

EGEND

- APPLICATION BOUNDARY
- EXISTING TREES / VEGETATION

softworks

- | | |
|---|---------------------------|
|  | PROPOSED TREE PLANTING |
|  | ORNAMENTAL HEDGE PLANTING |
|  | NATIVE HEDGE PLANTING |
|  | ORNAMENTAL SHRUB PLANTING |
|  | THICKET MIX |
|  | SPECIMEN SHRUB PLANTING |
|  | AMENITY GRASS |
|  | WILDFLOWER MEADOW |

hardworks

-  **BITUMINOUS MACADAM SURFACE**
 -  **BLOCK PAVING**
 -  **CONCRETE PAVING SLABS**
 -  **FINE HOGGIN SURFACE**
 -  **WOODEN DECKING**
 -  **ESTATE RAILING** -
1200mm high steel estate railing in black.
 -  **CLOSE-BOARD FENCING** -
1900mm high close-boarded timber fence,
(min.1.5yr life span)

Street Furniture

-  **TIMBER BENCH**
 -  **TIMBER PERGOLA**
 -  **BOLLARD LIGHTING**

5 Public Footpath Improvement

The public footpath connecting Ford Road to the River Arun footpath will be upgraded as part of the application, with a new Hoggin surface and timber edging providing durable year round access to the river.



② Communal Courtyards

Each of the apartments blocks will be served by a high quality communal courtyard. Both courtyards will make use of their south facing aspect and provide an attractive rest area for the new residents. Seating areas, set within attractive planted surroundings will be lit with low level lighting to provide year enjoyment. A combination of colourful herbaceous and structural shrub planting will also surround private amenity lawn areas.



3 Soft Landscaping: Indicative Planting Schedule

A variety of planting across the Site will achieve a high quality landscape design and help to integrate the new development into the existing landscape framework. The proposed planting will reflect the character of the area and provide an attractive place to live. Formal, ornamental planting will be used within the communal open space, with more native species introduced within the car parking area and on the entrance to the Site. New tree, shrub planting and landscaping along the boundaries will help filter potential views of the new housing from the surrounding area. These areas will provide ecological benefits as well as creating an attractive landscape. Proposed planting will be easily maintained and compliment the setting of the new residential development.

Below is a suggested planting list for the soft landscaping:

Latin Name	Common Name
Tree Planting	
Betula pendula	Silver Birch
Prunus avium 'Plena'	Double Gean
Hedge Planting	
Fagus sylvatica	Common Beech
Native Hedgerow Mix	
Acer campestre	Hedge Maple
Corylus avellana	Hazelnut
Crataegus monogyna	Hawthorn
Carpinus betulus	Hornbeam
Euonymus europaeus	Common Spindle
Ilex aquifolium	Holly
Malus sylvestris	Crab Apple
Prunus spinosa	Blackthorn
Rhamnus cathartica	Buckthorn
Viburnum lantana	Wayfarer
Viburnum opulus	Gelder Rose
Shrubs	
Choisya ternata 'Sundance'	Mexican Orange
Hebe 'Midsummer Beauty'	Shrubby Veronica
Lavandula angustifolia 'Hidcote'	English Lavender 'Hidcote'
Mahonia media 'Winter Sun'	Oregon Grape 'Winter Sun'
Rosmarinus officinalis 'Miss Jessop's Upright'	Rosemary 'Miss Jessopp's Upright'
Herbaceous	
Geranium macrorrhizum 'White Ness'	Cranesbill 'White-Ness'
Rudbeckia fulgida 'Goldsturm'	Coneflower 'Goldsturm'
Verbena bonariensis	Argentinian Vervain
Stachys byzantina	Lamb's Ear
Specimen Shrubs/Grasses	
Phormium tenax	New Zealand Flax
Ilex crenata 'Dark Green'	Box-leaved Holly
Calamagrostis 'Overdam'	Feather Reed-grass 'Overdam'



D	03/06/19	JB	Updated drainage
C	24/05/19	BS	Updated to architects layout
B	21/05/19	BS	Minor amendments to layout
A	10/04/19	SS	Comments from client
Rev	Date	By	Description

CSA
environmental

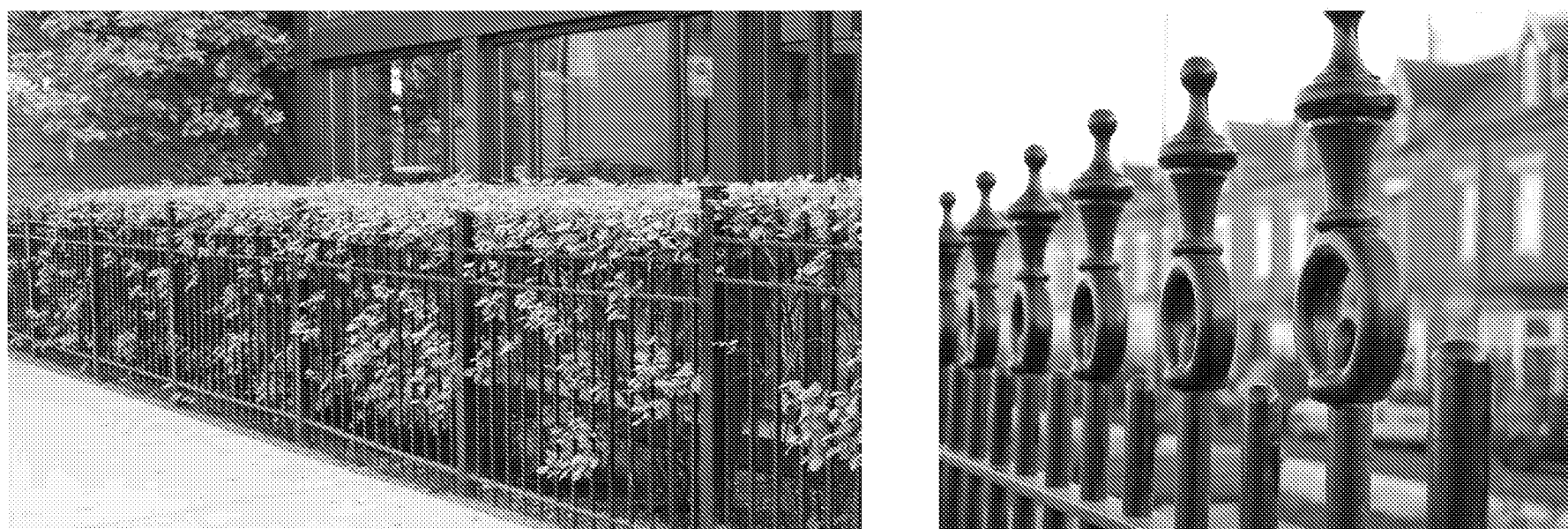
Dixies Barns, High Street,
Ashwell, Hertfordshire SG7 5NT

t 01462 743647
e ashwell@csaenvironmental.co.uk
w csaenvironmental.co.uk

Title	Landscape Strategy Plan		
Client	Oakford Homes		
Scale	1:200 @ A0	Drawn	SS
Date	April 2019	Checked	BS
Drawings File	CSA/4163/104	Rev	0

1 Ford Road Boundary Treatment and Public Art

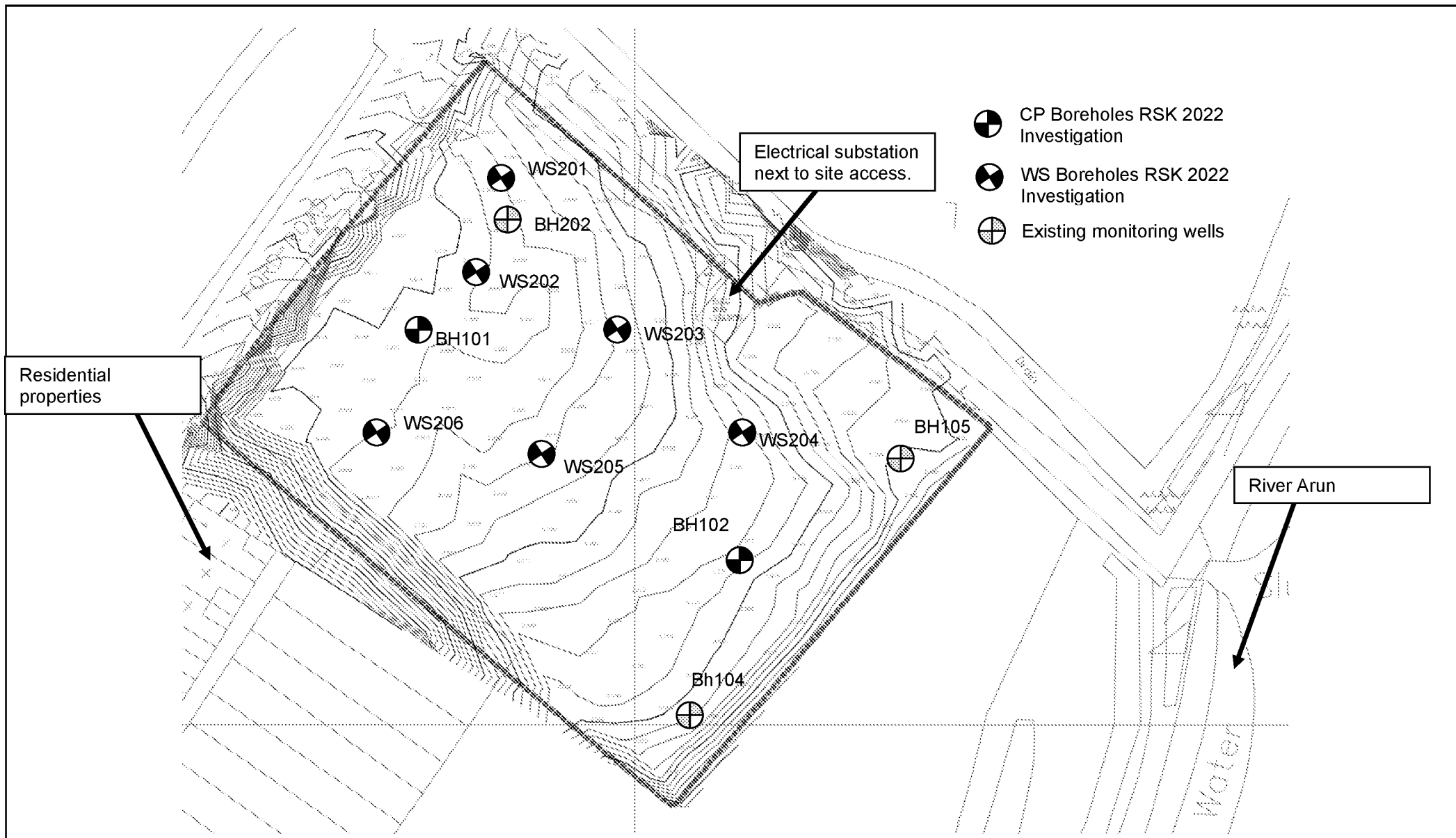
The boundary fronting Ford Road will comprise black metal railings and a new native Beech hedgerow, to match the adjacent cemetery boundary. The railings will be 1.2m in height, with the potential to incorporate public art at the detailed design stage. The building will be set back from Ford Road in line with the pattern of adjacent properties.



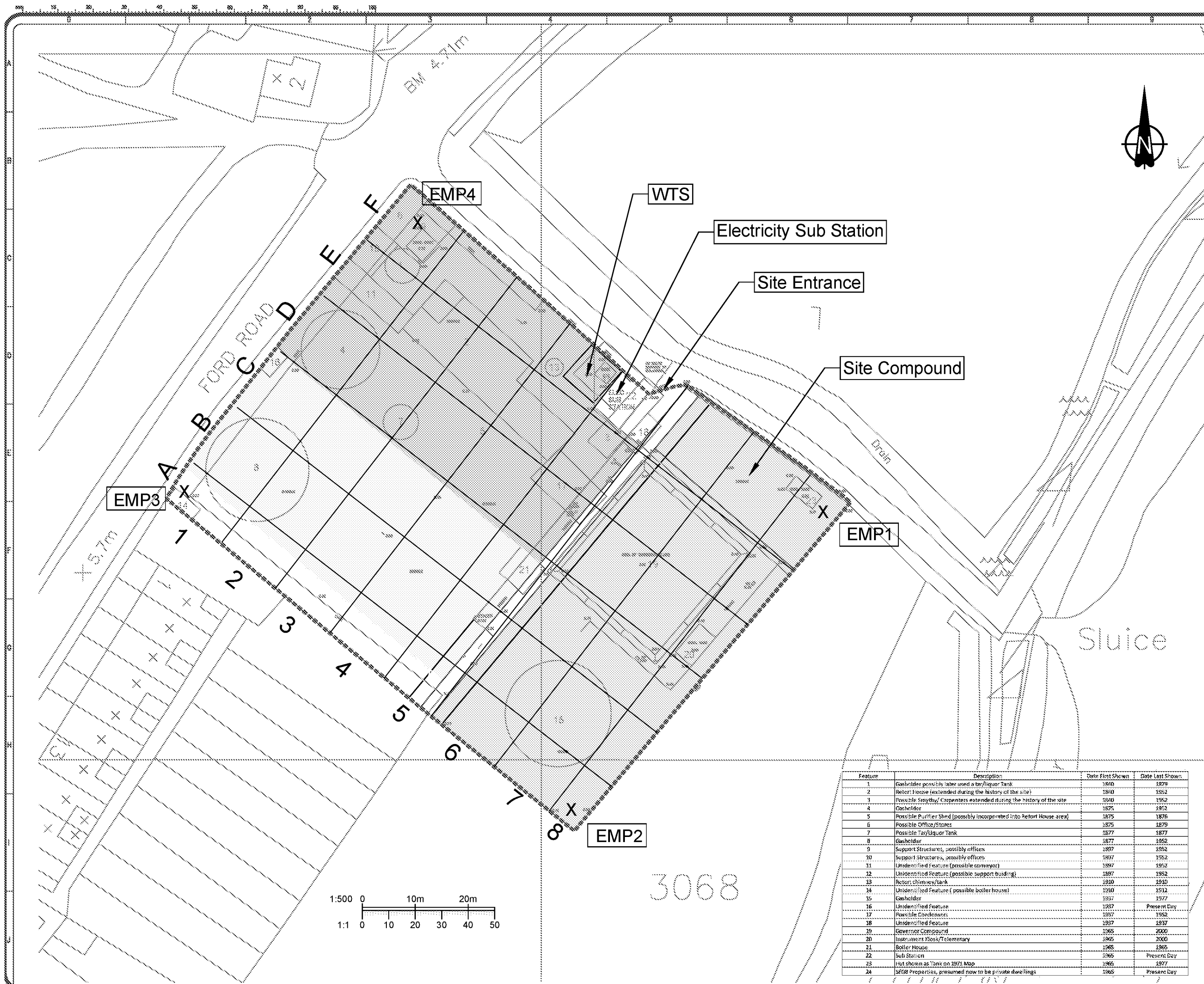
④ Car Parking

The parking area will be broken up with areas of ornamental shrub planting and a row of trees, softening the space. Low level bollard lighting to aid navigation towards the building entrances. High quality block paving will be used throughout the parking area.





	Site Layout / Exploratory Hole Location Plan	Client: Oakford Homes	Figure No: 2
		Site: Arundel Gas Works	Job No: 29780
		Scale: N.T.S	Source: N/A



- Legend**
- National Grid Property Holdings Site Boundary
 - [Hatched Box] Site Compound
 - [Square Box] Water Treatment System
 - [Light Grey Box] Area 1
 - [White Box] Area 2
 - [Medium Grey Box] Area 3
 - [Dark Grey Box] Area 4
 - [Dashed Line Box] Surface Water Easement
 - [Diamond Box] Historical Features
 - X Environmental Monitoring Point Locations (EMP)

0 First Issue08.09.21

REV / COMMENTDATE

Columbus House
Village Way
Cardiff
CF15 7NE
029 2036 8636

enquiries@celtic-ld.com
www.celtic-ld.com

Client

Project

Arundel Gas Works
Ford Road, Arundel

Title

Remedial Areas with Grid

Drawn by
JS

Checked
SG

Date
08.09.21

Authorised
Date

Original Scale
1:500

Date
08.09.21

Rev
0

Paper
A3

Drawing Number

D1820/5011/A4

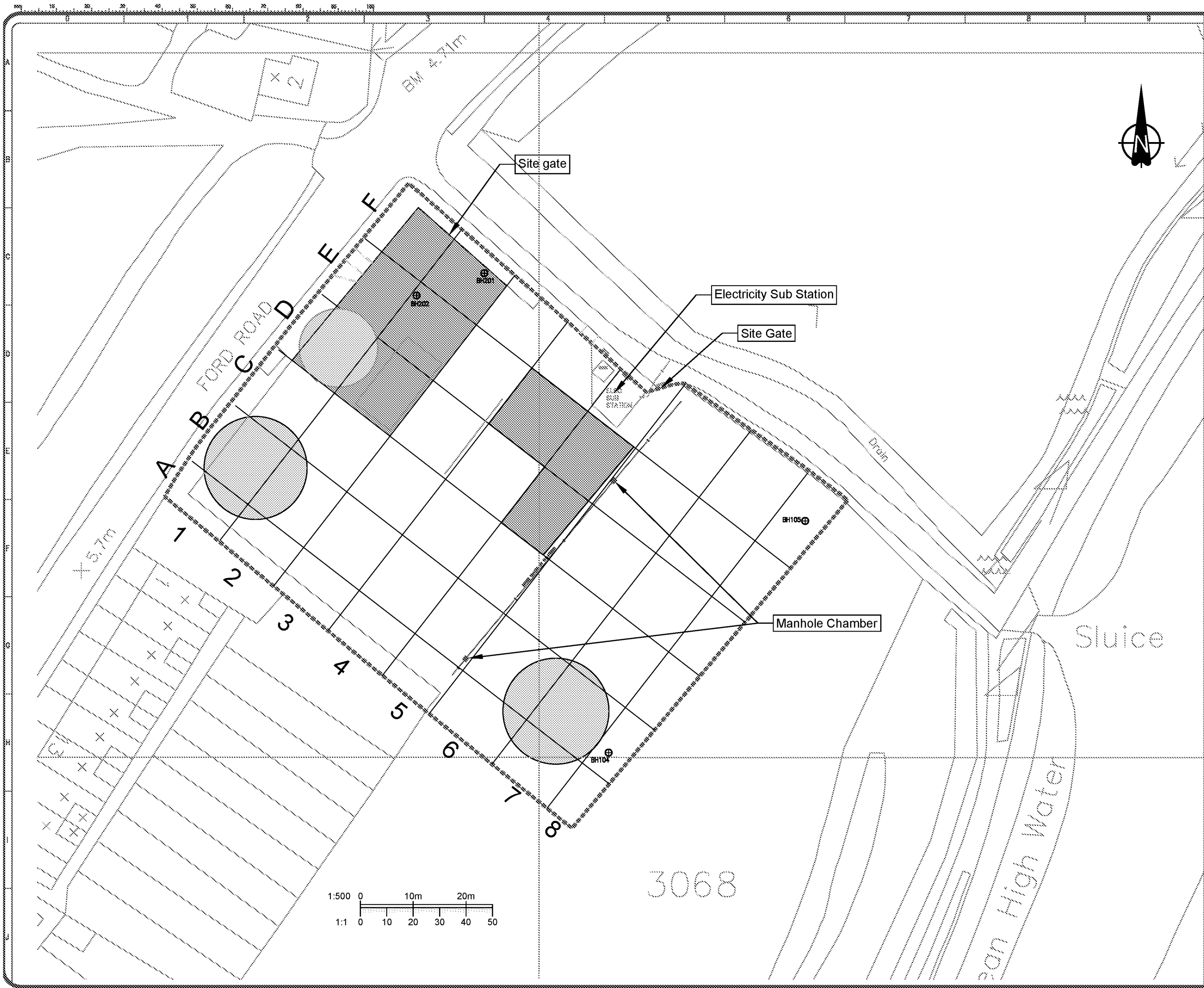
Feature	Description	Date First Shown	Date Last Shown
1	Gasholder possibly later used a tar/liquor Tank	1840	1879
2	Retort House (extended during the history of the site)	1840	1952
3	Possible Smithy/ Carpenters extended during the history of the site	1940	1952
4	Gasholder	1875	1952
5	Possible Purifier Shed (possibly incorporated into Retort House area)	1875	1876
6	Possible Office/Stores	1875	1879
7	Possible Tar/Liquor Tank	1877	1877
8	Gasholder	1877	1952
9	Support Structures, possibly offices	1897	1952
10	Support Structures, possibly offices	1897	1952
11	Unidentified Feature (possible conveyor)	1897	1952
12	Unidentified Feature (possible support building)	1897	1952
13	Retort chimneys/tank	1910	1910
14	Unidentified Feature (possible boiler house)	1910	1912
15	Gasholder	1917	1977
16	Unidentified Feature	1937	Present Day
17	Possible Gasometers	1937	1952
18	Unidentified Feature	1937	1937
19	Governor Compound	1965	2000
20	Instrument Room/Telemetry	1965	2000
21	Boiler House	1965	1965
22	Sub Station	1965	Present Day
23	Hut shown as Tank on 1871 Map	1965	1977
24	SGS Properties, presumed now to be private dwellings	1965	Present Day

3068



- Legend
- National Grid Property Holdings Site Boundary
 - Site Compound
 - Water Treatment System
 - Area 1
 - Area 2
 - Area 3
 - Area 4
 - Surface Water Easement

0	First Issue	08.09.21
REV	COMMENT	DATE
Columbus House Village Way Cardiff CF15 7NE 029 2036 8636		
enquiries@celtic-ld.com www.celtic-ld.com		
Client		
nationalgrid		
Project		
Arundel Gas Works Ford Road, Arundel		
Title		
Validation Testing Locations		
Drawn by	Checked	Authorised
JS	SG	
Original Scale	Date	Rev
1:500	08.09.21	0
Drawing Number		Paper
D1820/5011/A5		A3



SSS_ISO 8001_with_UKAS_TOL_HR.jpg

Legend

- National Grid Property Holdings Site Boundary
- Stabilised Materials
- Concrete Gasholder Base
- Below Ground Brick Wall
- Below Ground Remnant Cast Iron Pipework
- Below Ground Redundant Gas Pipe (25mm PE)
- Surface Water Drain

0	First Issue	08.09.21
REV	COMMENT	DATE

Columbus House
Village Way
Cardiff
CF15 7NE
029 2036 8636

enquiries@celtic-ltd.com
www.celtic-ltd.com

Client

National Grid Logo .JPG

Project

Arundel Gas Works
Ford Road, Arundel

Title

Constraints Plan

Drawn by	Checked	Date	Authorised	Date
JS	SG	08.09.21		

Original Scale	Date	Rev	Paper
1:500	08.09.21	0	A3

Drawing Number

D1820/5011/A6



Legend

- National Grid Property Holdings Site Boundary
- Surface Contours
(0.1m increments illustrated)
(0.5m increments labelled)



0	First Issue	08.09.21
REV	COMMENT	DATE

Celtic enGlobe
Columbus House
Village Way
Cardiff
CF15 7NE
029 2036 8636
enquiries@celtic-ld.com
www.celtic-ld.com

Client
nationalgrid

Project
Arundel Gas Works
Ford Road, Arundel

Title
Final Site
Topographic Levels

Drawn by JS	Checked SG	Date 08.09.21	Authorised Date
Original Scale 1:500	Date 08.09.21	Rev 0	Paper A3

Drawing Number
D1820/5011/A7

Appendix B – Conceptual Site Model (CSM) for Proposed Soilfix Works

Source	Receptor	Harm	Pathway	Probability of Exposure (without controls)	Consequence	Magnitude of risk	Justification for magnitude	Proposed Control / Risk Management	Residual Risk (with controls)
Hydrocarbon impacted soils / LNAPL	Remediation site operatives, and other visiting personnel to facilitate works.	Human health	Direct contact	High	Medium	Medium	Short term exposure.	1. Stockpiles to be shaped and sealed to minimise water ingress and potential for runoff. 2. Protective eyewear and nitrile gloves to be worn when undertaking procedures that require direct contact with soil.	Low
	Site drainage, underlying soils	Pollution	Vertical / lateral migration of free phase / dissolved contaminants via soils, services and / or existing drainage infrastructure	Medium	Medium	Medium	Underlying soils are the source of the impacted material being excavated	1. All remediation mobile plant to stay within the remediation boundary to avoid tracking material onto peripheral areas. 2. All contaminated material to be stored away from any existing drains. Bunds using clean material to be created if required to contain surface water runoff	Low
	Surface water drainage ditch to river	Pollution	Contamination entering ditch may be transported to river	Medium	Medium	Medium	May occur as a result of runoff	1. Storm drain will be permanently diverted outside of the boundary. 2. Stockpiles will be placed away from the drainage ditch.	Low
	Public roads surrounding site (including mud & debris)	Pollution	Vehicle movements in and out of remediation area	Low	Low	Low	It is not anticipated that public road-going vehicles are to come into direct contact with contaminated soils	1. Public road-going vehicles are to be parked outside the site boundary on the public right of way during exposure of contaminated soils.	Low
Gas / vapours from soil (including solvents and petroleum hydrocarbons)	Site workers, off-site residents / workers	Human health	Emissions directly from site operations	High	Medium	Medium	Contaminants identified in site investigations	1. Experienced watching brief to be on site during operations. 2. Air monitoring during works. 3. Damping down to suppress odours. Odour neutralisation misters if required. 4. Site operatives to don suitable RPE if monitoring indicates necessary.	Low
Asbestos Impacted Soils	Remediation site operatives, and other visiting personnel to facilitate works.	Human health	Inhalation	Low	Medium	Medium/Low	Asbestos is not visible on-site and has not been identified in previous surveys.	1. Hand picking of any ACMs identified on the site surface prior to commencement. 2. Soilfix discovery strategy to be followed if previously unidentified material or gross material discovered during works. 3. Watching brief during works with soils wetted down during periods of dry weather to maintain moisture content.	Low
	Off site receptors	Human health	Inhalation/dust	Low	Medium	Medium/Low			Low
Contaminant breakdown products	Site workers. Off-site receptors.	Human health	Direct contact, inhalation, ingestion.	Medium	Medium	Medium	Trained personnel. Distance from receptors.	Vapour monitoring in place at boundary and on site locations if odours are a nuisance. Stabilisation is a non-destructive process, it encapsulates contamination in-situ, stabilising into monolith to reduce mobilisation of contaminants. Restricted access to treatment area with mandatory PPE. Area cordoned off to prevent access once treatment complete.	Low
	Shallow aquifer	Controlled Waters - water resource	Daughter products from remediation	Low	Low	Low	All contaminants of concern are to be treated in-situ and ex-situ.	Monitoring of treatment technologies. Validation monitoring to ensure long-term remediation goals are met. Soils stabilise into monolith, reducing mobilisation of any contaminants.	Low
Soil Conditioning / Stabilisation Binders (likely to be cement and lime)	Site workers. offsite receptors.	Human health	Direct contact, inhalation, ingestion.	Medium	Medium	Medium	Trained personnel. Distance from receptors.	1. Site personnel to wear appropriate PPE (e.g. gloves, light eye protection). 2. Personnel trained and COSHH aware. 3. Dust suppression utilised. 4. Site perimeter monitoring to be undertaken as per monitoring plan.	Low
	Air	Environmental pollution	Wind-blown materials.	Medium	Medium	Medium	Works controlled	5. Material to be securely stored (away from incompatible materials) to prevent unauthorised access, only trained personnel to have access.	Low
	Surface water drainage ditch to river	Pollution	Contamination entering ditch may be transported to river	Medium	Medium	Medium	May occur as a result of runoff	6. Binders spread, mixed and soils compacted and sealed as one exercise to prevent emissions/runoff.	Low
	Site and adjacent drainage, underlying soils	Pollution	Spills of cement or lime dust. Runoff of cement/lime containing soils	Medium	Medium	Medium	Works controlled	7. Storm drain will be permanently diverted outside of the boundary. 8. Stockpiles will be placed away from the drainage ditch.	Low
Waste storage and treatment - Control of pests, scavengers and litter	Remediation site operatives, nearby residents and passers-by	Human health	Odours	Low	Low	Low	Organic/putrescible waste will only be generated from the site welfare facilities.	1. Food waste stored inside locked building prior to disposal offsite. Any other putrescible materials stored in sealed skips	Low
Noise from Plant	Remediation site operatives, nearby residents and passers-by	Human health / Pollution	Exposure to noise generated by plant/equipment	Medium	Low/Medium	Low/Medium	Significant amount of mobile plant will be in use.	1. Noise monitoring at site boundary. 2. Maintenance of plant and equipment. 3. Operate plant only within agreed hours.	Low
Emissions (dust, vapours, odours, VOCs)	Air	Environmental pollution. Neighbouring housing.	Emissions directly from site operations (including dust, vapours, gases, odour, VOCs)	Medium	Medium	Medium	Sensitive surrounding residential housing receptors	1. Site perimeter monitoring including visual / olfactory and field equipment for qualitative monitoring to agreed action levels. 2. Suppression methods for dust and odour utilised if required (see emissions control plan)	Low
Fuel / oil leaks or spills from mobile plant used for remediation	Site drainage and underlying soils	Pollution	Leaking of fuel tanks/ bowser/ generator. Vandalism and attempted theft	Low	Medium	Low/Medium	Relatively small quantity will be stored on site.	1. Bunded storage with regular inspection. 2. Site security maintained at all times to minimise risk of vandalism/theft.	Low
	Surface water drainage ditch to river	Pollution	Contamination entering ditch may be transported to river	Medium	Medium	Medium	May occur as a result of runoff	3. Storm drain will be permanently diverted outside of the boundary. 4. Stockpiles will be placed away from the drainage ditch.	Low

Appendix C – Proposed Emissions Monitoring and Control Plan

Table 1: Ford Road Gasworks, Arundel –Emissions Monitoring and Control Plan

Medium	Principal Sources	Monitoring Location	Type of Monitoring	Threshold Proposed	Justification	Methodology	Frequency	Mitigation Measures to Maintain Emission Below Threshold
Dust	Plant movement, excavating materials, stockpiling, screening / processing / stabilising soils with binders.	All site boundary monitoring points (C500_EMP: EMP1, EMP2, EMP3, EMP4)	Qualitative: (1-4) 1 – Not noticeable 2 – Slight dust 3 – Moderate dust 4 – Significant dust	Visible dust leaving site Trigger >3 Action >4	Unacceptable condition	Visual assessment	Daily during activities	Standard Mitigation Measures: - Effective traffic management plans. - Site layout to be planned so machinery and dust causing activities are located as far as from site boundaries/ sensitive receptors as possible. - Damping down internal haul roads, soil processing areas and newly laid surfaces where necessary. - Sealing of stockpiles. Soil and other excavated materials storage areas shall be sprayed with water to suppress dust in periods of dry weather, where necessary. - Keeping artics/tippers on concrete/tarmac surfaced routes and where not possible 6F2/6F5. Where materials needed to be deposited at location (ensuring tippers/artics do not run over contaminated materials, wherever possible and minimising dust generation). Planning of work based on wind conditions. - Speed limits on unsurfaced temporary roads shall be employed to reduce speeds to minimise re-suspension of dust. - Drop heights from tipper vehicles, loading shovels, hoppers and other materials handling equipment shall be minimised. - Water spray bar on screeners and crushers. - The tyres and undercarriage of vehicles departing the site onto public roads shall be inspected and, where necessary, cleaned before entering onto public roads. - Transport of waste materials on and off-site shall utilise specialist vehicles that contain the waste materials to prevent spillages; transport vehicles using public roads shall be licensed for waste transport. - Daily inspection of public road (Ford Road) and adjoining public right of way, as well as internal haul roads. Road sweepers will be deployed if nuisance/unsafe soiling of public access routes, or internal haul roads as required. Wheel wash deployment will also be considered if soiling is unmitigated. - Stabilisation binders (cement, PFA, lime) will be applied under controlled working practices to minimise dust. Works will be reassessed should high winds occur prior or during activities. In-situ mixing as a slurry will minimise creation of dusts - Respirator with P3 specification filter for site operatives when all other controls used. Response to Exceedance of Trigger Value: - Use of enhanced dust suppression measures where necessary to control fugitive dust emissions (e.g., 'dust fighter' or jet wash/bowser). Reassessment of activities to establish whether an alternative available.
		All site boundary monitoring points (C500_EMP: EMP1, EMP 2, EMP3, EMP4)	Quantitative	Trigger – 150mg/m ² /day Action - 200mg/m ² /day Quantitative	EA Technical Guidance Document M17 V2 July 2013	Frisbee Dust Deposit Gauges	4x gauges deployed in the corners of the site, sampled, and analysed fortnightly after baseline week.	
		Site personnel	Qualitative	Visible dust	Localised dust may be generated as part of works	Visual assessment	Task specific	
		Selected site boundary monitoring points (C500_EMP: EMP1, EMP2, EMP3, EMP4)	Quantitative	Trigger +5% over background level in µg.m-3 (15 min average) Action +10% over background µg.m-3 (15 minute average), or 250 µg.m-3	Industry standard	PM10 real time monitoring (background monitoring carried out pre-commencement)	Daily during site operations	



Medium	Principal Sources	Monitoring Location	Type of Monitoring	Threshold Proposed	Justification	Methodology	Frequency	Mitigation Measures to Maintain Emission Below Threshold
Dust (cont.)								Response to Exceedance of Action Value: If Action value is breached the works causing the production of fugitive dust will cease and an alternative / supplementary methodology sought.
Asbestos fibres	Excavation and processing of Made Ground containing asbestos fibres / fragments	Site personnel	Quantitative	0.1 fibres/ml ⁻¹ (Action Value)	CAR 2012 Control Limit	UKAS accredited method	Task specific – hand picking material and processing asbestos contaminated soils	Standard Mitigation Measures: <i>(including those detailed above for Dust)</i> - Asbestos fragments were handpicked during previous remediation works at the site. Soil samples were also shown to have positive asbestos identification as fibres in soil, with only one result above the detection limit (0.001%) so well below the hazardous waste threshold. A watching brief will be employed during excavation works to identify any visible asbestos containing materials. - Asbestos Plan of Work and Risk Assessment in accordance with CAR-SOIL. - Ensuring competency of personnel carrying out specific tasks on asbestos impacted sites. - Asbestos air monitoring for reassurance purposes (respirable fibre analysis) personal and boundary, where appropriate. - Sampling to check asbestos fibre content of site won materials and materials requiring off-site disposal; and - Dust / fibre suppression measures –, as required. - Ensuring appropriate issue of PPE during any ACM handpicking– overalls, respirators (P3 filters), as required (determined by risk assessment). Response to Exceedance of Action Value: - If Action value is breached any works in the area will be ceased and an investigation into the cause / source of the emission will be carried out and reported with working methods amended as needed.
		Selected site boundary monitoring points (C500_EMP: EMP1, EMP2, EMP3, EMP4)	Quantitative	0.01 fibres/ml ⁻¹ (Action Value)	Lowest quantification HSG248 and MDHS39-/4	UKAS accredited method SEM	Task specific – hand picking material and processing asbestos contaminated soils	
Noise	Tippers/ artics Excavators, dumpers, breakers, material processing plant (screeners, crushers, stabilisation plant) Welfare generators	All site boundary monitoring points (C500_EMP: EMP1, EMP2, EMP3, EMP4)	Quantitative	75 dB LAeq TWA (15 minutes) (Action Value)	DoE Advisory Leaflet (AL) 72 BS4142 (5% above baseline considered impractical as a Threshold due to current derelict nature of site, though Soilfix will carry out monitoring initially and attempt to reduce noise emissions as far as possible to this threshold)	Portable noise meter at site boundary	Daily	Standard Mitigation Measures: - No mechanical plant noise outside agreed working hours (8.00am – 6pm Monday to Friday). - Modern and well-maintained plant. - Any generators housed in acoustically lined containers as far as practicable. Locate noisy equipment away from site boundaries if practicable. - High noise-generating plant and equipment, including generators, shall be positioned as far as practicable away from sensitive receptors. - Construction vehicles and machinery shall be switched off when not in use; engine idling shall not be permitted. - Construction vehicles and other mechanical equipment shall be designed to minimise noise emissions, including selection of ‘sound reduced’ or inherently low noise models and the fitting of exhaust silencers, air intake silencers and mufflers, where practicable.

Medium	Principal Sources	Monitoring Location	Type of Monitoring	Threshold Proposed	Justification	Methodology	Frequency	Mitigation Measures to Maintain Emission Below Threshold
Noise (cont.)								- Construction vehicles and equipment shall be maintained in good working condition to minimise extraneous noise from mechanical vibration, braking, gear changes, hydraulic lifting, engine, exhaust system and/or other sources. - Shouting and raised voices to be kept to a minimum – radios prohibited unless two-way radios for site communications. - Regular toolbox talks on the management of noise emissions. Response to Exceedance of Action Value: - A breach in the Action value will result in noise generating activities being reassessed to establish whether more suitable abatement measures are available (e.g., relocating stockpiles to perimeter to buffer noise / acoustic barriers). - Supplementary noise monitoring will be carried out at the location of exceedance, 1m from nearest building facade or complaints received. If the exceedance is greater than 85dBLAeqTWA then works will cease immediately and the working methods reassessed.
		Site personnel	Quantitative	80 dB LAeq optional protection 85 dB LAeq Modify working method, or if unable hearing protection must be worn (Action Values)	HSE Workplace Exposure Limit	Portable noise meter	Task specific	Standard Mitigation Measures: - The level at Soilfix must provide hearing protection and hearing protection zones is 85 dB (daily or weekly average exposure) and the level at which Soilfix will assess the risk to workers' health and provide them with information and training is 80 dB(A). There is also an exposure limit value of 87 dB(A), taking account of any reduction in exposure provided by hearing protection, above which workers must not be exposed. - Modify working method, or if unable to do this use hearing protection when working near unacceptable noise levels. Noise level signage to be displayed where required i.e., on outside of any working plant containers.
VOC's	Excavation/material processing/stabilisation/ movement of contaminated soils.	All site boundary monitoring points (C500_EMP: EMP1, EMP2, EMP3, EMP4)	Quantitative	1ppm total VOCs (STEL/TWA 15 minutes) (Action Value)	EH40 STEL for benzene – identified as main volatile compound of concern. Low odour thresholds may cause nuisance to site neighbours	Tiger Phocheck / Minirae PID	Daily during excavation / processing of contaminated soils	Standard Mitigation Measures: - Solid hoarding around the site boundary. - Minimising excavation limits when highly odorous/volatile contaminated materials are being excavated, where practicable. - Sealing stockpiles. - Use of rotary/dust cannons as atomisers with odour neutralisation solutions. - Use of foam sprays for rapid odour mitigation if required. - Respirators with A2 specification vapour filter for site personnel, as necessary. Response to Exceedance of Action Value: - Cease odour/VOC emitting works immediately and review/repeat VOC/olfactory monitoring. Deploy increased odour suppression equipment or dosage. Supplementary olfactory/VOC
			Quantitative	1ppm total VOCs STEL/ TWA 15 minutes) (Action Value)	As above	Tiger Phocheck / Minirae PID	Task specific	
		Site personnel	Qualitative	Any physical symptoms (e.g., headaches) (Action Value)	Unacceptable condition	Personal assessment	Continuous	

Medium	Principal Sources	Monitoring Location	Type of Monitoring	Threshold Proposed	Justification	Methodology	Frequency	Mitigation Measures to Maintain Emission Below Threshold
VOC's (cont.)								monitoring at site boundary and selected receptor locations if Action value is consistently exceeded or complaints received. For persistent odour/VOC complaints and / or exceedance of 1ppm TWA, olfactory assessment to be extended to surrounding receptors, in conjunction with specialist third party consultant.
Odours	Excavation / processing / stabilisation / movement of contaminated soils.	All site boundary monitoring points (C500_EMP: EMP1, EMP2, EMP3, EMP4)	Qualitative: (1-4) 1 – Not noticeable 2 – Slight odour 3 – Moderate odour 4 – Significant	Rating of 3 or 4 (Action Value)	EA H4 Guidance. Prevent nuisance to site neighbours	Olfactory assessment (sniff testing) as per EA H4 Guidance. Periodically checked by visiting Soilfix staff and 3 rd party consultant to manage risk of desensitization	Daily during excavation / processing of contaminated soils	Controls and Responses as per VOC section above.
Surface Water Drainage / Ground Water	LNAPL or dissolved contamination mobilised into groundwater (or drainage) from excavation / breakout / stockpiling of contaminated materials,	Monitoring wells, work area, surface water drainage gullies, interceptors, and outfalls.	Quantitative	Visible mobile LNAPL entering site drainage system / moving offsite / into ground (Action Value)	Unacceptable condition	Visual	Daily	Standard Mitigation Measures: - Any vulnerable surface water drainage system manholes being retained during works to be protected (e.g., absorbent pads, sandbags). - Storm drainage currenting running through the site will be permanently diverted along the perimeter of the site boundary early on in the enabling programme. - Any LNAPL contamination encountered during excavation to be removed using absorbents and then disposed under duty of care. - Grossly contaminated mobile contamination to be contained and managed as per conditions of Soilfix's deployed remedial treatment permit. - Spill kits available. - Fuel stored in 110% capacity bunds. - Regular inspections of plant, storage area, bunds and working areas. Response to Exceedance of Action Value: - Stop and contain the source of contamination, or investigate to determine the source as required. - Clean up contamination where possible. - Contact the Environment Agency to notify of significant releases to surface waters.
	Leaks/spills of diesel / petrol / oil from plant/equipment	In locations of stored fuel or working equipment / plant	Qualitative	If a leak is observed from plant (Action Value)	Unacceptable condition	Visual check	Daily	
	Contamination entering storm drain running through site that flows into ditch offsite that discharges into River Arun	External to eastern boundary	Qualitative	<u>Action</u> Visible LNAPL in offsite ditch (Action Value)	Unacceptable condition	Visual check	Daily	



Legend:

Site Boundary -----

Monitoring Point ⊗

Contract: C500.OAK

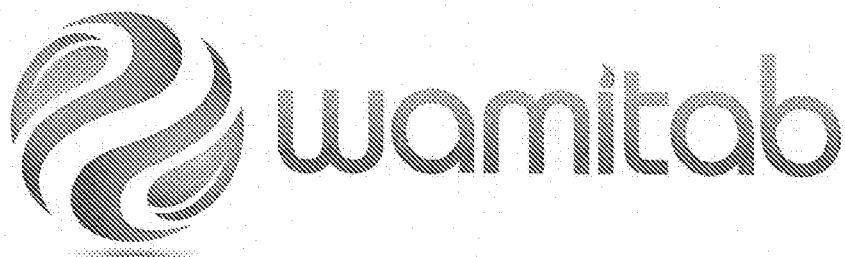
Client: Oakford Homes

Drawing Title:
Environmental Monitoring Plan

Drawing Number: C500_EMP

Drawing Date: 04/04/2022

Appendix D – WAMITAB Certificate for Proposed TCM



Qualification Title:

**WAMITAB Level 4 Medium Risk Operator Competence for
Contaminated Land Remediation**

Qualification Accreditation Number:

601/8518/1

This Certificate is awarded to

Paul Hazlehurst

Verification date: 02/11/2020

Authorised:



Katie Cockburn
Director of Qualifications and Standards

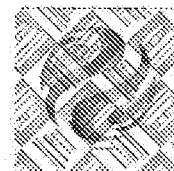
Learner ID: 114820

Certificate No.: 5171110

Date of Issue: 04/11/2020



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wamitab

Units achieved by

Paul Hazlehurst

Units gained:

Level

A/508/0756	Maintain health and safety in the waste resource management industry	L4
F/508/0757	Manage the environmental impact of work activities	L4
F/508/0760	Manage the movement, sorting and storage of waste	L4
R/508/0861	Control work activities on a waste management facility	L4
D/508/1009	Manage site operations for the remediation of contaminated land	L4
R/508/1007	Manage the transfer of outputs and disposal of residues from remediation of contaminated land	L4

Verification date: 02/11/2020

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Director of Qualifications and Standards

Learner ID: 114820

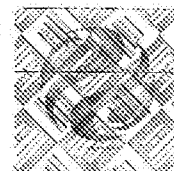
Certificate No.: 5171110

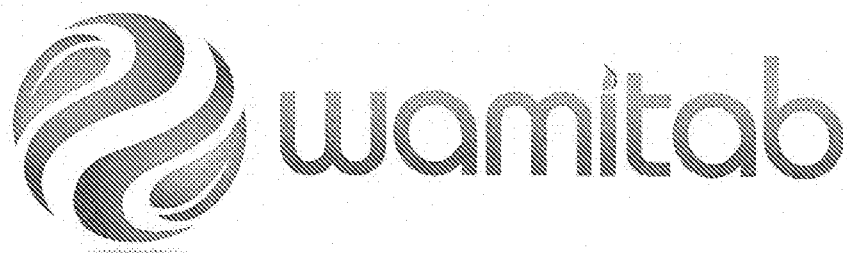
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Operator Competence Certificate

Title:

Contaminated Land Remediation

This Certificate is awarded to

Paul Hazlehurst

Verification date: 02/11/2020

Authorised:

Learner ID: 114820

Certificate No.: 5171110

Date of Issue: 04/11/2020

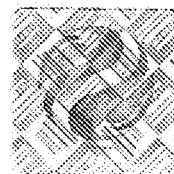
Director of Qualifications and Standards

CIWM Chief Executive Officer

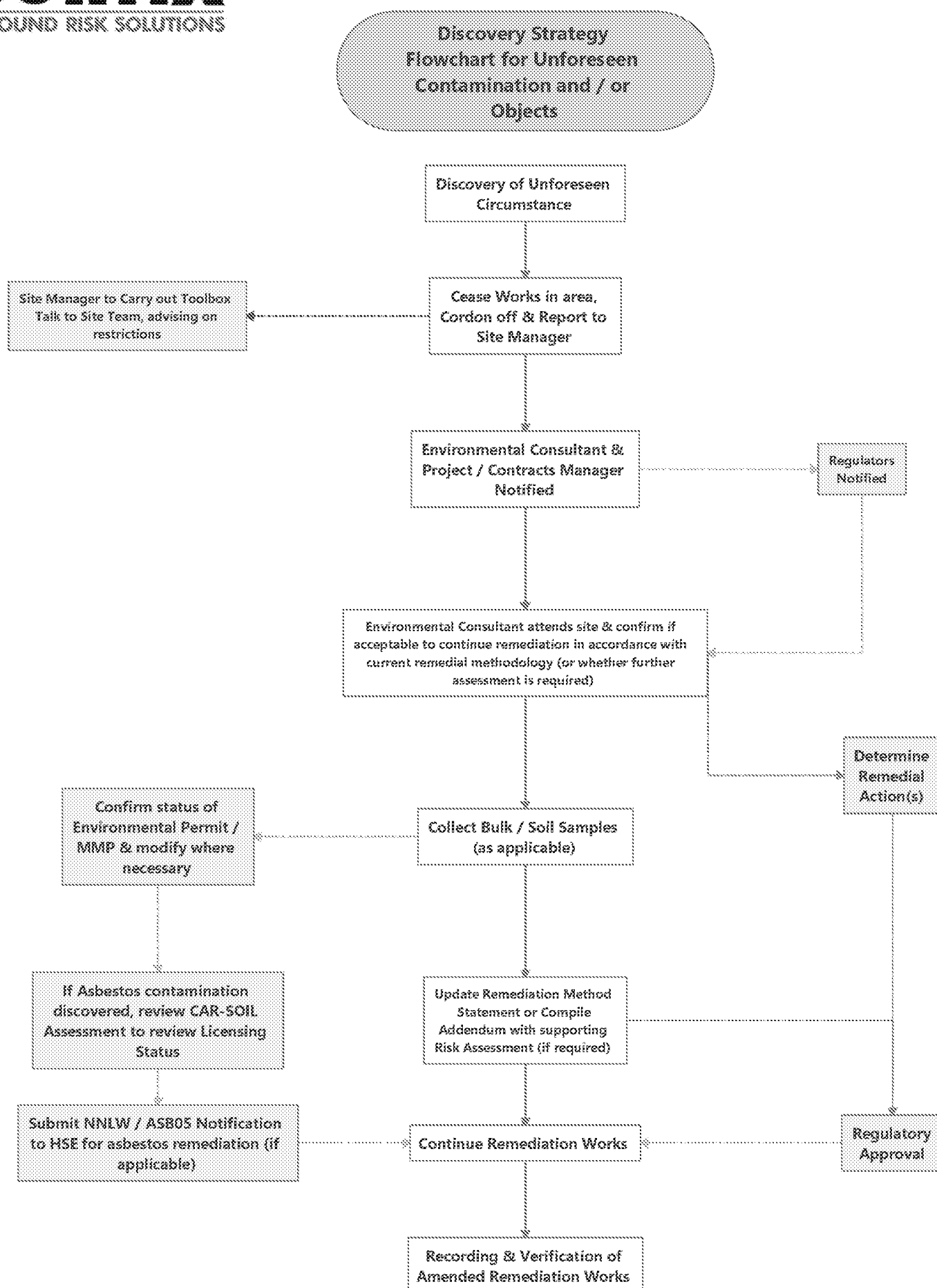


The Chartered Institution
of Wastes Management

This certificate is jointly awarded by WAMITAB and the Chartered Institution of Wastes Management (CIWM) and provides evidence to meet the Operator Competence requirements of the Environmental Permitting (EP) Regulations, which came into force on 6 April 2008.



Appendix E – Discovery Strategy for Unexpected Materials / Contamination



Appendix F – Clean cover criteria for residential end use without plant up-take

Generic assessment criteria for human health: residential scenario without home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009⁽¹⁾. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009⁽²⁾. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)^(3,4), as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)⁽⁵⁾ used in the generation of SGVs.

C4SL were initially published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010⁽³⁾). Further C4SL were published in 2021 for vinyl chloride, tetrachloroethene (PCE) and trichloroethene (TCE). Where a C4SL has been published, the RSK GAC duplicates the C4SL using all input parameters within the SP1010 final project report⁽³⁾ and associated chemical specific reports⁽⁶⁾, and adopts them as GAC for these substances. Due to the use of decimal places rather than significant figures applied to the Contaminated Land Exposure Assessment (CLEA) tool outputs, the GAC presented may be marginally differently to the C4SL values, however any differences between the values are minimal and would not equate to an unacceptable risk.

For all other substances the C4SL exposure modifications relevant for residential without home-grown produce end use have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) and reducing exposure frequency for dermal contact outdoors.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015⁽⁷⁾ or by the USEPA⁽¹⁴⁾, where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the CLEA tool v1.071, supporting EA guidance^(5,8,9) and revised exposure scenarios published for the C4SL⁽³⁾. The SAC are also termed GAC.

Conceptual model

In accordance with SR3⁽⁵⁾, the residential without home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In

accordance with Box 3.1 of SR3⁽⁵⁾, the pathways considered for production of the SAC in the residential without home-grown produce scenario are

- direct soil and dust ingestion in areas of soft landscaping
- dermal contact with soil and indoor dust
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium⁽¹⁾, the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh} , are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase⁽⁹⁾. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached⁽⁹⁾. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required⁽⁹⁾:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook⁽⁹⁾, this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook⁽⁹⁾, which explains how to calculate an effective assessment criterion manually.

SR3⁽⁵⁾ states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7⁽¹⁰⁾, the EA TOX⁽¹⁾ reports, the C4SL SP1010 project report and associated chemical specific reports^(3,6), the 2015 LQM/CIEH report⁽⁷⁾ or the USEPA IRIS database⁽¹⁴⁾. Where a LLTC^(3,6) has been published for a substance, RSK has used these input parameters to derive the RSK GAC. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report⁽¹¹⁾.

For TPH, aromatic hydrocarbons C₅–C₈ were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential without home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. SR3⁽⁵⁾ notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3⁽³⁾, with a dust loading factor detailed in Section 9.3 of SR3⁽⁵⁾. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3⁽⁵⁾. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3⁽⁵⁾ input parameters for residential without home-grown produce

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3⁽⁵⁾. Modifications to the default SR3⁽⁵⁾ exposure scenarios based on the C4SL exposure scenarios⁽³⁾ are presented in Table 2 below.

The final selected GAC are presented by pathway in Table 3 and the combined GAC in Table 4.

Figure 1: Conceptual model for CLEA residential scenario without home-grown produce

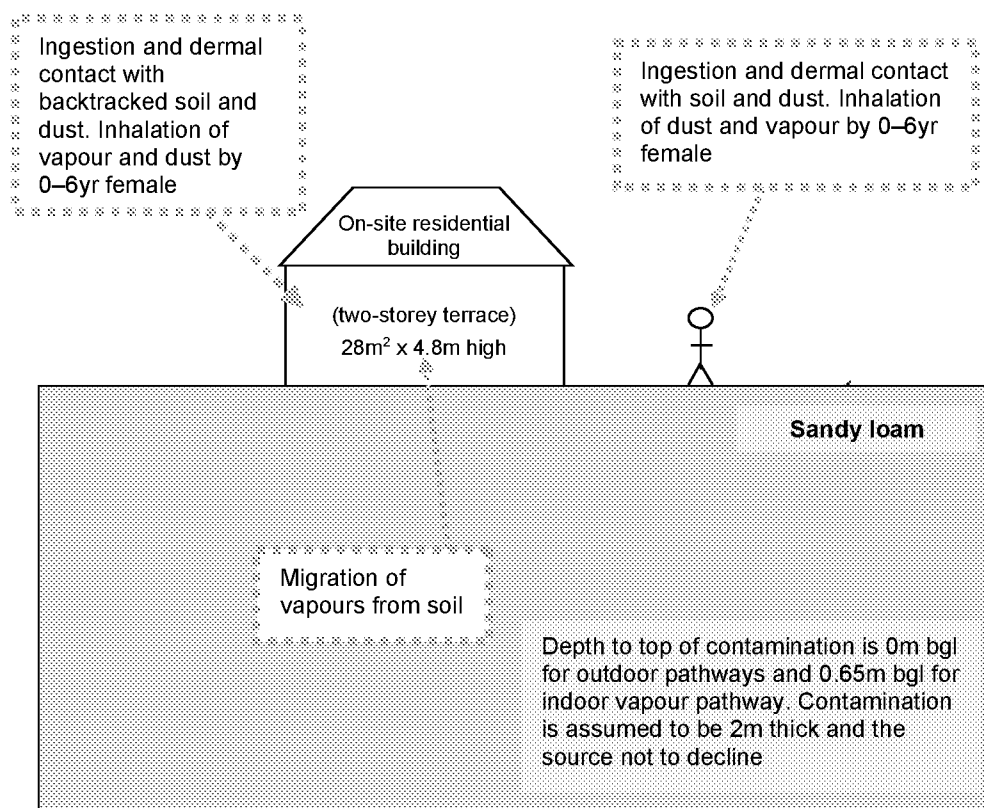


Table 1: Exposure assessment parameters for residential scenario without home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential without home-grown produce	Chosen land use
Receptor	Female child	Key generic assumption given in Box 3.1, SR3 ⁽⁵⁾
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3 ⁽⁵⁾ . Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3) ⁽⁵⁾
Soil type	Sandy loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3) ⁽⁵⁾
Start age class (AC)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3 ⁽⁵⁾
End AC	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents' ⁽¹³⁾
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential without home-grown produce – modified receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
Soil to skin adherence factor – (outdoor)	mg soil/cm ² skin	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010 ⁽³⁾					
Inhalation rate	m ³ day ⁻¹	5.4	8.0	8.9	10.1	10.1	10.1
Justification		Mean value USEPA, 2011 ⁽¹²⁾ ; Table 3.2, SP1010 ⁽³⁾					
Notes: For cadmium , the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI _{oral} and TDI _{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3 ⁽¹⁾ , Science Report SC050021/Cadmium SGV ⁽¹⁾ and the project report SP1010 ⁽³⁾ for more information.							

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GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE



Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR
Barium	(b)	1.36E+03	NR	NR	NR	1.36E+03	NR	NR	NR	1.36E+03	NR	NR	NR
Beryllium		1.56E+02	1.72E+00	NR	NR	1.56E+02	1.72E+00	NR	NR	1.56E+02	1.72E+00	NR	NR
Boron		1.08E+04	5.20E+06	NR	NR	1.08E+04	5.20E+06	NR	NR	1.08E+04	5.20E+06	NR	NR
Cadmium	(a)	1.95E+02	4.68E+02	1.49E+02	NR	1.95E+02	4.68E+02	1.49E+02	NR	1.95E+02	4.68E+02	1.49E+02	NR
Chromium (III) - trivalent	(c)	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR
Chromium (VI) - hexavalent	(a,d)	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR
Copper		1.09E+04	1.41E+04	7.13E+03	NR	1.09E+04	1.41E+04	7.13E+03	NR	1.09E+04	1.41E+04	7.13E+03	NR
Lead	(a)	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR
Elemental Mercury (Hg ⁰)	(d)	NR	2.41E-01	NR	4.31E+00	NR	5.74E-01	NR	1.07E+01	NR	1.25E+00	NR	2.58E+01
Inorganic Mercury (Hg ²⁺)		5.71E+01	3.83E+03	5.82E+01	NR	5.71E+01	3.83E+03	5.82E+01	NR	5.71E+01	3.83E+03	5.82E+01	NR
Methyl Mercury (Hg ⁴⁺)		1.80E+01	1.87E+01	8.19E+00	7.33E+01	1.80E+01	3.62E+01	1.20E+01	1.42E+02	1.80E+01	7.89E+01	1.46E+01	3.04E+02
Nickel	(d)	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR
Selenium	(b)	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR
Vanadium		1.17E+03	1.46E+03	NR	NR	1.17E+03	1.46E+03	NR	NR	1.17E+03	1.46E+03	NR	NR
Zinc	(b)	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR
Cyanide (free)		4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR
Volatile Organic Compounds													
Benzene	(a)	7.28E+01	9.01E-01	8.90E-01	1.22E+03	7.36E+01	1.68E+00	1.64E+00	2.26E+03	7.36E+01	3.46E+00	3.23E+00	4.71E+03
Toluene		2.87E+04	9.08E+02	8.80E+02	8.69E+02	2.87E+04	2.00E+03	1.87E+03	1.92E+03	2.87E+04	4.55E+03	3.93E+03	4.36E+03
Ethylbenzene		1.29E+04	8.34E+01	8.29E+01	5.18E+02	1.29E+04	1.98E+02	1.83E+02	1.22E+03	1.29E+04	4.96E+02	4.42E+02	2.84E+03
Xylene - m		2.32E+04	8.29E+01	8.22E+01	6.25E+02	2.32E+04	1.95E+02	1.83E+02	1.47E+03	2.32E+04	4.59E+02	4.47E+02	3.46E+03
Xylene - o		2.32E+04	8.87E+01	8.83E+01	4.78E+02	2.32E+04	2.08E+02	2.06E+02	1.12E+03	2.32E+04	4.86E+02	4.79E+02	2.62E+03
Xylene - p		2.32E+04	7.93E+01	7.80E+01	5.76E+02	2.32E+04	1.86E+02	1.85E+02	1.35E+03	2.32E+04	4.36E+02	4.28E+02	3.17E+03
Total xylene		2.32E+04	7.93E+01	7.80E+01	6.25E+02	2.32E+04	1.96E+02	1.85E+02	1.47E+03	2.32E+04	4.36E+02	4.28E+02	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		3.87E+04	1.04E+02	1.04E+02	2.04E+04	3.87E+04	1.89E+02	1.89E+02	3.31E+04	3.87E+04	3.21E+02	3.19E+02	6.27E+04
Trichloroethene (TCE)		9.73E-03	3.61E-02	NR	1.54E+03	2.04E-02	7.57E-02	NR	3.22E+03	4.52E-02	1.68E-01	NR	7.14E+03
Tetrachloroethene (PCE)		1.80E+03	3.19E-01	3.19E-01	4.24E+02	1.80E+03	7.15E-01	7.16E-01	9.51E+02	1.80E+03	1.64E+00	1.64E+00	2.18E+03
1,1,1-Trichloroethane		7.74E+04	9.01E+00	9.01E+00	1.43E+03	7.74E+04	1.84E+01	1.84E+01	2.92E+03	7.74E+04	4.04E+01	4.04E+01	6.39E+03
1,1,1,2-Tetrachloroethane		7.34E+02	1.54E+00	1.53E+00	2.60E+03	7.34E+02	3.56E+00	3.55E+00	6.02E+03	7.34E+02	8.29E+00	8.20E+00	1.40E+04
1,1,2,2-Tetrachloroethane		7.34E+02	3.92E+00	3.90E+00	2.67E+03	7.34E+02	8.04E+00	7.95E+00	5.46E+03	7.34E+02	1.76E+01	1.72E+01	1.20E+04
Carbon Tetrachloride		5.15E+02	2.58E-02	2.58E-02	1.52E+03	5.15E+02	5.65E-02	5.64E-02	3.32E+03	5.15E+02	1.29E-01	1.28E-01	7.54E+03
1,2-Dichloroethane		1.55E+01	9.20E-03	9.20E-03	3.41E+03	1.55E+01	1.33E-02	1.29E-02	4.91E+03	1.55E+01	2.28E-02	2.27E-02	8.43E+03
Vinyl Chloride (chloroethene)		4.86E+00	1.47E-02	1.47E-02	1.36E+03	4.86E+00	1.80E-02	1.80E-02	1.76E+03	4.86E+00	2.91E-02	2.89E-02	2.69E+03
1,2,4-Trimethylbenzene		NR	5.68E+00	NR	4.74E+02	NR	1.29E+01	NR	1.16E+03	NR	2.69E+01	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
Semi-Volatile Organic Compounds													
Acenaphthene		7.64E+03	4.86E+04	6.60E+03	5.70E+01	7.64E+03	1.18E+05	7.17E+03	1.41E+02	7.64E+03	2.88E+05	7.43E+03	3.36E+02
Acenaphthylene		7.65E+03	4.59E+04	6.55E+03	8.61E+01	7.65E+03	1.11E+05	7.15E+03	2.12E+02	7.65E+03	2.53E+05	7.42E+03	5.06E+02
Anthracene		3.82E+04	1.53E+05	3.06E+04	1.17E+00	3.82E+04	3.77E+05	3.47E+04	2.91E+00	3.82E+04	8.76E+05	3.66E+04	6.96E+00
Benzo(a)anthracene		1.98E+01	2.47E+01	1.10E+01	1.71E+00	1.98E+01	4.37E+01	1.36E+01	4.28E+00	1.98E+01	6.26E+01	1.50E+01	1.03E+01
Benzo(a)pyrene	(a)	5.34E+00	3.51E+01	NR	9.11E-01	5.34E+00	3.77E+01	NR	2.28E+00	5.34E+00	3.89E+01	NR	5.46E+00
Benzo(b)fluoranthene		4.97E+00	1.93E+01	3.95E+00	1.22E+00	4.97E+00	2.13E+01	4.03E+00	3.04E+00	4.97E+00	2.22E+01	4.06E+00	7.29E+00
Benzo(g,h,i)perylene		4.38E+02	1.87E+03	3.55E+02	1.54E-02	4.38E+02	1.94E+03	3.58E+02	3.85E-02	4.38E+02	1.97E+03	3.59E+02	9.23E-02
Benzo(k)fluoranthene		1.31E+02	5.41E+02	1.06E+02	6.87E-01	1.31E+02	5.76E+02	1.07E+02	1.72E+00	1.31E+02	5.91E+02	1.07E+02	4.12E+00
Chrysene		3.95E+01	1.19E+02	2.97E+01	4.40E-01	3.95E+01	1.49E+02	3.12E+01	1.10E+00	3.95E+01	1.66E+02	3.19E+01	2.64E+00

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE



Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Dibenzo(a,h)anthracene		3.95E-01	1.45E+00	3.10E-01	3.93E-03	3.95E-01	1.64E+00	3.18E-01	9.82E-03	3.95E-01	1.74E+00	3.22E-01	2.36E-02
Fluoranthene		1.59E+03	3.83E+04	1.53E+03	1.89E+01	1.59E+03	8.87E+04	1.58E+03	4.73E+01	1.59E+03	1.83E+05	1.58E+03	1.13E+02
Fluorene		5.09E+03	6.20E+03	2.80E+03	3.09E+01	5.09E+03	1.53E+04	3.82E+03	7.65E+01	5.09E+03	3.62E+04	4.47E+03	1.83E+02
Indeno(1,2,3-cd)pyrene		5.65E+01	2.12E+02	4.46E+01	6.13E-02	5.65E+01	2.39E+02	4.56E+01	1.53E-01	5.65E+01	2.50E+02	4.60E+01	3.68E-01
Naphthalene		2.50E+03	2.33E+01	2.31E+01	7.64E+01	2.50E+03	5.58E+01	5.40E+01	1.83E+02	2.50E+03	1.31E+02	1.25E+02	4.32E+02
Phenanthrene		1.58E+03	7.17E+03	1.30E+03	3.60E+01	1.58E+03	1.76E+04	1.45E+03	8.96E+01	1.58E+03	4.07E+04	1.52E+03	2.14E+02
Pyrene		3.82E+03	8.79E+04	3.66E+03	2.20E+00	3.82E+03	2.04E+05	3.75E+03	5.49E+00	3.82E+03	4.23E+05	3.79E+03	1.32E+01
Phenol		6.48E+04	4.58E+02	4.55E+02	2.42E+04	6.48E+04	6.95E+02	6.88E+02	3.81E+04	6.48E+04	1.19E+03	1.17E+03	7.03E+04
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC ₅ -EC ₆		3.23E+05	4.24E+01	4.24E+01	3.04E+02	3.23E+05	7.79E+01	7.79E+01	5.58E+02	3.23E+05	1.81E+02	1.81E+02	1.15E+03
Aliphatic hydrocarbons >EC ₆ -EC ₉		3.23E+05	1.04E+02	1.04E+02	1.44E+02	3.23E+05	2.31E+02	2.31E+02	3.22E+02	3.23E+05	5.29E+02	5.29E+02	7.36E+02
Aliphatic hydrocarbons >EC ₉ -EC ₁₀		6.45E+03	2.66E+01	2.66E+01	7.77E+01	6.45E+03	6.59E+01	6.59E+01	1.90E+02	6.45E+03	1.56E+02	1.55E+02	4.51E+02
Aliphatic hydrocarbons >EC ₁₀ -EC ₁₂		6.45E+03	1.33E+02	1.32E+02	4.75E+01	6.45E+03	3.31E+02	3.27E+02	1.18E+02	6.45E+03	7.93E+02	7.67E+02	2.83E+02
Aliphatic hydrocarbons >EC ₁₂ -EC ₁₆		6.45E+03	1.11E+03	1.06E+03	2.37E+01	6.45E+03	2.78E+03	2.42E+03	5.91E+01	6.45E+03	6.67E+03	4.37E+03	1.42E+02
Aliphatic hydrocarbons >EC ₁₆ -EC ₃₅	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC ₃₅ -EC ₄₄	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC ₉ -EC ₁₀		2.58E+03	4.74E+01	4.72E+01	6.13E+02	2.58E+03	1.18E+02	1.15E+02	1.50E+03	2.58E+03	2.77E+02	2.69E+02	3.58E+03
Aromatic hydrocarbons >EC ₁₀ -EC ₁₂		2.58E+03	2.52E+02	2.52E+02	3.64E+02	2.58E+03	8.29E+02	5.94E+02	8.99E+02	2.58E+03	1.52E+03	1.24E+03	2.15E+03
Aromatic hydrocarbons >EC ₁₂ -EC ₁₆		2.58E+03	2.85E+03	1.80E+03	1.69E+02	2.58E+03	7.07E+03	2.30E+03	4.19E+02	2.58E+03	1.68E+04	2.48E+03	1.00E+03
Aromatic hydrocarbons >EC ₁₆ -EC ₂₁	(b)	1.86E+03	NR	NR	5.37E+01	1.90E+03	NR	NR	1.34E+02	1.82E+03	NR	NR	3.21E+02
Aromatic hydrocarbons >EC ₂₁ -EC ₃₅	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC ₃₅ -EC ₄₄	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. GRAC - groundwater assessment criteria. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

	Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.
	Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.
	Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs naphthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for boron and selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE			
Table 4 Human health generic assessment criteria for residential without home-grown produce			
RSK			
Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	40	40	40
Barium	1,300	1,300	1,300
Beryllium	1.7	1.7	1.7
Boron	11,000	11,000	11,000
Cadmium	149	149	149
Chromium (III) - trivalent	910	910	910
Chromium (VI) - hexavalent	21	21	21
Copper	7,100	7,100	7,100
Lead	310	310	310
Elemental Mercury (Hg ⁰)	0.2	0.6	1.2
Inorganic Mercury (Hg ²⁺)	56	56	56
Methyl Mercury (Hg ⁴⁺)	9	12	15
Nickel	180	180	180
Selenium	430	430	430
Vanadium	1,200	1,200	1,200
Zinc	40,000	40,000	40,000
Cyanide (free)	40	40	40
Volatile Organic Compounds			
Benzene	0.9	1.6	3.3
Toluene	900 (869)	1,900	3,900
Ethylbenzene	80	190	440
Xylene - m	80	190	450
Xylene - o	90	210	480
Xylene - p	80	180	430
Total xylene	80	180	430
Methyl tertiary-Butyl ether (MTBE)	100	170	320
Trichloroethene (TCE)	0.010	0.020	0.045
Tetrachloroethene (PCE)	0.32	0.71	1.64
1,1,1-Trichloroethane	9.0	18.4	40.4
1,1,1,2 Tetrachloroethane	1.5	3.5	8.2
1,1,2,2-Tetrachloroethane	3.9	8.0	17.2
Carbon Tetrachloride	0.026	0.056	0.128
1,2-Dichloroethane	0.009	0.013	0.023
Vinyl Chloride (chloroethene)	0.015	0.019	0.029
1,2,4-Trimethylbenzene	5.6	12.9	26.9
1,3,5-Trimethylbenzene	NR	NR	NR
Semi-Volatile Organic Compounds			
Acenaphthene	6,600 (57)	7,200	7,400
Acenaphthylene	6,600 (86)	7,200	7,400
Anthracene	31,000 (1.17)	35,000	37,000
Benzo(a)anthracene	11.0	13.6	15.0
Benzo(a)pyrene	5.3	5.3	5.3
Benzo(b)fluoranthene	4.0	4.0	4.1
Benzo(g,h,i)perylene	355	358	359
Benzo(k)fluoranthene	106	107	107
Chrysene	30	31	32
Dibenzo(a,h)anthracene	0.31	0.32	0.32
Fluoranthene	1,500	1,600	1,600
Fluorene	2,800 (31)	3,800 (77)	4,500 (183)
Indeno(1,2,3-cd)pyrene	45	46	46
Naphthalene	23	55	125
Phenanthrene	1,300 (36)	1,450	1,520
Pyrene	3,700	3,800	3,800
Phenol	440*	688	1,170
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC ₅ -EC ₆	42	78	161
Aliphatic hydrocarbons >EC ₆ -EC ₈	100	230	530
Aliphatic hydrocarbons >EC ₈ -EC ₁₀	27	65	155
Aliphatic hydrocarbons >EC ₁₀ -EC ₁₂	130 (48)	330 (118)	770 (283)
Aliphatic hydrocarbons >EC ₁₂ -EC ₁₆	1,100 (24)	2,400 (59)	4,400 (142)
Aliphatic hydrocarbons >EC ₁₆ -EC ₃₅	65,000 (8)	92,000 (21)	111,000
Aliphatic hydrocarbons >EC ₃₅ -EC ₄₄	65,000 (8)	92,000 (21)	111,000
Aromatic hydrocarbons >EC ₈ -EC ₁₀	47	115	269
Aromatic hydrocarbons >EC ₁₀ -EC ₁₂	300	600	1,200
Aromatic hydrocarbons >EC ₁₂ -EC ₁₆	1,800 (169)	2,300 (419)	2,500
Aromatic hydrocarbons >EC ₁₆ -EC ₂₁	1,900	1,900	1,900
Aromatic hydrocarbons >EC ₂₁ -EC ₃₅	1,900	1,900	1,900
Aromatic hydrocarbons >EC ₃₅ -EC ₄₄	1,900	1,900	1,900
Minerals			
Asbestos	Stage 1 test – No asbestos detected with ID; Stage 2 test - <0.001% dry weight (exceedance of either equates to an exceedance of the GAC) ¹		
Notes: ¹ - Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data. NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used EC - equivalent carbon. SAC - soil assessment criteria. ¹ LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry. The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994. SAC for TPH fractions, PAHs naphthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3. (VALUE IN BRACKETS) RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.			