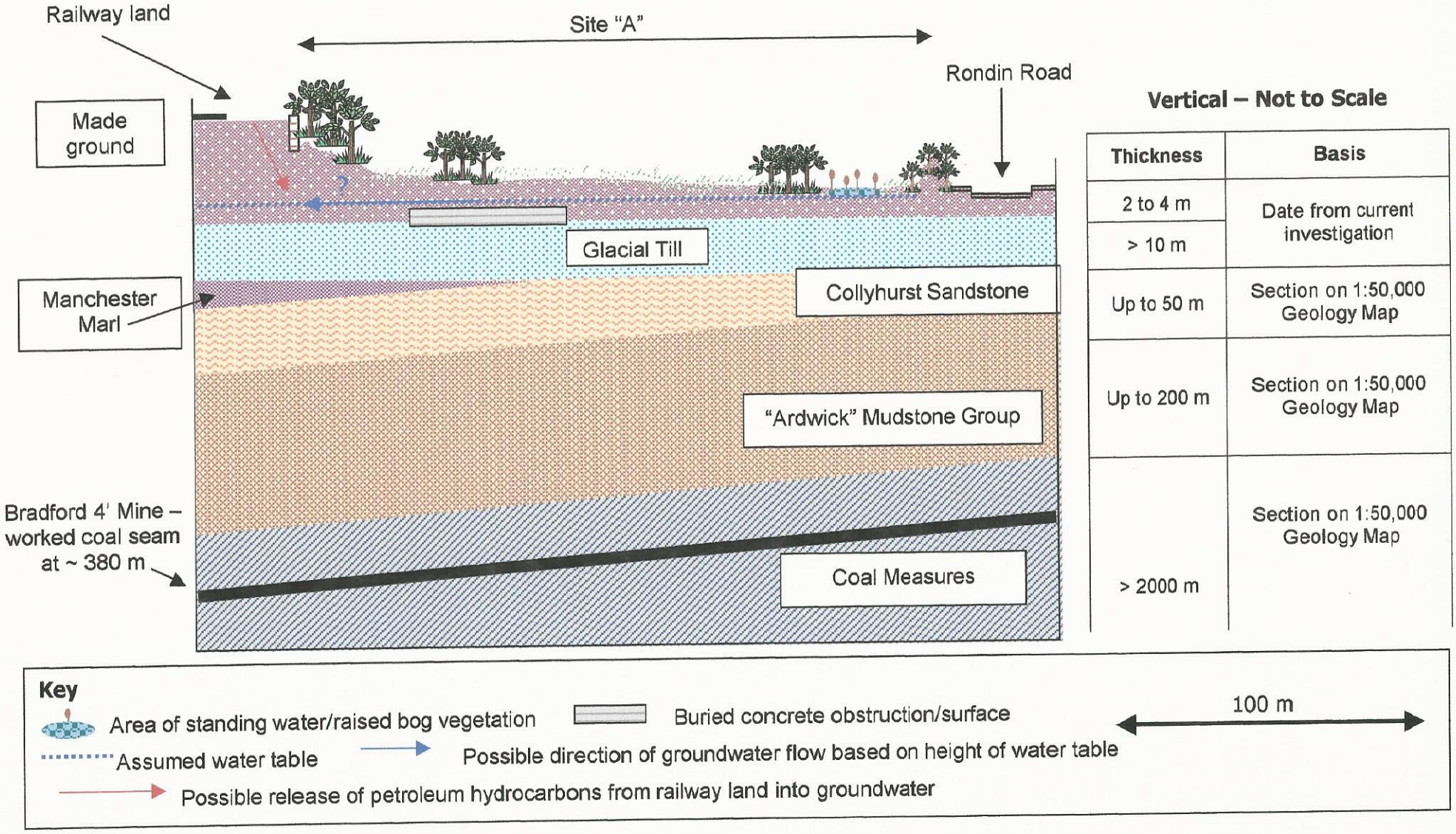
Figure 1. Conceptual Model of Site "A", Rondin Road – Plan View



KEY

- Mature trees & shrubs along embankment
- Prominent bramble cover
- Grassy vegetation with ragwort, clover, horsetail, bramble
- Groves of trees (willows & buddleia)
- Compacted soil ridges
- Standing water, with bull rushes
- Raised bog vegetation
- Overgrown electrical transformers
- Location of former buildings
- A ..... B Section (see Fig. 2)
- Buried concrete obstructions found

Figure 2. Conceptual Model of Site "A", Rondin Road – Section



1 INTRODUCTION

This report contains the results of supplementary groundwater and ground gas sampling and review of the risk assessment for hydrocarbons as part of the Phase 2 Investigation into the site condition of Site A in the Rondin Road development, Ardwick, Manchester. The report has been prepared by Bill Green of Castings Technology International (hereafter referred to as Cti). This report should be read in conjunction with Cti report 38045.

2 OBJECTIVES OF THE ASSESSMENT

The objectives of the investigation were as follows:

a) to provide quantitative data on groundwater and ground gas contaminant concentrations, which would be relevant to the development of the site and obtaining of planning permission.

b) to confirm the nature of physical attributes of the site and its vulnerability, which may be relevant in setting appropriate conditions under the planning system or PPC.

c) to refine and enhance the conceptual model developed for the site.

3 DETAILS OF INVESTIGATIONS

3.1 Specific points of investigation

The investigation was designed to obtain information on the following points:

- Contaminant concentrations in groundwater.
- Concentration of volatile organic compounds in the ground gas.

3.2 Sampling and analysis strategy

A programme of soil sampling was planned to include:

➔ Sampling of boreholes BH 1, BH 2 and BH 5

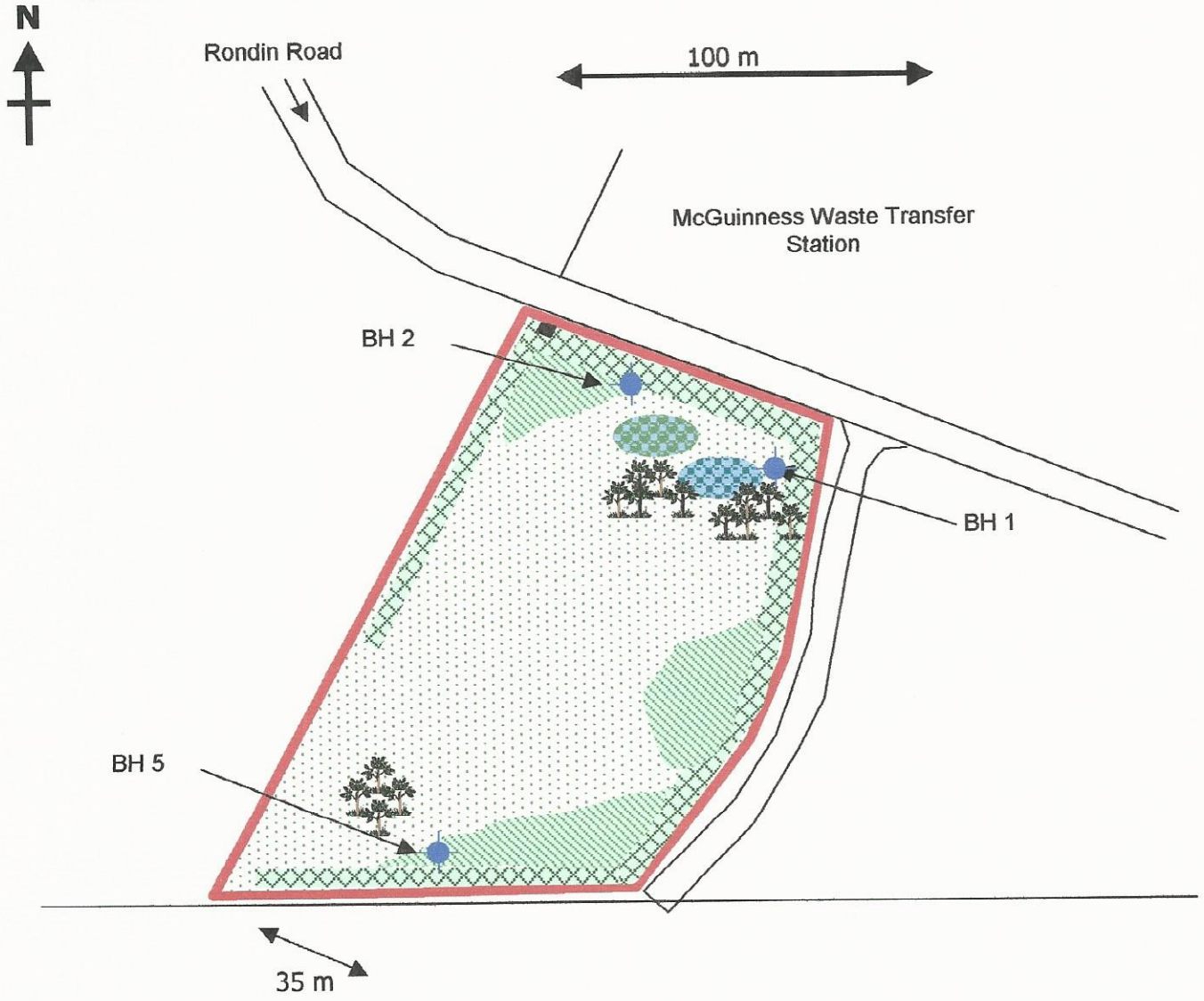
The provisional sampling plan is shown in Figure 3 below.

The contaminants included for consideration in the samples collected are shown in Table 2 below. The analysis suites were selected on the basis of potential contaminants.

Table 2. Summary of Contaminants Sampled

CONTAMINANTS	Groundwater	Ground Gas
Metals, Metalloids & their oxides:		
As, B, Cd, Cr, Fe, Pb, Ni, Zn, Hg, Se	✓	-
Chloride, sulphate	✓	-
pH	✓	-
Volatile organic compounds (VOCs)	✓	✓

Figure 3. Site "A" - Provisional Sampling Plan



KEY

- Mature trees & shrubs along embankment
- Prominent bramble cover
- Grassy vegetation with ragwort, clover, horsetail, bramble
- Groves of trees (willows & buddleia)
- Standing water, with bull rushes
- Raised bog vegetation
- Groundwater monitoring borehole

3.3 Sample collection techniques

The groundwater sampling was conducted using Cti DOP 391 and following the guidance outlined in ISO 5667-2:1993, 'Guidance on sampling techniques', ISO 5667-3:1986, 'Guidance on the preservation and handling of samples', ISO 5667-6:1990, 'Guidance on sampling of rivers and streams' and the Environment Agency Technical Guidance Note LFTGN02 - Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water, where applicable.

The borehole samples were collected in appropriate bottles from positions shown on the plan in Figure 3. and sent for analysis at Alcontrol Geochem Ltd., a UKAS accredited laboratory.

Sampling for ground gases was undertaken following the procedures set out in CIRIA Report 151 – Interpreting measurements of gas in ground.

Groundwater

Prior to the start of sampling the level of the groundwater and the presence of free product was measured. The borehole was subsequently purged of three times the volume of groundwater in the borehole to remove any stagnant water. The samples were taken immediately following purging.

Ground Gases

VOCs were sampled onto a sorbent charcoal tube from the capped head-spaces of the borehole prior to the sampling of groundwater.

3.4 Laboratory analysis

The laboratory analysis work for the groundwater was sub-contracted to Alcontrol Geochem Ltd., a UKAS accredited laboratory.

The ground gas samples were analysed by RPS Laboratories a UKAS accredited laboratory.

4 SUMMARY OF RESULTS

The results of the intrusive investigations are summarised in the sections below.

Shallow Groundwater

Standing water was present in all three wells on each of the visits in December 2007 and February 2008 (See Cti Reports Ref: 40330 and 40330-2).

No free product was found in any of the wells and the concentrations of the contaminants of concern were all well below the EEC/UK drinking water standard except for Nickel in BH 5 on the visit in February 2008. The results were little changed on any of the visits.

Hardness data for the nearest surface water (Corn Brook) could not be obtained as the brook is culverted along the length closest to the site.

Ground Gases

Ground gases (VOCs) were sampled in February 2008 (See Cti Reports Ref: 40330-2). Concentrations were below the analytical limit of detection at < 0.8 mg m^{-3}.

No hydrocarbon odours were detected on either of the sampling visits.

4.1 Petroleum Hydrocarbons and Polycyclic Aromatic Hydrocarbons (PAH)

No areas of excessive hydrocarbon contamination were encountered during the sample work at the Rondin Road site in 2004, although hydrocarbon odours were detected in a number of locations. Selection of samples for hydrocarbon and PAH analysis was based on horizons where a significant hydrocarbon odour was detected. No hydrocarbon odours have been noticed on subsequent visits.

A total of 8 soil samples from the site were analysed for total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH). The results ranged from 310 to 4900 mg/kg of TPH and 23 to 320 mg/kg of PAH.

Petroleum hydrocarbons are complex mixtures of organic chemicals with varying toxicity to human health. They are also classified as List I substances with regard to pollution of groundwater. PAH are often associated with hydrocarbon mixtures, present in products as produced for use and generated where oil undergoes partial combustion. Seven of the PAH reported in the standard analysis are considered to be genotoxic carcinogens, for which no safe dose can be established.

UK guidance on the assessment of risks to human health from petroleum hydrocarbons is currently undergoing development to enable more robust risk-based evaluations to be made.[1] The work includes a consideration of analytical methods and reporting practices, selection of indicator substances, development of toxicological data and setting of Soil Guideline Values. Several toxicological reports have already been published by Defra and the Environment Agency and others are currently under preparation,[2] but to date no Soil Guideline Values have been published and no date has been set for their publication.

Benchmark values for the assessment of such contaminants that have been used in the past include:

- The Dutch Intervention Value of 5000 mg/kg for mineral oil.

  The intervention values establish a threshold above which a remediation action plan would be required. They were developed to support multi-functionality of land use and have traditionally been amongst the strictest in Europe. The Environment Agency considers the direct application of Dutch Intervention Values as being inappropriate, however, the value provides a point of comparison for preliminary evaluation of the data.

- The ICRCL Upper Threshold value of 50 mg/kg for PAH.

  ICRCL thresholds were used prior to 2002 for the assessment of the significance of land contamination at UK sites. The Upper Threshold was a value considered to provide an acceptable threshold for a land use of parks, playing fields and open

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[1] Principles for Evaluating the Human Health Risks from Petroleum Hydrocarbons in Soils: a consultation paper, Environment Agency 2003.

[2] Lists of published and planned toxicology reports are available via a link from the CLEA homepage on the environment agency website at: www.environment-agency.gov.uk

spaces. The use of ICRCL thresholds was withdrawn by Defra in 2002 following the introduction of the CLEA (Contaminated Land Exposure Assessment) model.[3]

- The USEPA Region 6 Human Health Medium Specific Screening Levels 2008

  The USEPA Region 6 Human Health Medium-Specific Screening Levels address common human health exposure pathways. They do not consider all potential human health exposure pathways nor address ecological concerns. The comparison of preliminary investigation data against risk-based media concentrations provides for an initial evaluation for the relative environmental concern for a site or set of environmental data and commonly used defaults. The values are not regulatory, but are derived using equations from EPA guidance. The screening level for those PAH considered to potentially cause cancer for soils for industrial outdoor workers is around 250 mg/kg.

The petroleum hydrocarbon expected at the site would consist of heavier fractions, e.g., diesel and lube oils. It is also likely that any volatile constituents, such as benzene, that might have been present originally, would long since have been removed via volatilisation, dissolution to groundwater or by natural degradation processes. PAH are generally of low volatility. On this basis, it is concluded that there is little risk to human health via a vapour inhalation pathway.

Risks to human health via ingestion, inhalation of soil and dermal exposure may occur in conjunction with the proposed land use if significant areas of the site remain unsurfaced. However, it is planned that the operational areas would be completely covered with hard surfacing and where this is the case, the exposure pathway would be broken and no risk would exist.

The results obtained in 2004 indicated concentrations that may potentially be significant. Although the PAH results were well below the former ICRCL action level, the recent toxicological assessments on individual PAH indicate that much lower concentrations may be required for protection of human health. Furthermore, it is possible that more significant concentrations of hydrocarbons contamination may be encountered during the site development. However as it is proposed that the whole of the site is to be hard surfaced, there will be no risk to users of the site once it is in operation. Further natural degradation of both TPH and PAH will have occurred over the subsequent four years, further reducing the risk posed to human health.

Recommendations for dealing with any areas of gross hydrocarbon contamination are also discussed in Section 6 below.

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[3] Defra, CLAN 1/02: Withdrawal of ICRCL Guidance Note 89/53 (2nd Edition)

4.2 Groundwater data

Samples were obtained on 10th December 2007 and 20th February 2008.

A comprehensive suite of analyses was undertaken on groundwater samples from three monitoring wells: one well at the south end of the site (presumed up gradient position) and two wells at the north end of the site (presumed down gradient positions).

The results are shown in Tables 3 and 4.

Table 3. Summary of Groundwater Data

December 2007

Sample Identity	BH1	BH2	BH5	LoD/Units	EC/UK Drinking Water Standard
Sample Type	WATER	WATER	WATER		
Sampled Date	10.12.07	10.12.07	10.12.07		
Arsenic (ICP-MS)	3	<1	1	<1 ug/l	10 ug/l
Boron (ICP-MS)	35	30	150	<10 ug/l	1000 ug/l
Cadmium Dissolved (ICP-MS)	<0.4	<0.4	<0.4	<0.4 ug/l	5 ug/l
Chromium Dissolved (ICP-MS)	<1	1	1	<1 ug/l	50 ug/l
Lead Dissolved (ICP-MS)	<1	<1	<1	<1 ug/l	25 ug/l
Nickel Dissolved (ICP-MS)	<1	2	18	<1 ug/l	20 ug/l
Selenium Dissolved (ICP-MS)	<1	2	<1	<1 ug/l	10 ug/l
Vanadium Dissolved (ICP-MS)	1	<1	<1	<1 ug/l	-
Zinc Dissolved (ICP-MS)	<3	<3	38	<3 ug/l	5000 ug/l
Sulphate (Kone)	85	90	140	<3 mg/l	250 mg/l
Chloride (Kone)	30	25	48	<1 mg/l	250 mg/l
Total VOCs (GC-MS)	<1	<1	<1	<1 ug/l	-
Floating free product	None Detected			-	-
pH	8.22	7.87	8.34	<1.00pH Units	6.5-10

Table 4. Summary of Groundwater Data

February 2008

Sample Identity	BH1	BH2	BH5	LoD/Units	EC/UK Drinking Water Standard
Sample Type	WATER	WATER	WATER		
Sampled Date	20/02/08	20/02/08	20/02/08		
Arsenic(ICP-MS)	5	<1	1	<1 ug/l	10 ug/l
Boron(ICP-MS)	110	55	210	<20 ug/l	1000 ug/l
Cadmium Dissolved (ICP-MS)	<0.5	0.8	<0.5	<0.5 ug/l	5 ug/l
Chromium Dissolved (ICP-MS)	3	5	5	<1 ug/l	50 ug/l
Copper Dissolved (ICP-MS)	<1.6	36	3.0	<1.6 ug/l	2000 ug/l
Lead Dissolved (ICP-MS)	<0.5	4.4	1.0	<1 ug/l	25 ug/l
Nickel Dissolved (ICP-MS)	13	13	38	<1.5 ug/l	20 ug/l
Selenium Dissolved(ICP-MS)	2	<1	<1	<1 ug/l	10 ug/l
Zinc Dissolved (ICP-MS)	<5	7	150	<5 ug/l	5000 ug/l
Chloride (Kone)	27	44	53	<1 mg/l	250 mg/l
Total VOCs (GC-MS) #	<1	<1	<1	<1 ug/l	-
Floating free product	None Detected			-	-
pH	8.47	8.25	8.17	<1.00pH Units	6.5-10

Generally the results for inorganic contaminants of groundwater appeared to be below the relevant Environmental Quality Standards and Water Quality Objectives set for inland surface waters. This comparison is usually undertaken as a preliminary assessment of risk and precludes the need for further work if the results are satisfactory.

The only result found to be outside of an acceptable range was Ni in Borehole 5 on the 20 Feb 2008 sample

No evidence of organics was found in any of the samples collected

The results currently available do not provide evidence of any major contamination issues in groundwater and should not pose any risk to nearby surface waters.

4.3 Ground gas data

Samples were obtained on 20th February 2008.

The samples collected were analysed semi-quantitatively for a "Top Ten" VOC suite.

The results are shown in Table 5.

Table 5. Summary of Groundwater Data
February 2008

Ground Gases	Volatile Organic Compounds			LoD/Units
Sample Identity	**BH 1**	**BH 2**	**BH 5**	
Sample Type	Charcoal	Charcoal	Charcoal	
Sampled Date	20/02/08	20/02/08	20/02/08	
GCMS Screen (Top 10)	< 5µg	< 5µg	< 5µg	<5µg
Total Detected:	**< 0.6 mgm^{-3}**	**< 0.6 mgm^{-3}**	**< 0.8 mgm^{-3}**	
Uncertainty:	± 20%			
Date:	20-02-08	20-02-08	20-02-08	
Test Period:	13:59 to 14:39	14:02 to 14:42	13:42 to 14:13	
Sample Duration:	40 mins	40 mins	31 mins	
Sample Rate:	200 ml/min	200 ml/min	200 ml/min	

The concentration of volatile organic compounds within the headspace of the boreholes was below the detection limit of the analytical method.

The results currently available do not provide evidence of any major contamination issues in ground gases and should not pose any risk via inhalation to future users of the site.

5 FINAL DISCUSSION

A discussion of the results and their significance has already been presented in Section 4. This section will draw additional conclusions from the data about the site, where these have not already been discussed.

5.1 Risks arising during site development work

The main risks arising at the site are likely to be of concern during the development work, rather than at end use. Some of the issues that will require further consideration and the adoption of appropriate management and mitigation measures are listed below:

- Dust suppression techniques should be employed as necessary to minimise inhalation by site workers and migration of air-borne dusts off site. As site soils are likely to be moist, respiratory protection should not be required as routine, but may be appropriate if undertaking an unusually dusty operation.
- Workers should be instructed to maintain good hygiene practices to avoid the unnecessary ingestion of contaminated dusts and prolonged dermal contact. Washing facilities should be provided on site and workers required to clean up prior to breaks.
- The likelihood of encountering some significant pockets of hydrocarbon contamination should be planned for. Heavily contaminated soils should be removed and replaced with clean fill material. It may be cost-effective to set up on-site bio-remediation of such soils by provision of a bunded storage area where treatment could be undertaken. This would be preferred to off-site removal of contaminated soil, which would require disposal in an expensive hazardous landfill.
- Drainage and dewatering systems for site water should incorporate oil separators to collect any hydrocarbons mobilised during the development work. Any oil collected may require disposal as a hazardous waste or could be recycled by Howarth Metals as furnace fuel.

5.2 Risks arising from the future use as a metals recycling facility

The residual risks to human health at the site following development are dependant on the nature of the development and extent of site surfacing provided. While metals contamination do not appear likely to pose significant risks, the potential from PAH may require further assessment when the development plans have been finalised.

The primary risk following development could be a potential for hydrocarbon migration into and via shallow groundwater. It is possible that the site development could mobilise unidentified pockets of hydrocarbons that are currently contained within the made ground. The extent of the potential risk should be evaluated as an on-going exercise during the site development work. Final arrangements for site drainage and on-going monitoring of groundwater should be established based on the perceived residual risk to ground and surface waters.

6 CONCLUSION

The additional investigations indicate that there is little contamination of the groundwater from metals, chlorides or sulphates. No free product or VOCs have been found in any of the boreholes.

Most contamination assessed at the site was not found to pose a significant risk to human health or controlled waters for the proposed end use.

Potential health risks to development workers will be higher and recommendations on matters requiring consideration were discussed in Section 5 above.

Shallow groundwater at the site is only slightly contaminated and contaminants are unlikely to pose a significant risk to surface waters. The potential however exists for site drainage water to be contaminated. Mitigation measures should be planned to prevent off site releases as part of the development work.