

Appendix F

Budget cost assessments

Appendix F - Assessment of budget remediation costs

Remedial task A - Gas works

Budget remedial costs					
Dimensions - from 'Footprints' tab				Dimensions based on:	Groundwater pump and treat ¹ (lump sum)
L	W	D	Volume		
40	30	3	3600	Footprints' tab	250,000.00
Excavation					
Rate ²			Extension		
10.00			36,000.00		
%age inert and non-haz			50%		%age haz
Haulage, tax and disposal - non haz and inert			Haulage, tax and disposal - haz		Haz/non-haz split based on presence of a range of contaminants of concern including hydrocarbons
Rate ²			Extension		
40.00			72,000.00		
sum			25,000.00		
			for licensing and permits		
Reinstatement					
Rate ²			Extension		
15.00			54,000.00		
Ex-situ stabilisation ³					
Rate			Extension		
100.00			360,000.00		
sum			40,000.00		for trials, licensing and permits ⁵
Impermeable cover ⁴					
Rate			Extension		
5.00			7,200.00		
No further action (beyond risk assessment)					
0.00					
Validation costs - consultants costs, sampling, analysis and interpretation					
Assume as a proportion of cost of disposal			88200		10.0%

Summary ⁶			Prelims	Contingency	Total
1	Excavation, disposal, validation and reinstatement	1,335,200.00	467,320.00	133,520.00	1,936,040.00
2	Ex-situ stabilisation and validation	738,200.00	258,370.00	73,820.00	1,070,390.00
3	Impermeable cover	7,200.00	2,520.00	720.00	10,440.00
4	Do nothing	0	0	0	0.00

prelims =	35.0%
contingency =	10.0%

Notes	
1	Meeting of 25 Jul 23. ATG indicated £500,000 for pump and treat. Cost assessment assumes P&T needed only for gas works and carriage shed. Therefore, costs split between these two.
2	The unit rates used to undertake this remedial options appraisal have been determined after extensive consultation with BAM Nuttall Limited and their supply chain. In addition, appropriate unit rates from other relevant projects have been considered. The unit rates and associated costs that have been used are therefore, considered to be appropriately robust for the purpose of this cost-benefit assessment. These rates and costs should not however, be used for any other purpose. Arup can accept no liability for any subsequent changes in relevant costs or unit rates arising from changes in legislation, guidance or industry practice.
3	Meeting of 25 Jul 23. ATG indicated £160/cu m ex-situ stabilisation for PFAS only, treated and placed. After consultation with BAM QS and review of other PFAS project, £100/cu m used
4	Treatment area for impermeable cover based on remediation footprint x 120%
5	Excludes excavation for earthworks area 3
6	Assumes £125,000 for trials licensing and permits, with costs shared between the gas works, TP422/TP423, carriage shed and TP405A remediation

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Remedial task B - TP422/TP423

Budget remedial costs					
Dimensions - from 'Footprints' tab				Dimensions based on:	Groundwater pump and treat ¹ (lump sum)
L	W	D	Volume		
70	40	3	8400	Footprints' tab - further trial pits to be completed to refine extent of hotpost	Not required

Excavation			
Rate ²		Extension	
10.00		84,000.00	

%age inert and non-haz	90%	%age haz	10%	Haz/non-haz split based on principal CoC being PFAS
Haulage, tax and disposal - non haz and inert		Haulage, tax and disposal - haz		
Rate ²		Rate ²		
40.00		450.00		
sum		25,000.00		
		for licensing and permits		

Reinstatement	
Rate ²	Extension
15.00	126,000.00

Ex-situ stabilisation ³	
Rate	Extension
100.00	840,000.00
sum	40,000.00
for trials, licensing and permits ³	

Impermeable cover ⁵	
Rate	Extension
5.00	16,800.00

No further action (beyond risk assessment)	
0.00	

Validation costs - consultants costs, sampling, analysis and interpretation	
Assume as a proportion of cost of disposal	68040
	10.0%

Summary ⁵		Prelims	Contingency	Total
1	Excavation, disposal, validation and reinstatement	983,440.00	344,204.00	98,344.00
2	Ex-situ stabilisation and validation	948,040.00	331,814.00	94,804.00
3	Impermeable cover	16,800.00	5,880.00	1,680.00
4	Do nothing	0	0.00	0.00

prelims =	35.0%
contingency =	10.0%

Notes	
1	Meeting of 25 Jul 23. ATG indicated £500,000 for pump and treat. Cost assessment assumes P&T needed only for gas works and carriage shed. Therefore, costs split between these two.
2	The unit rates used to undertake this remedial options appraisal have been determined after extensive consultation with BAM Nuttall Limited and their supply chain. In addition, appropriate unit rates from other relevant projects have been considered. The unit rates and associated costs that have been used are therefore, considered to be appropriately robust for the purpose of this cost-benefit assessment. These rates and costs should not however, be used for any other purpose. Arup can accept no liability for any subsequent changes in relevant costs or unit rates arising from changes in legislation, guidance or industry practice.
3	Meeting of 25 Jul 23. ATG indicated £160/cu m ex-situ stabilisation for PFAS only, treated and placed. After consultation with BAM QS and review of other PFAS project, £100/cu m used
4	Treatment area for impermeable cover based on remediation footprint x 120%
5	Excludes excavation for earthworks area 3
6	Assumes £120,000 for trials licensing and permits, with costs shared between the gas works, TP422/TP423, carriage shed and TP405A remediation

Remedial task C - Carriage shed

prelims =	35.0%
contingency =	10.0%

Notes		
1	Meeting of 25 Jul 23. ATG indicated £500,000 for pump and treat. Cost assessment assumes P&T needed only for gas works and carriage shed. Therefore, costs split between these two.	
2	The unit rates used to undertake this remedial options appraisal have been determined after extensive consultation with BAM Nuttall Limited and their supply chain. In addition, appropriate unit rates from other relevant projects have been considered. The unit rates and associated costs that have been used are therefore, considered to be appropriately robust for the purpose of this cost-benefit assessment. These rates and costs should not however, be used for any other purpose. Arup accept no liability for any subsequent changes in relevant costs or unit rates arising from changes in legislation, guidance or industry practice.	
3	Meeting of 25 Jul 23. ATG indicated £160/cu m ex-situ stabilisation for PFAS only, treated and placed. After consultation with BAM QS and review of other PFAS project, £100/cu m used	
4	Treatment area for impermeable cover based on remediation footprint x 120%	
5	Excludes excavation for earthworks area 3	
6	Assumes £120,000 for trials licensing and permits, with costs shared between the gas works, TP422/TP423, carriage shed and TP405A remediation	

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Remedial task D - TP405A

Budget remedial costs					
Dimensions - from 'Footprints' tab				Dimensions based on:	Groundwater pump and treat ¹ (lump sum)
L	W	D	Volume		
15	10	1	150	Footprints' tab	Not required
Excavation					
Rate ²		Extension			
10.00		1,500.00			
%age inert and non-haz		90%		%age haz	10%
Haulage, tax and disposal - non haz and inert				Haulage, tax and disposal - haz	
Rate ²		Extension		Rate ²	
40.00		5,400.00		450.00	
sum		25,000.00		6,750.00	
for licensing and permits					
Reinstatement					
Rate ²		Extension			
15.00		2,250.00			
Ex-situ stabilisation ³					
Rate		Extension			
100.00		15,000.00			
sum		5,000.00		for trials, licensing and permits ⁶	
Impermeable cover ⁵					
Rate		Extension			
5.00		900.00			
No further action (beyond risk assessment)					
0.00					
Validation costs - consultants costs, sampling, analysis and interpretation					
Assume as a proportion of cost of disposal		inc elsewhere		incl	

Summary ⁵			Prelims	Contingency	Total
1	Excavation, disposal, validation and reinstatement	40,900.00	14,315.00	4,090.00	59,305.00
2	Ex-situ stabilisation and validation	20,000.00	7,000.00	2,000.00	29,000.00
3	Impermeable cover	900.00	315.00	90.00	1,305.00
4	Do nothing	0.00	0.00	0.00	0.00

prelims =	35.0%
contingency =	10.0%

Notes		
1	Meeting of 25 Jul 23. ATG indicated £500,000 for pump and treat. Cost assessment assumes P&T needed only for gas works and carriage shed. Therefore, costs split between these two.	
2	The unit rates used to undertake this remedial options appraisal have been determined after extensive consultation with BAM Nuttall Limited and their supply chain. In addition, appropriate unit rates from other relevant projects have been considered. The unit rates and associated costs that have been used are therefore, considered to be appropriately robust for the purpose of this cost-benefit assessment. These rates and costs should not however, be used for any other purpose. Arup can accept no liability for any subsequent changes in relevant costs or unit rates arising from changes in legislation, guidance or industry practice.	
3	Meeting of 25 Jul 23. ATG indicated £160/cu m ex-situ stabilisation for PFAS only, treated and placed. After consultation with BAM QS and review of other PFAS project, £100/cu m used	
4	Treatment area for impermeable cover based on remediation footprint x 120%	
5	Excludes excavation for earthworks area 3	
6	Assumes £120,000 for trials licensing and permits, with costs shared between the gas works, TP422/TP423, carriage shed and TP405A remediation	

Appendix F - Assessment of budget remediation costs

Remedial task E - Residual PFAS

Budget remedial costs						
Area	D ⁷	Volume	Dimensions based on:	Groundwater pump and treat ¹ (lump sum)		
56000	6	336000	Google Earth	500,000.00		
Excavation						
Rate ²		Extension				
10.00		3,360,000.00				
%age inert and non-haz		90%		Haz/non-haz split based on principal CoC being PFAS, supported by findings of GIR		
Haulage, tax and disposal - non haz and inert		Haulage, tax and disposal - haz				
Rate ²		Extension				
40.00		12,096,000.00				
sum		25,000.00				
%age haz		10%		for licensing and permits		
Haulage, tax and disposal - haz		Haulage, tax and disposal - haz				
Rate ²		Extension				
450.00		15,120,000.00				
sum						
Reinstatement						
Rate ²		Extension				
15.00		Not required for excavation and disposal option				
Ex-situ stabilisation ³						
Rate		Extension				
100.00		33,600,000.00				
sum		125,000.00				
Impermeable cover ⁴						
Rate		Extension				
5.00		280,000.00				
Sum		500,000.00				
Permeable reactive barrier ⁵						
Rate		Extension				
3,350.00		2,010,000.00		600 m long		
5%		1,005,000.00		10 years		
sum		195,000.00				
No further action (beyond risk assessment)						
		0.00				
Validation costs - consultants costs, sampling, analysis and interpretation						
Assume as a proportion of cost of disposal		2721600		10.0%		
Summary ⁶						
		Prelims		Contingency	Total	
1	Excavation, disposal, validation and reinstatement		33,822,600.00	11,837,910.00	3,382,260.00	49,042,770.00
2	Ex-situ stabilisation and validation		36,946,600.00	12,931,310.00	3,694,660.00	53,572,570.00
3	Impermeable cover		780,000.00	273,000.00	78,000.00	1,131,000.00
4	Permeable reactive barrier		3,210,000.00	1,123,500.00	321,000.00	4,654,500.00
5	Do nothing		0.00	0.00	0.00	0.00

prelims = contingency =

prelims =	35.0%
contingency =	10.0%

Notes	
1	Meeting of 25 Jul 23. ATG indicated £500,000 for pump and treat. Cost assessment assumes P&T needed only for gas works and carriage shed.
2	The unit rates used to undertake this remedial options appraisal have been determined after extensive consultation with BAM Nuttall Limited and their supply chain. In addition, appropriate unit rates from other relevant projects have been considered. The unit rates and associated costs that have been used are therefore, considered to be appropriately robust for the purpose of this cost-benefit assessment. These rates and costs should not however, be used for any other purpose. Arup can accept no liability for any subsequent changes in relevant costs or unit rates arising from changes in legislation, guidance or industry practice.
3	Meeting of 25 Jul 23. ATG indicated £160/cu m ex-situ stabilisation for PFAS only, treated and placed. After consultation with BAM QS and review of other PFAS project, £100/cu m used
4	Treatment area for impermeable cover based on remediation footprint x 120%
5	PRB cost based on meeting with ATG 25 Jul 23. 600m long, 3m reactive zone £2M = £3350/lin m
6	Excludes excavation for earthworks area 3
7	By eye based on cross sections in Arup GIR

Appendix F - Assessment of budget remediation costs

Remedial options viability/cost matrix

Where remediation is considered viable, budget costs are provided.

Remedial task	Remedial option 1a - Excavation, disposal and reinstatement ¹	Remedial option 1b - Excavation and disposal ²	Remedial option 2 -Ex situ stabilisation ³	Remedial option 3 Impermeable cover	Remedial option 4 Permeable Reactive Barrier ⁴	Remedial option 5 - No further action
A Gas works	£2,000,000	Not applicable	£1,100,000	Not applicable	Not required	Not viable risks to human health and controlled waters have been identified
B TP422/TP423	£1,500,000	Not applicable	£1,400,000	Not applicable	Not required	
C Carriage shed	£2,000,000	Not applicable	£2,200,000	Not applicable	Not required	
D TP405A	£60,000	Not applicable	£30,000	Not applicable	Not required	May be viable subject to further assessment during earthworks
E Residual PFAS	Not viable	£50,000,000	£53,000,000	£1,200,000	£4,700,000	Viable based on findings of Arup indicative PFAS model

Notes

- 1 Includes: dewatering if required, excavation, haulage and disposal, reinstatement and validation.
- 2 Includes: dewatering if required, excavation, haulage and disposal and validation. This has only been considered for the case in which all made ground is removed.
- 3 Includes: dewatering if required, excavation, stabilisation, reinstatement and validation.
- 4 Includes: closely-spaced CFA boreholes along 600m alignment, with 3m reactive zone in each.

The unit rates used to undertake this remedial options appraisal have been determined after extensive consultation with BAM Nuttall Limited and their supply chain. In addition, appropriate unit rates from other relevant projects have been considered. The unit rates and associated costs that have been used are therefore, considered to be appropriately robust for the purpose of this cost-benefit assessment. These rates and costs should not, however, be used for any other purpose.
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Disposal rates

From BAM Verbally £450/cu m

By email	Inert off site (17-05-04)	£240.00	Load
	Non-Hazardous off site (17-05-04)	£280.00	Load
	Hazardous off site due to TPH/PAH (17-05-03*) (min. 19t	£30.00 p/tonne + £300.00 p/load	As stated
	Hazardous off site due to metals (17-05-03*) (min. 19t charge)	£147.00 p/tonne + £650.00 p/load	As stated
	Hazardous off site due to asbestos (17-05-03*) (min. 19t	£167.00 p/tonne + £650.00 p/load	As stated
	Fly tipped waste off site (20-03-01) (min. 3t charge)	£190.00 p/tonne + £150.00 p/load	As stated
	Soils cont. less than 5% Japanese Knotweed off site (17-05-04)	£550.00	Load
	Non-Hazardous screened soils off site (17-05-04)	£280.00	Load
	Soils cont. Trichloroethene (17-05-03*) (min. 19t charge)	£30.00 p/tonne + £300.00 p/load	As stated

CDR comments	Load =	Column F converted to cu m		Plus charge per load	Charge per cu m
N/A - per load	8 cu m	-	-	-	£30.00
N/A - per load		-	-	-	£35.00
	Density =	66	£/cu m	828	103.5
	2.2 t/cu m	323.4	£/cu m	3237.2	404.65
		367.4	£/cu m	3589.2	448.65
		418	£/cu m	3494	436.75
N/A - per load					£68.75
N/A - per load					£35.00
		66	£/cu m	828	103.5
				Mean haz	£430.02

The unit rates used to undertake this remedial options appraisal have been determined after extensive consultation with BAM Nuttall Limited and their supply chain. In addition, appropriate unit rates from other relevant projects have been considered. The unit rates and associated costs that have been used are therefore, considered to be appropriately robust for the purpose of this cost-benefit assessment. These rates and costs should not however, be used for any other purpose. Arup can accept no liability for any subsequent changes in relevant costs or unit rates arising from changes in legislation, guidance or industry practice.

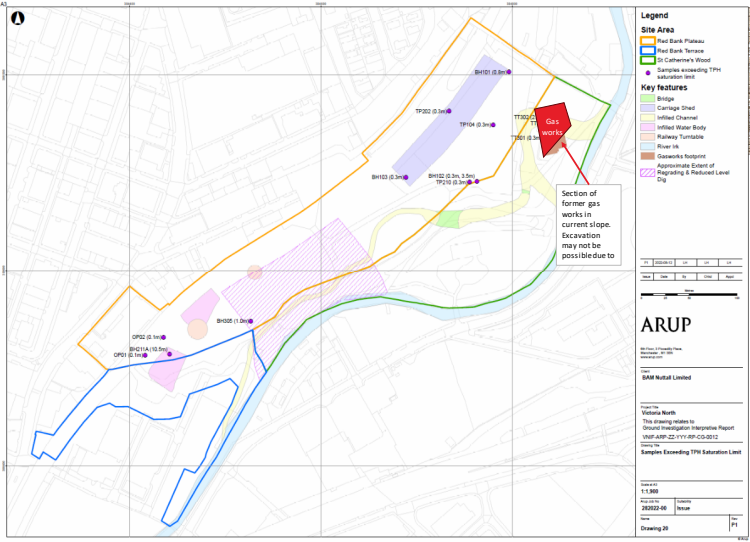
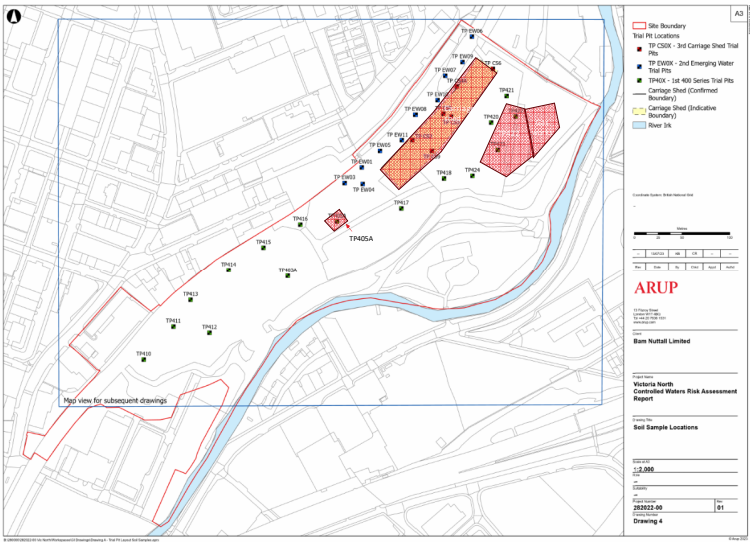
Appendix F - Assessment of budget remediation costs

Pre-remediation trials and other costs

From other job

				Comments
1	Large scale lab trials on 3 alternative options to inform field trial	£	65000	Need to include as part of stabilisation costs
2	Soil Stabilisation / Solidification	£	35000	Need to include as part of stabilisation costs
3	Permitting and licences	£	25000	Need to include in all options
4	PRB - pilot field trial	£	170000	Need to include as part of PRB costs - 10 lin m
5	Validation testing	£	25000	sampling and analysis only
6	Excavate and stabilise impacted soil	£	100 /cu m	Compares with £160/cu m from ATG
7	Backfill stabilised soil	£	3 /cu m	Compares with £15/cu m uplifted from BAM rates
8	Full-scale dewatering	£	550000	Compares with £500000 from ATG
9	PRB - full scale works - injection BHs not trench	£	1700000	Compares with £3M from ATG rates but costs for V North are for 600 lin m - other site is 150 lin m
10	Total for works quoted for other site	£	8500000	Works are broader in scope than V North but this baseline used to determine prelims and a %age (see below)
11	Prelims (site accommodation, staff costs, mobilisation, legals and insurance etc)	£	2000000	
12	Prelims as a %age of construction costs		23.5%	
13	Total for remediation works quoted for other site	£	3300000	
14	Prelims	£	1200000	
15	Prelims as a %age of remediation costs		36.4%	
16	Temp SW drainage for impermeable layer (residual PFAS only)	£	500000	Other site is c. 100,000sq m - price for Sw drainage was £1M. Prorata for area of V North plateau (50,000 sq m)

Incl in stabilisation costs	£	125000
Incl in PRB costs		195000
Incl %age for prelims		35.0%
Inc contingency		10.0%



Dims take off (m)	
Gas works	30 W 50 L1 25 L2 37.5 L
TP422	40 W 70 L
CS	25 W1 30 W2 27.5 W 150 L
TP405A	10 L 15 W
TP410	10 L 15 W

For residual remediation option only



Area at top of plateau	47789 Dan Kinely BAM email 7 Aug @ 8:42
Area at base of plateau	63400 G Earth (left)
Mean area	55594.5

use 56000 sq m