
6 Summary of Findings & Proposed Remedial Programme

6.1 Introduction

This section summarises the conclusions of the desk study and the ground investigation undertaken at the site; outlining the understanding of the extent and nature of contamination in the shallow groundmass; identifying areas requiring remedial action; and describing a general remedial action programme to minimise the impacts identified on the proposed development.

6.2 Summary of Findings

As the proposed development of the site is unknown at the present time, the hazards to the present or future site users have been assessed in relation to compounds present above the current UK and Dutch Guidelines for two situations, based on our understanding of CNTs proposals. These include:

- leaving the site in its current condition of open land; and
- the commercial or industrial development of the site consisting mainly of buildings, areas of hard cover and landscaping.

It is considered that there is a very minor risk associated with the off-site migration of compounds through the ground as groundwater was generally absent during the site investigation and the NRA leaching tests indicated that the contaminants are not present in a mobile form. Also there is no indication of mobilisation of the identified compounds to the Willowbrook.

The compounds generally encountered on site consisted of phytotoxic metals including zinc, with occasional elevated concentrations of lead. In addition sulphur and sulphate were present at high concentrations. It was observed that the higher concentrations coincided with the black steelworks waste, with the reworked Glacial Till located above and below this material having lower concentrations.

6.3 Risk/Target Models

The risks from slightly elevated concentrations of the determinands outlined above have been assessed in relation to various potential pathways that cause exposure to particular compounds, and their toxicity. The various pathways of uptake of compounds are specific to their nature.

The primary pathway for potential uptake of compounds in the soil by site users is considered to be from oral ingestion. In addition, possible ingestion of surface water may be considered.

There are potential risks to plant growth as levels of phytotoxic compounds in particular zinc, were identified above ICRCCL trigger levels, in some of the samples taken in the near surface soils. However, as these materials have a high clay content the risk is significantly reduced.

Fish life and the general ecosystem of the water courses downstream of the site should not be affected by the discharge of surface water. Sampling and laboratory analysis of ponded water from the site was not carried out but the samples from the water courses adjacent to the site showed no evidence of contamination.

The elevated levels of heavy metals identified in the steelworks waste are not considered a risk as the waste is surrounded by reworked glacial clays which act as a barrier to the generation and migration of the leachate. In addition, the NRA leaching tests undertaken on the soil materials indicate that the contaminants are not present in a mobile form and thus are unlikely to migrate off-site.

Contamination of any groundwater beneath the site in the sandstone is not considered a risk due to the fact that the strata underlying the site to a depth of at least 17m was confirmed as clays with low permeability.

6.4 Contamination Risks to Future Site Users

The assessment of risks to site users must take into account the probable route of uptake of a compound and an assessment of the contact time involved.

The ingestion of soil presents a pathway by which compounds may reach the targets. Soil ingestion is considered to be a significant problem with respect to children but as the site is targeted for industrial development, this pathway is not considered to be a high risk.

The inhalation of suspended soil particles presents another pathway by which contamination may reach the target. Heavy metals may be transported in this manner. Elevated arsenic levels have been identified in the made ground across the site at concentrations exceeding the suggested ICRL TTC of 10mg/kg. It is generally recognised that this guideline level for arsenic is too onerous and it is known that this compound may be present in concentrations up to 53mg/kg in naturally occurring agricultural soils. In addition the Dutch Intervention level is 55mg/kg, which is considered to be a more appropriate value. However, the concentration of arsenic measured in the near surface soils at the site were occasionally in excess of this value so may be considered a risk at the site during development activities.

It will be necessary to undertake spot checks and reviews during any future construction to update the strategy for identifying and dealing with hazards and their associated risks.

6.5 Construction Risks

The COSHH Regulations provide a comprehensive approach to the safe handling of a range of substances in the workplace and provides information on the hazards and risks to health involved in handling and necessary precautions taken to protect health.

Construction workers should be equipped with appropriate personal protective equipment as stated in the CIRIA 'Guide to Safe Working Practices for Contaminated Sites' (CIRIA, 1993).

X Any Contractor responsible for the excavation, transportation and disposal of any contaminated soil will need to comply with the Environmental Protection (Duty of Care) Regulations 1991. This will necessitate preparing a COSHH assessment on the soil for removal.

The risks present during the construction phase may be no greater than for other low level contaminated sites and the fact that any contamination is likely to be concentrated in readily definable areas or depths will make control of the risk easily achievable.

The gas monitoring undertaken to date indicates that the site is generating methane, carbon dioxide and hydrogen sulphide at levels which may require future buildings on site to be designed with suitable gas protection measures (CIRIA Report 149). Reference may also have to be made to the BRE document Radon: guidance on protective measures for new dwellings, (BRE, 1991).

Foundation designs will also have to take account of the elevated concentrations of sulphate in the soils and groundwater at the site. Referring to BRE Digest 363, July 1991, based on the results of sulphate testing in groundwater, it is anticipated that concrete to at least Class 3 will be required in underground situations, especially in piles which are likely to encounter the steelworks waste.

x
6.6 Pollution Liability

6.6.1 Groundmass

Elevated levels of heavy metals were detected within the black steelworks waste identified at various depths across the site. However, this material was found between low permeability reworked glacial clays at the surface and at depth, which are likely to isolate the contaminants. In addition, the waste materials had low leaching potential with the result that the metals will have a resultant low mobility.

6.6.2 Groundwater

The absence of significant groundwater within the made ground, the presence of impermeable clays effectively sealing the sludge material, and the results of the leaching tests, indicate that there is low risk of potential contamination of groundwater and off site migration of contaminants. The three samples of groundwater collected from the site contained low levels of compounds with the exception of sulphate which was present at elevated concentrations. The results confirm that the metals within the waste have a low solubility and that the risk to off-site migration of contaminants is low.

6.6.2 Surface Water and Sediment

It is considered that there are no potential problems of contamination of the Willowbrook from the leaching of materials found on site. The stream water

and sediment analyses indicated that the water was clean and the leaching tests indicates that the contaminants are not present in a mobile form. The low permeability of the surface materials indicates that storm water will either collect on site (ponding) or discharge directly to the stream, with negligible infiltration into the glacial clays covering the site.

6.7 Proposed Remedial Action Programme

In its present condition and taking account of its present limited use, the site is not considered to pose a risk to current site users, or the surrounding environment.

space

Should the site be developed for commercial or industrial use with the majority of the surface covered with landscaping, hard cover or buildings, as is the situation on the surrounding industrial estates, it is considered that only limited remediation or protective measures may be necessary as the site is not considered to pose a significant risk to the users of such a development.

These could include the following:

the environment

- The moat surrounding the 'naphthalene pit' would need to be drained, during site preparation works. The analyses from the water and sediment in the moat, indicated that there is low levels of contamination present. It is considered that the water could be discharged into a foul water sewer, although this will need to be approved with the local authorities.
- The design of building foundations should take account of the poor consistency of the steelworks waste which may require the use of piles. The use of sulphate resistant concrete (class 3) should also be considered.
- The potential presence of landfill gases (methane, carbon dioxide, hydrogen sulphide and possibly radon) are likely to require the incorporation of gas protection measures within the building design. It is likely that a passive gas venting system will be required as a minimum. This would incorporate a vented underslab void and a sealed gasproof membrane below the building. This should provide sufficient protection to any development and site occupiers as the gas flow rate measured on site was negligible and the steelworks waste in which the gases originate is confined within impermeable glacial clays. It is considered that the gas

was only detected due to migration pathways being introduced from the steelworks waste in the form of the gas monitoring wells themselves. The presence of piles, if used, on site will create a pathway for the gases generated within the steelworks waste to reach the ground surface, further highlighting the requirement for protection measures. Where piles are used which may encroach into the steelworks waste, special care should be taken to ensure the gas proofing around the pile caps.

(Note: the steelworks waste does not underlie the whole of the site.)

- Steelworks waste and clinker encountered on the ground surface should either be removed, or covered with a suitable inert material during the site development. This is also likely to be required to enhance the drainage at the ground surface, with storm water collected and discharged to a suitable location.

X
It is recommended that detailed designs are prepared for the remedial action programme proposed above to facilitate the prompt and effective minimisation of the identified contamination impacts resulting from historic activities at the site. The preparation of such detailed designs should involve site management to ensure that implementation of the agreed strategy is undertaken as cost effectively as possible. It should also involve full discussion with the Environment Agency, ~~formerly the NRA~~, and the Local Authority to ensure agreement on the recommended action plan can be reached at an early stage.

ALC/JS/(BW)/CKG/590196/000

May 1996

m:\...\birmingham\ent\corby\repot.doc

Frank Graham Consulting Engineers Limited

Shinfield House

School Green

Shinfield

Reading

Berkshire

RG2 9EW

References

- Atlas, R.M., 1986
Basic and Practical Microbiology
Macmillan Publishing Company, 1986
- BGS, 1976
One inch geological map Sheet 171: Kettering, Drift Edition
- BRE, 1991
Radon: Guidance on Protective Measures for New Buildings
- CIRIA, 1993
Construction Industry Research and Information Association, Funders Report
CP/9, A Guide to Safe Working Practices for Contaminated Sites, 1993.
- CIRIA,
Report 149
- DoE, 1994
Department of the Environment, Contaminated Land Research Report:
Sampling Strategies for Contaminated Land (CLR Report No 4, 1994).
- Environmental Advisory Unit, 1983
Willowbrook East Industrial Site, Corby: Site Investigation and
Interpretation. EAU, Dept of Botany, Liverpool University, October 1983
- Freemantle, 1987
Freemantle, M. H., Chemistry in Action, MacMillan Education Ltd., 1987
- HMSO, 1995
The Environment Act, Her Majesties Stationary Office, 1995.
- HMSO, 1991
The Building Regulations, London, HMSO, 1991

HMSO, 1994

Health and Safety at Work Act, 1974

HSE, 1991

Health and Safety Executive, Protection of Workers and the General Public
During the Development of Contaminated Land, 1991

HSE, 1995

Health and Safety Executive, EH 40/95, Occupational Exposure Limits,
1995.

ICRCL, 1987

Interdepartmental Committee on the Redevelopment of Contaminated Land,
Guidance on the Redevelopment of Contaminated Land, Guidance Note
59/83, HMSO

IGS, 1977

Institute of Geological Sciences, Hydrogeological Map of England and Wales
Scale 1:625,000

IGS, 1969

National Environment Council, Institution of Geological Sciences
British Regional Geology- Central England
3rd Edition
BA Hains, A Horton

Kenilworth Estates Ltd

Proposal to CNT for land acquisition at Willowbrook West Industrial Area,
Corby

NRA, 1994a

Policy and practise for the Protection of Groundwater
Regional Appendix - Anglian Region

NRA, 1994b

Policy and Practise for the Protection of Groundwater

Groundwater Vulnerability Map for North Northamptonshire and West Fens,

Scale 1:100,000

NRA, 1994c

The quality of rivers and canals in England and Wales (1990 to 1992)

NRA, 1994d

Leaching Test Method for the Assessment of Contaminated Land

NRA Interim Guidance

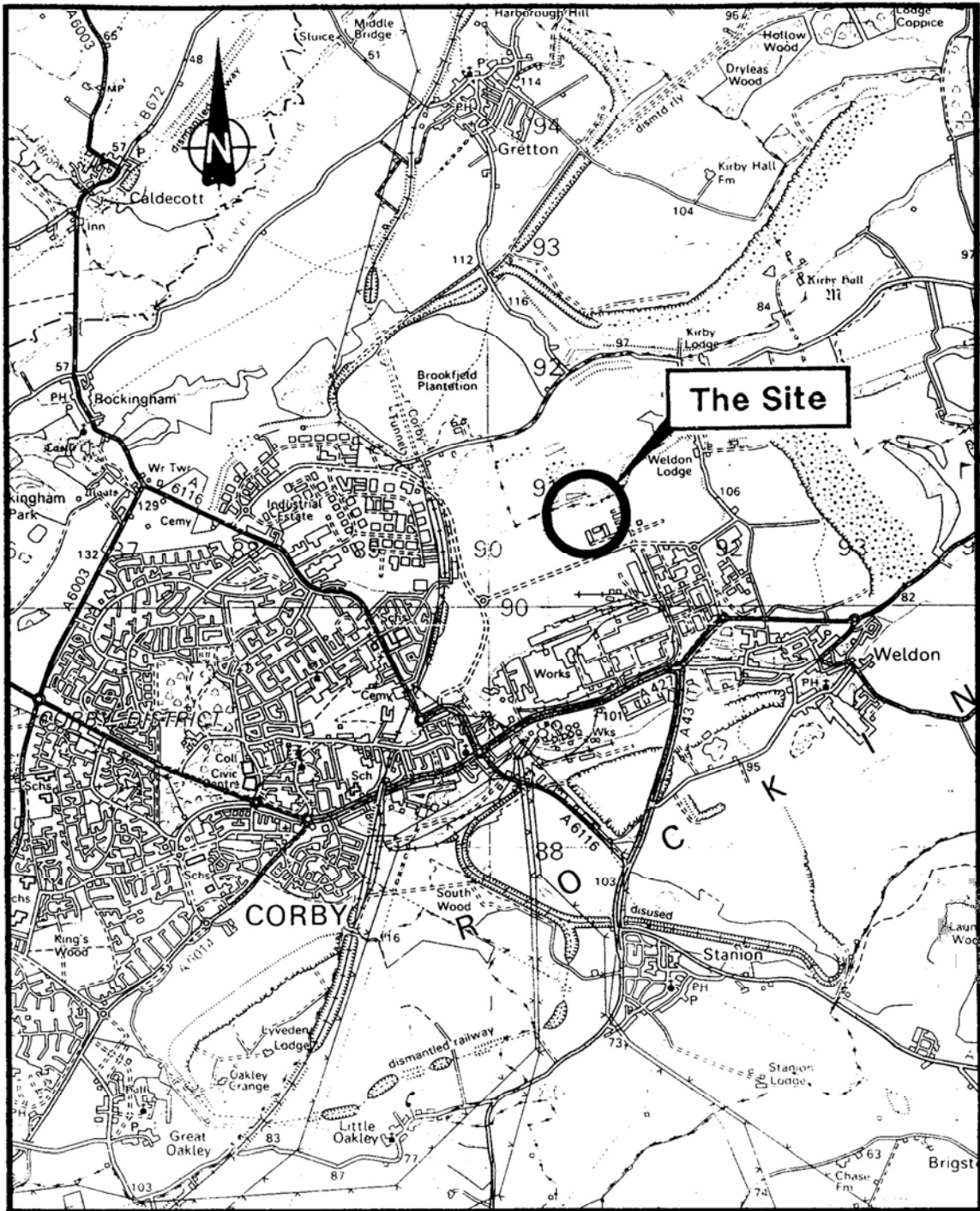
Soil Survey of England and Wales, 1983

Soil Map of England and Wales, Scale 1:250,000

Weldon Plant Ltd

Land restoration : Contaminated Land West of Shelton Road, Corby for CNT

Figures



Reproduced from the Ordnance Survey's map with the permission of the Controller of Her Majesty's Stationery Office.
Licence No. AL 549967
Crown copyright reserved.

Scale 1 : 50,000



Frank Graham
Consulting Engineers
COMMISSION FOR THE NEW TOWNS
SHELTON ROAD, CORBY
SITE LOCATION PLAN

Fig. 1



Appendices

Appendix A
Trial Pit Records

Method Mechanical excavator.		Size 0.6m*2.5m*4.0m		Location Shelton Road / Willowbrook Rd, Corby, Northants. 490800-290676		
Sample/Test		Hand Vane Shear Strength (kPa)	Description of Strata	Ground Level		106.90 m(OD)
Depth (m)	T Y P E			Depth (m)	Level m (OD)	Legend
0.10	D		MADE GROUND: Topsoil. (F)	0.10	106.80	
0.50	D		MADE GROUND: Brown, medium to coarse, gravelly Sand, with occasional brick, slag, metal and concrete fragments. (F)	0.65	106.25	
1.00	D					
2.00	D		MADE GROUND: Firm, grey and orange brown, slightly silty slightly sandy Clay, with some fine to coarse, angular to subrounded flint, chalk and ironstone gravel. Occasional slag fragments. Below 1.50m becoming stiff with occasional chalk cobbles. Below 3.20m occasional pockets (<50mm) of orange fine sand.			
3.00	D					
3.50	D					
3.50	D		MADE GROUND: Soft, dark brown, very silty Clay. Below 3.80m firm to stiff, with laminae of light brown medium sand. (F)	3.40	103.50	
4.00	D	12.02.96		4.00	102.90	
Remarks Trial pit dry and stable upon completion. Day works - 30 minutes washing down equipment.						
Client Commission for the New Towns / F.G.C.E.L.						Scale 1:25 Report 96/027

Method Mechanical excavator.	Size 0.6m*2.5m*4.0m	Location Shelton Road / Willowbrook Rd, Corby, Northants. 49095(-290740)
---------------------------------	------------------------	--

Sample/Test		Hand Vane Shear Strength (kPa)	Description of Strata	Ground Level		Legend
Depth (m)	TYPE			Depth (m)	Level m (OD)	
1.00	D		MADE GROUND: Topsoil. (F)	0.10	106.30	
2.00	D		MADE GROUND: Firm to stiff, grey, slightly silty Clay, with some fine to coarse, angular to subrounded chalk, sandstone and ironstone gravel. Occasional rootlets. Between 0.80 and 1.50m occasional pockets (<50mm) of orange fine sand. Below 1.50m trace ceramic, coal, metal and wood fragments. Below 2.20m locally mottled light grey.			
3.00	D					
3.50	D					
		14.02.96		(F)	4.00 102.40	

Remarks
Trial pit dry and stable upon completion.
Day works - 30 minutes washing down equipment.

Client
Commission for the New Towns / F.G.C.E.L.

MENTOR
Geotechnical & Materials Consultants Ltd.


Scale 1:25
Report 96/027

Method Mechanical excavator.	Size 0.6m*3.7m*4.0m	Location Shelton Road / Willowbrook Rd. Corby, Northants. 49101/-290760
---------------------------------	------------------------	---

Sample/Test		Hand Vane Shear Strength (kPa)	Description of Strata	Ground Level		Legend
Depth (m)	T Y P E			Depth (m)	Level m (OD)	
			MADE GROUND: Topsoil.	0.20	106.00	
0.50	D					
1.00	D					
2.00	D		MADE GROUND: Firm, grey brown, slightly silty slightly sandy Clay, with some fine to coarse, angular to subrounded, sandstone, ironstone and chalk gravel with traces of brick fragments. Below 0.80m becoming grey in colour with occasional cobbles. Below 1.70m becoming sandy clay. Below 2.00m stiff. Below 2.50m occasional green slag boulders and dark green glassy slag. Below 3.50m organic odour.			
3.00	D					
4.00	D	09.02.96		4.00	102.20	

Remarks
Trial pit dry and stable upon completion.
Day works - 30 minutes washing down equipment.

Client
Commission for the New Towns / F.G.C.E.L.




Geotechnical & Materials Consultants Ltd.

Scale 1:25
Report 96/027

Method Mechanical excavator.	Size 0.6m*2.0m*1.2m	Location Shelton Road / Willowbrook Rd, Corby, Northants. 490793-290709
---------------------------------	------------------------	---

Sample/Test		Hand Vane Shear Strength (kPa)	Description of Strata	Ground Level		
Depth (m)	T Y P E			Depth (m)	Level m (OD)	Legend
			MADE GROUND: Topsoil. (F)	0.10	106.5	[Cross-hatched pattern]
0.40	D		MADE GROUND: Brown, fine to coarse, angular to subangular, sandy slag Gravel, with occasional ironstone and chalk fragments. (F)	0.60	106.0	
0.60	D					
1.00	W	12.02.96	MADE GROUND: Firm to stiff, grey and orange brown, slightly silty Clay, with some fine to coarse, angular to subrounded flint, chalk and ironstone gravel. (F)	1.20	105.4	[Cross-hatched pattern]

Remarks
 Trial pit stopped at 1.20m due to rapid inflow of water from 0.6m.
 Day works - 30 minutes washing down equipment.

Client Commission for the New Towns / F.G.C.E.L.		Scale 1:25
		Report 96/027

Method Mechanical excavator.	Size 0.6m*2.7m*4.0m	Location Shelton Road / Willowbrook Rd, Corby, Northants. 49078(-290736)
---------------------------------	------------------------	--

Sample/Test		Hand Vane Shear Strength (kPa)	Description of Strata	Ground Level		Legend
Depth (m)	T Y P E			Depth (m)	Level m (OD)	
0.30	D		MADE GROUND: Soft, light brown, silty Clay, with occasional fine and medium chalk and ironstone gravel with some organic material. (F)	0.40	106.6	
0.80	D					
1.50	D		MADE GROUND: Firm to stiff, grey and brown, slightly silty Clay, with some fine to coarse, angular to subrounded chalk, ironstone and flint gravel. Occasional pockets (<150mm) of orange fine sand. Between 1.30 and 2.00m occasional coal and wood fragments. Odorous below 2.50m.			
2.50	D					
3.50	D			3.40	103.6	
3.70	D	10	MADE GROUND: Soft, dark brown, very silty Clay, with occasional laminae (<10mm) of light brown fine sand.			
		12.02.96		(F)	4.00	103.0

Remarks
Trial pit dry and stable upon completion.
Day works - 30 minutes washing down equipment.

Client
Commission for the New Towns / F.G.C.E.L.



Scale 1:25
Report 96/027

Method Mechanical excavator.		Size 0.6m*2.5m*4.0m		Location Shelton Road / Willowbrook Rd, Corby, Northants. 49088:-290763		
Sample/Test		Hand Vane Shear Strength (kPa)	Description of Strata	Ground Level		106.8(m(OD))
Depth (m)	T Y P E			Depth (m)	Level m (OD)	Legend
0.50	D		MADE GROUND: Topsoil. (F)	0.10	106.7	
1.00	D		MADE GROUND: Firm to stiff, orange brown and grey, mottled, slightly silty slightly sandy Clay, with some fine to coarse, angular to subrounded flint, chalk, sandstone and ironstone gravel. Traces of brick fragments.			
2.00	D					
3.00	D		[Indistinct boundary] MADE GROUND: Firm to stiff, grey, slightly silty Clay, with some fine to coarse, angular to subrounded sandstone and chalk gravel. Occasional pockets (<200mm) of orange brown clay with occasional rootlets. Below 1.50m occasional slag and wood fragments. Below 3.10m occasional pockets (<200mm) of odorous blue black silty clay.	1.50	105.3	
3.20	D					
4.00	D	12.02.96		(F)	4.00	102.8
Remarks Trial pit dry and stable upon completion. Day works - 30 minutes washing down equipment.						
Client Commission for the New Towns / F.G.C.E.L.					Scale 1:25	Report 96/027