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Multidisciplinary Consulting

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By Email: (Stephanie.Eaton@carterjonas.co.uk)

Our Ref: 774777-LET-ENV-001
24 January 2017

Ms Stephanie Eaton
Carter Jonas LLP
One Chapel Place
London
W1G 0BG

Dear Stephanie,

Marley Eternit Site, Whaddon Road, Meldreth – Remediation Costs

Further to your instruction, we have estimated the possible costs of remediation that could be incurred in the development of the above site.

Our estimate of costs relates to a 3.1 hectare brownfield site being redeveloped for residential use. A further 2.4 hectares of possible greenfield land is in the east, however planning records indicate an elongate infilled lagoon divides the two parts of the site.

We have been provided with the following documents on which our estimate is based:

- Resource and Environmental Consultants (September 2012) Preliminary geo-environmental site summary. Report 01c44470
- Resource and Environmental Consultants (October 2012) Phase I & II geo-environmental site investigation. Report 44470p1r0
- E3P (December 2014) Remediation & enabling works overview. Report 10-192-r1
- Grasscroft Development Solutions (November 2016) Residential viability appraisal
- Calderpeel Architects (June 2016) Proposed site master plan. Drawing 130(P1)100E

In terms of future residential development, the consultants E3P considered that remediation of ground contamination would be required as follows:

a. Made ground containing ACMs will be removed from future gardens. These ACMs will be placed at depth beneath buildings (circa 1000mm), softscaping (circa 2000mm) and underground in a box cut beneath a new estate road in the east.

b. Barrier pipe for new water supply.

c. Ground gas/hydrocarbon vapour resistant membrane in new buildings.

d. Remediation of hydrocarbons in groundwater.

REC Site Investigation Report

Remediation requirements are based on REC's monitoring of free product thickness. However, we consider there is a high level of uncertainty in the extent of hydrocarbons indicated by the report.

In our view, the stated thicknesses of free product found in boreholes could not physically exist based on the monitoring data. In seven instances, the thickness of free product exceeded the 'wet' length of the well and in one instance it exceeded the total depth of the well. *Clarification should be sought from REC on the data in their report.*

In addition, the levels of hydrocarbons in soil and in dissolved phase in groundwater are relatively low and the observations recorded during fieldwork are not consistent with significant hydrocarbon contamination. For example, the monitoring recorded a 1.58m thick layer of oil in WS301 however during drilling there was no evidence of hydrocarbons at all. Coupled with almost no hydrocarbons in the groundwater analysis and very low levels of carbon dioxide ground gas, the presence of significant free product would be considered unusual.

We would also question the likelihood of 1.0m to 1.9m of free product being present across the majority of the site area as this would represent a very significant volume of oil that was unlikely to have gone unreported or unnoticed in the adjacent drainage ditch and fish pond to the south.

E3P Remediation Overview Report

The E3P report provides an overview of proposed remediation and enabling works based on the findings of the REC report. In our opinion, the remediation proposals are not fully supported by the available evidence or have potentially significant cost risk issues. Our comments are as follows:

a. E3P's proposal for burying ACMs on-site is appropriate in principle. However it does not address the possibility of soils containing ACMs being contaminated with hydrocarbons. In that event, it is unlikely that the Environment Agency would agree to a burial scheme whereby potentially mobile contamination is placed back in the ground in direct contact with the principal aquifer (chalk strata).

b. E3P states that extensive hydrocarbon contamination requiring remediation is present across most of the site. As noted above, we consider the overall extent and thickness of free product is in doubt.

c. E3P states there are potentially explosive and carcinogenic ground gases beneath the site and risks "cannot be addressed without wholesale land remediation". This is unfounded as REC's monitoring shows no ground gas contamination at all and no organic vapour monitoring was undertaken to prove the presence of carcinogenic hydrocarbons in soil pore space. *Clarification should be sought from E3P on why a membrane was included in their overview.*

Grasscroft Viability Appraisal

We have the following comments on the viability appraisal report prepared by Grasscroft.

a. The appraisal includes a sum for driven piles. However, REC's recommendation is for traditional shallow strip foundations. We concur with REC and consider that piled foundations are not required for this site. The cost of shallow foundations will be less than for piles. *Clarification should be sought from Grasscroft why piled foundations have been assumed in the viability report costings.*

b. The appraisal includes a cost for a chemical resistant membrane. A requirement for a membrane is not supported by REC's findings. However, a membrane could be required if the extent of hydrocarbons in the REC report is found to be correct and some residual contamination remains after remediation. Therefore an allowance for a membrane would be sensible.

Remediation Costs

Based on our review of the REC and E3P reports, which identified a high level of uncertainty, we consider that a range of costs for remediation are appropriate.

To assist in our estimate of costs we have ground modelled the thicknesses and volume of made ground (drawing attached).

Cost breakdowns are attached and summarised in the two table below.

Best case	**£1,128,000**
▪ Removal of free product over 2300m^2 area completed in 6 months ▪ No hydrocarbon vapour barrier if remediation is effective ▪ ACMs removed from gardens and placed in 4m deep box cut 330m long ▪ ACMs beneath softscaping/POS buried at 2m ▪ ACMs removed beneath buildings and capped beneath POS (levels raised) ▪ Previously undeveloped land to the east is not contaminated. ▪ Barrier pipe to 100 units ▪ Natural soils from excavations used in capping ▪ Decommissioning abstraction wells	

Worst case	**£2,118,000**
▪ Removal of free product over 11000m^2 area completed in 12 months ▪ Hydrocarbon vapour barrier to 100 units if remediation is ineffective ▪ ACMs removed from gardens and placed in 4m deep box cut 330m long ▪ ACMs beneath softscaping/POS buried at 2m ▪ ACMs removed beneath buildings and capped beneath POS (levels raised) ▪ Previously undeveloped land to the east is contaminated ▪ Barrier pipe to 150 units ▪ Imported capping in gardens to 150 units and softscape ▪ Decommissioning abstraction wells	

The Homes and Communities Agency publication, *Guidance on dereliction, demolition and remediation costs* (March 2015) contains a remediation cost calculator. Using the HCA guidance, and based on previous site use and moderate/high water risk setting, an indicative cost for remediation is £1.3 to £3.3 million. On this basis the tabulated costs above are within the expected range.

Costs Risks

If hydrocarbons have contaminated ACMs to the extent that made ground cannot be buried in the ground then on-site burial is unlikely to be acceptable to the Environment Agency. This would generate a large volume of soil for off-site disposal containing both hydrocarbons and asbestos.

In the event that this risk is realised then the E3P strategy is not feasible and remediation costs could increase to £5.23M due to considerable landfill disposal charges.

The available data indicates groundwater requiring remediation comprises free phase hydrocarbons. If further investigations identify significant hydrocarbons in dissolved phase or soil then the cost and timescale of groundwater treatment could increase further.

There is no investigation data for the previously undeveloped 2.4 ha strip of land in the east, however planning records suggest the existence of an infilled lagoon. It is assumed that some remediation could be required in a worst case situation but can be dealt with using standard systems such as capping, barrier pipe and membranes. Remediation costs could increase if hydrocarbons and asbestos extend beneath this area.

Other Costs

The following related costs are excluded:

- Asbestos removal in buildings
- Ground investigation and contaminated land consultancy
- Demolition and dealing with redundant services
- Decommissioning fuel and chemical storage tanks and infrastructure
- Development platform and foundations

Caveats

MLM do not provide QS services and any estimate will be based on our knowledge of contractor's costs from past projects on which MLM has been involved. The costs do not necessarily reflect current market rates that could be obtained under tender conditions. Any statement of quantities will have been provided by the client or determined from our best estimate.

Further investigations and assessments are required to determine final remediation requirements and for obtaining regulatory agreement.

Yours sincerely,

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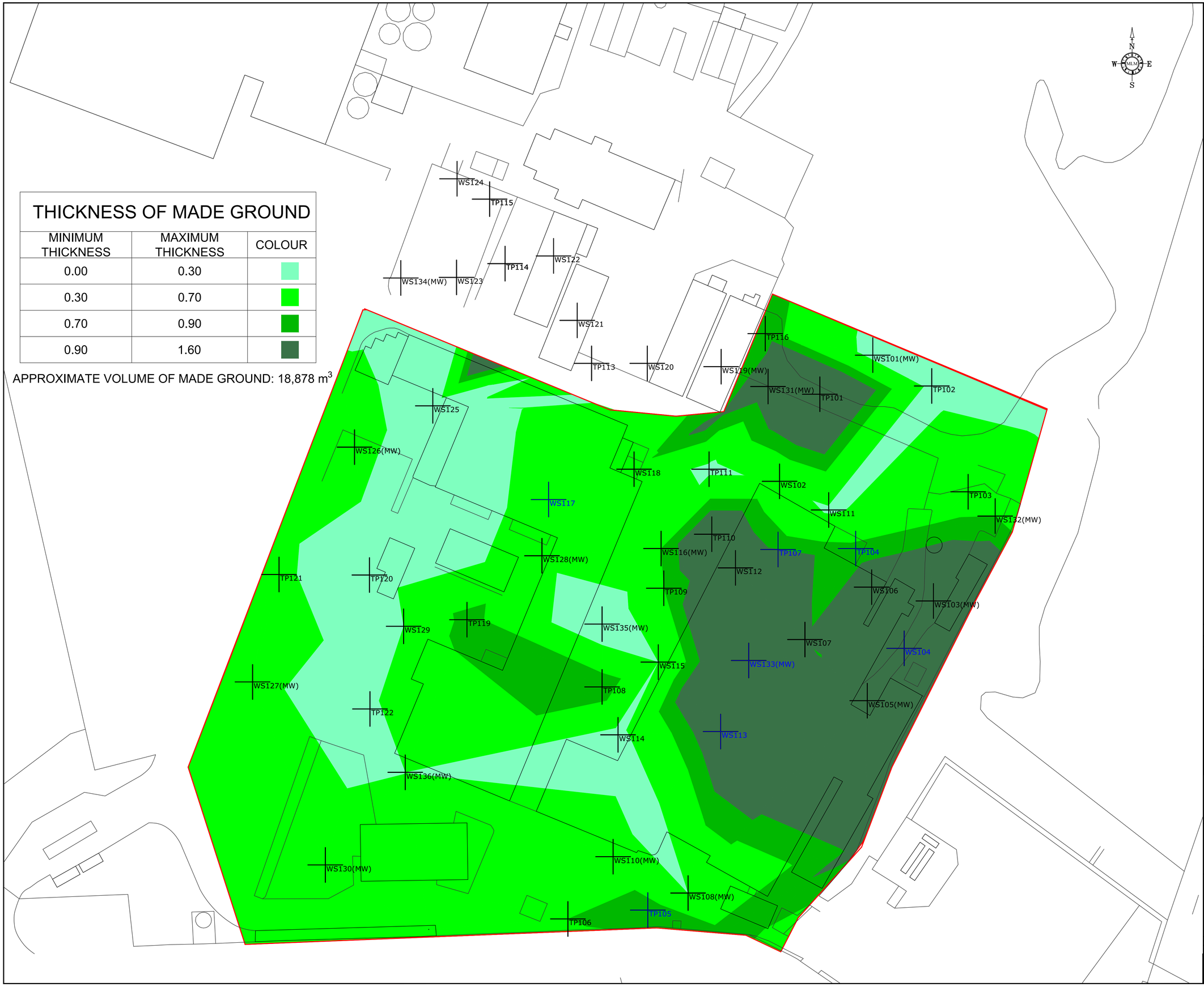
Drawing 7742777-DWG-ENV-002
Cost breakdowns – best case, worst case and landfill disposal of ACMs

Drawing 7742777-DWG-ENV-002



THICKNESS OF MADE GROUND

MINIMUM THICKNESS	MAXIMUM THICKNESS	COLOUR
0.00	0.30	
0.30	0.70	
0.70	0.90	
0.90	1.60	

APPROXIMATE VOLUME OF MADE GROUND: 18,878 m^3

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEER'S, ARCHITECT'S AND SPECIALIST'S DRAWINGS AND THE SPECIFICATION.

2. DO NOT SCALE FROM THIS DRAWING MANUALLY OR ELECTRONICALLY. WRITTEN PERMISSION MUST BE OBTAINED FROM MLM PRIOR TO SCALING ELECTRONICALLY OR USING THIS ELECTRONIC FILE.

3. BASE PLAN TAKEN FROM PDF DRAWING NO. 44470-004-r0 BY RESOURCE AND ENVIRONMENTAL CONSULTANTS LTD.

4. GEOLOGICAL DATA TAKEN FROM RESOURCE AND ENVIRONMENTAL CONSULTANTS LTD LOGS IN REPORT REF. 44470p1r0 DATED OCTOBER 2012.

5. MADE GROUND THICKNESS HAS BEEN EXTENDED TO SITE BOUNDARY USING CLOSEST BOREHOLE/TRIAL PIT INFORMATION TO PROVIDE A MORE ACCURATE REPRESENTATION OF GROUND CONDITIONS.

6. FOR SURFACE CONCRETE THICKNESS AND VOLUME REFER TO DRAWING 774777-DWG-ENV-001.

7. MADE GROUND IS NOT AT TRUE DEPTH IN BOREHOLES MARKED IN BLUE DUE TO REFUSAL OF EXCAVATION.

CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2015

DESIGNER'S HAZARD INFORMATION FOR CONSTRUCTION

1. IF YOU DO NOT FULLY UNDERSTAND THE RISKS INVOLVED DURING THE CONSTRUCTION OF THE ITEMS INDICATED ON THIS DRAWING ASK YOUR MANAGER, HEALTH & SAFETY ADVISOR OR A MEMBER OF THE DESIGN TEAM BEFORE PROCEEDING.

THE ABOVE NOTES REFER SPECIFICALLY TO THE INFORMATION SHOWN ON THIS DRAWING.

REFER TO THE HEALTH AND SAFETY PLAN FOR FURTHER INFORMATION.

Rev	Date	Description	Made	Checked
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Drawing Status: PRELIMINARY

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Website: www.mlm.uk.com

Client: CARTER JONAS LLP

Project: ETERNIT

Drawing Title: GROUND MODEL SHOWING MADE GROUND THICKNESS AND VOLUME

Drawn/Design	ER/AT	Date	JAN 2017	Scales	1:500 @ A1
Checked	JM	Approved	DG	MLM Ref	774777

Drawing No.: 774777-DWG-ENV-002 Rev: .

Cost breakdowns – best case, worst case and landfill disposal of ACMs

774777 - Marley Eternit Site, Meldreth - BEST CASE

Ref	Item	Qty	Unit	Rate, £	Amount, £
1	**Asbestos in Made Ground**				
	Total volume of all made ground in the west	18878	m3		NA
	Average thickness of made ground (= total volume ÷ area)	0.61	m		NA
	Volume of made ground beneath future gardens (100 unit x 100m2 x 0.61m +10%)	6710	m3		NA
	Volume of made ground beneath future softscape/POS (assume 10% of total area x 0.61m +10%)	2080	m3		NA
a	Excavate ACMs in gardens	6710	m3	3.00	20,130
	Length of box cut	320	m		NA
	Depth of box cut	4	m		NA
	Width of box cut	10	m		NA
	Thickness of road construction above ACMs	0.50	m		NA
	Temporary sheet pile wall to support box cut (2 sides 10m deep)	640	m	800.00	512,000
	Excavate box cut	12800	m3	3.00	38,400
	Volume of box cut available to ACM burial (ie. volume below road construction)	11200	m3		NA
	Place and compact ACMs from gardens in box cut (allow 1m road construction on top)	6710	m3	2.00	13,420
	Surplus box cut volume available to ACM burial	4490	m3		NA
	Place and compact natural soil from box cut in gardens	6710	m3	2.00	13,420
	Surplus natural soil	6090	m3		NA
b	Excavate ACMs in softscaping/POS and stockpile	2080	m3	3.00	6,240
	Excavate natural below ACMs in softscape/POS by 2m and stockpile	6200	m3	3.00	18,600
	Place and compact ACMs at reduced level in softscape/POS	2080	m3	2.00	4,160
	Place and compact natural soil from stockpile above ACMs in softscape/POS	6200	m2	2.00	12,400
c	Excavate ACMs beneath buildings/services	6710	m3	3.00	20,130
	Place and compact ACMs from buildings in remaining box cut voidspace	4490	m3	2.00	8,980
	Place and compact surplus (**) natural soil from box cut	6090	m3	2.00	12,180
	Deficit of fill	620	m3		NA
	Import deficit	620	m3	25.00	15,500
	Place and compact surplus of ACM by raising levels in POS	2220	m3	2.00	4,440

	Grade western area	31000	m2	1.00	31,000
2	**Soil Disposal (1m3 = 1.5 tonnes**				
	Inert	0	Te	10.00	0
	Nonhaz	0	Te	25.00	0
	Hydrocarbons	0	Te	50.00	0
	Asbestos	0	Te	140.00	0
3a	**Groundwater Remediation**				
	Free product removal only (6 months)	2300	m2		95,000
	No dissolved phase or soil treatment				
4	**Barrier pipe**				
	Barrier pipe	100	unit	570.00	57,000
5	**Hydrocarbon vapour protection**				
	Membrane	0	unit	2,500.00	0
6	**Clean capping/subsoil**				
	Gardens - 600mm capping not required if natural soil from box cut replaces made ground ACMs	0	unit	1,500.00	0
	Softscaping - 450mm capping not required as natural soil from excavation placed back on top	0	m2	11.25	0
	Topsoil				Excl.
7	**Remediation Verification**				
	Engineer	50	visit	350.00	17,500
	Testing hydrocarbons	500	nr	35.00	17,500
	Asbestos	500	nr	20.00	10,000
	Testing gardens/softscaping	500	nr	60.00	30,000
	Report		sum		20,000
8	**Contractor role**				
	Supervision and management	7	wk	3,000.00	21,000
	H&S Plan		sum		1,500
	Environmental protection/monitoring (asbestos)		sum		50,000
	Mobilisation		sum		5,000
	Wheel wash		sum		7,000

9	**<u>Abstraction Wells</u>**				
	Decommissoning abstraction wells	2	nr	6,000.00	12,000
	SUB-TOTAL				1,074,501
	Contingency, 5%				53,725
	TOTAL				**1,128,226**

774777 - Marley Eternit Site, Meldreth - WORSE CASE

Ref	Item	Qty	Unit	Rate, £	Amount, £
1	**Asbestos in Made Ground**				
	Total volume of all made ground in the west	18878	m3		NA
	Average thickness of made ground (= total volume ÷ area)	0.61	m		NA
	Volume of made ground beneath future gardens (100 unit x 100m2 x 0.61m +10%)	6710	m3		NA
	Volume of made ground beneath future softscape/POS (assume 10% of total area x 0.61m +10%)	2080	m3		NA
a	Excavate ACMs in gardens	6710	m3	3.00	20,130
	Length of box cut	320	m		NA
	Depth of box cut	4	m		NA
	Width of box cut	10	m		NA
	Thickness of road construction above ACMs	0.50	m		NA
	Temporary sheet pile wall to support box cut (2 sides 10m deep)	640	m	800.00	512,000
	Excavate box cut	12800	m3	3.00	38,400
	Volume of box cut available to ACM burial (ie. volume below road construction)	11200	m3		NA
	Place and compact ACMs from gardens in box cut (allow 1m road construction on top)	6710	m3	2.00	13,420
	Surplus box cut volume available to ACM burial	4490	m3		NA
	Place and compact natural soil from box cut in gardens	6710	m3	2.00	13,420
	Surplus natural soil	6090	m3		NA
b	Excavate ACMs in softscaping/POS and stockpile	2080	m3	3.00	6,240
	Excavate natural below ACMs in softscape/POS by 2m and stockpile	6200	m3	3.00	18,600
	Place and compact ACMs at reduced level in softscape/POS	2080	m3	2.00	4,160
	Place and compact natural soil from stockpile above ACMs in softscape/POS	6200	m2	2.00	12,400
c	Excavate ACMs beneath buildings/services	6710	m3	3.00	20,130
	Place and compact ACMs from buildings in remaining box cut voidspace	4490	m3	2.00	8,980
	Place and compact surplus (**) natural soil from box cut	6090	m3	2.00	12,180
	Deficit of fill	620	m3		NA
	Import deficit	620	m3	25.00	15,500
	Place and compact surplus of ACM by raising levels in POS	2220	m3	2.00	4,440

	Grade western area	31000	m2	1.00	31,000
2	**Soil Disposal (1m3 = 1.5 tonnes**				
	Inert	0	Te	10.00	0
	Nonhaz	0	Te	25.00	0
	Hydrocarbons	0	Te	50.00	0
	Asbestos	0	Te	140.00	0
3a	**Groundwater Remediation**				
	Free product removal only (12 months)	11000	m2		645,000
	No dissolved phase or soil treatment				
4	**Barrier pipe**				
	Barrier pipe	150	unit	570.00	85,500
5	**Hydrocarbon vapour protection**				
	Membrane	100	unit	2,500.00	250,000
6	**Clean capping/subsoil**				
	Gardens - 600mm capping required in the east	50	unit	1,500.00	75,000
	Softscaping - 450mm capping in the east	3100	m2	11.25	34,875
	Topsoil				Excl.
7	**Remediation Verification**				
	Engineer	50	visit	350.00	17,500
	Testing hydrocarbons	500	nr	35.00	17,500
	Asbestos	500	nr	20.00	10,000
	Testing gardens/softscaping	500	nr	60.00	30,000
	Report		sum		20,000
8	**Contractor role**				
	Supervision and management	7	wk	3,000.00	21,000
	H&S Plan		sum		1,500
	Environmental protection/monitoring (asbestos)		sum		50,000
	Mobilisation		sum		5,000
	Wheel wash		sum		7,000

9	**Abstraction Wells**				
	Decommissoning abstraction wells	2	nr	8,000.00	16,000
	SUB-TOTAL				2,016,876
	Contingency, 5%				100,844
	TOTAL				**2,117,719**

774777 - Marley Eternit Site, Meldreth - ACMs TO LANDFILL

Ref	Item	Qty	Unit	Rate, £	Amount, £
1	**Asbestos in Made Ground**				
	Total volume of all made ground in the west	18878	m3		NA
	Average thickness of made ground (= total volume ÷ area)	0.61	m		NA
	Volume of made ground beneath future gardens (100 unit x 100m2 x 0.61m +10%)	6710	m3		NA
	Volume of made ground beneath future softscape/POS (assume 10% of total area x 0.61m +10%)	2080	m3		NA
a	Excavate ACMs in gardens ACMs contaminated with hydrocarbons and cannot be buried on site	6710	m3	3.00	20,130
b	Excavate ACMs in softscaping/POS ACMs contaminated with hydrocarbons and cannot be buried on site	2080	m3	3.00	6,240
c	Excavate ACMs beneath buildings/services ACMs contaminated with hydrocarbons and cannot be buried on site	6710	m3	3.00	20,130
	Grade western area	31000	m2	1.00	31,000
2	**Soil Disposal (1m3 = 1.5 tonnes**				
	Inert	0	Te	10.00	0
	Nonhaz	0	Te	25.00	0
	Hydrocarbons	0	Te	50.00	0
	Asbestos	23250	Te	140.00	3,255,021
3a	**Groundwater Remediation**				
	Free product removal only (12 months) No dissolved phase or soil treatment	11000	m2		645,000

4	**Barrier pipe**				
	Barrier pipe	150	unit	570.00	85,500
5	**Hydrocarbon vapour protection**				
	Membrane	100	unit	2,500.00	250,000
6	**Clean capping/subsoil/fill**				
	Gardens - 600mm capping required in the east	50	unit	1,500.00	75,000
	Softscaping - 450mm capping in the east	3100	m2	11.25	34,875
	Upfill areas where ACMs removed	15500	m3	25.00	387,503
	Topsoil				Excl.
7	**Remediation Verification**				
	Engineer	50	visit	350.00	17,500
	Testing hydrocarbons	500	nr	35.00	17,500
	Asbestos	500	nr	20.00	10,000
	Testing gardens/softscaping	500	nr	60.00	30,000
	Report		sum		20,000
8	**Contractor role**				
	Supervision and management	7	wk	3,000.00	21,000
	H&S Plan		sum		1,500
	Environmental protection/monitoring (asbestos)		sum		50,000
	Mobilisation		sum		5,000
	Wheel wash		sum		7,000
9	**Abstraction Wells**				
	Decommissoning abstraction wells	2	nr	6,000.00	12,000
	SUB-TOTAL				4,981,769
	Contingency, 5%				249,088
	TOTAL				**5,230,857**