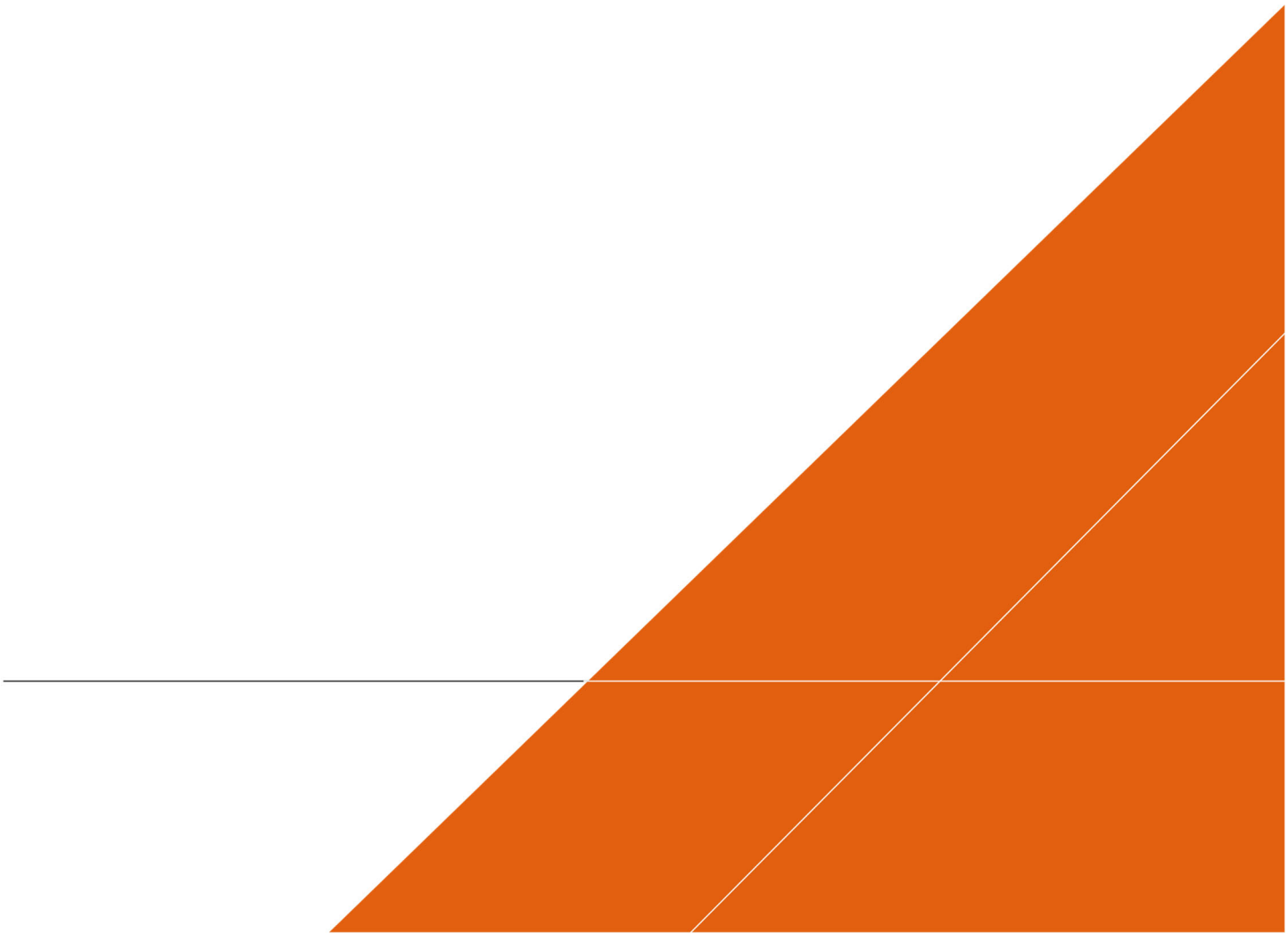
ARCADIS Design & Consultancy for natural and built assets

WASTE ACCEPTANCE PROCEDURES

Waste Recovery Permit - Deposit for Recovery

Reclamation of the former British Sugar Refinery Site, York

SEPTEMBER 2022



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1 Introduction

Arcadis UK Ltd (Arcadis) has prepared this Waste Acceptance Procedures Report in order to support the addition of a bespoke (Deposit for Recovery) waste operation and associated Waste Recovery Plan (WRP) as part of an application to vary Environmental Permit (EP) (EPR/QP3593NF) at the Former British Sugar Factory, Millfield Lane, York, YO26 6AY (the 'site'). A site location plan is presented as Figure 1.

The objective of this report is to provide the waste recovery Compliance Criteria and associated procedures defined in order to demonstrate that waste recovered at the site is suitable for use in construction of the residential development platform and that potential risks to human health and environmental (water resources) receptors are effectively managed.

The reclamation works incorporating the waste recovery process are supported by an approved Remediation and Reclamation Strategy (RRS) (URS, 2015) for which a Remediation and Reclamation Strategy addendum (RRSA) has been produced to incorporate the latest site data (Arcadis, 2020).

1.1 Waste Acceptance

The deposit for recovery operation proposed does not involve the importation or acceptance of any waste material at the site. Only waste that is currently located on site, within the current EP boundary, will be recovered for permanent deposit across the proposed extended EP boundary, shown on Figure 2.

A key objective of the operation is to promote the recovery of waste currently located within the EP boundary and the reuse of site-won materials at the site as much as possible, minimising off-site disposal and the import of materials. The reclamation works and waste recovery operation rely on a cut and fill balance as a sustainable approach to providing the development platform needed to enable residential redevelopment.

The volumes of non-waste materials to be brought to site, if required, are anticipated to be relatively small and likely relating to the importation of clean topsoil. Therefore, the primary focus of this document will relate to defining the Compliance Criteria supporting the recovery of waste currently located within the EP boundary and demonstrating recovered waste is suitable for use as bulk fill within the development platform.

In the event clean, non-waste materials are required to be imported to construct the development platform, Compliance Criteria are also defined to ensure suitability of these materials.

2 Remediation and Reclamation Objectives

2.1 Overall Objectives

The objectives of the 2020 RRSA remain in accordance with those outlined in the 2015 RRS, namely to provide for residential development with landscaping and amenity use at the site as follows:

- to ensure that the site is geo-environmentally and geotechnically suitable for the proposed residential end use;
- to ensure that any on-site contamination is mitigated or remediated such that potential risks to human health, development infrastructure and the environment are minimised to a standard suitable for use of the site for residential development;
- to ensure that the development platform is geotechnically suitable for the construction of foundations and pavements associated with the proposed development;
- to ensure that the remediation and reclamation activities are undertaken in such a way as to prevent potential pollution of the environment; and
- to promote the recovery of waste and the reuse of site-won materials at the site as much as possible, minimising off-site disposal and the import of materials.

2.2 Soil Contamination Objectives

The objective of the works is to effectively manage the potential human health and environmental risks associated with identified TPH (total petroleum hydrocarbons), PAH (polycyclic aromatic hydrocarbons), ammoniacal nitrogen and asbestos contaminants in soil by active remediation and/or breaking source-pathway-receptor linkages through material management and thus facilitate recovery / reuse within the development platform.

To achieve this objective the remediation works are intended:

- to excavate, test, sentence and segregate all soil materials as required (but including identified TPH hotspots) and where soil materials are identified as having elevated concentrations of volatile hydrocarbons, in respect to the RTVs (remedial target values), they are to be sentenced for treatment by ex situ aerobic bioremediation (prior to any stabilisation required);
- to excavate, test, sentence and segregate all soil materials as required (but including identified PAH hotspots) and where soil materials are identified as having elevated concentrations of non-volatile hydrocarbons, in respect to the RTVs, they are to be placed below to top 1m of the development platform to break direct contact and plant uptake exposure pathways; and,
- to excavate, test, sentence and segregate all soil materials as required (but including identified ammoniacal nitrogen hotspots) and where such materials is identified as having elevated concentrations of ammoniacal nitrogen, in respect to the soil leachate RTVs, they are to be sentenced for treatment by stabilisation to reduce contaminant leachability;
- to stabilise soil materials excavated from across the site to reduce moisture contents and improve compaction properties to allow compaction to achieve the criteria of 95% Maximum Dry Density (MDD) and 5% air voids and, therefore, reduce ground gas and pore water migration potential;
- to excavate, test, sentence and segregate all soil materials (including identified hotspots with free asbestos fibres), and, where visible ACM (asbestos containing material) is identified this is to be removed and sentenced for off-site disposal. Otherwise, soil materials with detected quantities of asbestos fibres in soil are to be placed within the development platform at a minimum of 1m below the formation level to break dust/fibre inhalation pathways. Maintain a watching brief for the presence of ACM in all excavated soils with identified ACM handpicked or segregated from the soil, wherever possible, and sentenced for off-site disposal. Any areas of the site where soils containing asbestos have been permanently placed should have this clearly indicated on the soil audit and

also be included on a marked up site plan indicating location, depth and extent of any asbestos containing soils.

Remediation of diffuse metal contamination in the Made Ground is not an objective of the remediation works as the concentrations of metals in the Made Ground are below the levels at which remediation is necessary. However, as a secondary benefit of the remediation and reclamation, immobilisation of diffuse metal contamination in the Made Ground is anticipated. This will limit further any potential for the generation and migration into groundwater of leachable metals in made ground soil pore waters.

Hydrocarbon compounds defined as volatile or non-volatile are listed in Table 5.8 of the 2015 RRS.

2.3 Groundwater Objectives

Concentrations of metal and metalloid determinants recorded within samples from the site are not considered to present a risk to human health for a residential with plant uptake end-use or to environmental receptors (principally the River Ouse), via leaching from soils and migration in groundwater. Similarly, measured concentrations of ammoniacal nitrogen are not considered to represent a significant risk to water resources and while active remediation works will be undertaken to reduce the leachability of ammoniacal nitrogen this will be for the purposes of 'Source Reduction' and no active remediation of groundwater is considered required.

Therefore, the objective of the works in relation to groundwater will be to minimise any temporary adverse effects to groundwater and/or surface water during the works, ensure there is no significant deterioration in groundwater quality following remediation and to reduce ammoniacal nitrogen leachability to the groundwater. To achieve this objective the remediation works are intended:

- to provide for groundwater monitoring prior to, during and following completion of the remediation and reclamation works with assessment of trends or statistics, in combination with comparison with set values (e.g. Updated Site Specific Assessment Criteria (SSAC) for Groundwater derived as part of the updated Hydrogeological Risk Assessment (HRA) (Arcadis, 2020) where appropriate);
- to provide for leachate testing of materials during the works following excavation and following remediation prior to placement;
- to assess results of leachate chemical testing against Tier 3 risk assessment values for ammonia and ammonium;
- to remediate Made Ground materials to reduce ammonia and ammonium leachability via soil stabilisation.
- to provide temporary works capture, treatment and discharge of any perched water encountered during the works so to minimise the risk of adverse impact upon receiving surface waters and/or facilitate compliance with any discharge consent criteria; and
- to stabilise soil materials excavated from across the site, where required, to improve compaction properties and to compact fill to reduce pore spaces and, therefore, reduce infiltration rates and contaminant leaching potential.

2.4 Ground Gas Objectives

The objective of the 2015 RRS and the updated RRSA is to reduce ground gas concentrations and flow to a level compliant with the Amber 1 level of the NHBC traffic light system, with the proviso that conditions following remediation and reclamation will be no greater than Amber 2.

As outlined within the RRSA recent data and trend analysis indicates a significantly improved situation compared with the 2015 RRS assessment due to continued degradation of Organic Rich Material within deposited Made Ground. Two ground gas monitoring locations are currently classified as Amber 2 (in accordance which are located in Historic Pond 7, three locations classified as Amber 1 and all remaining locations classified as Green.

Therefore, the focus of the remediation works in relation to ground gas will concern Organic Rich Material located within Historic Pond 7 where the two Amber 2 classifications are observed.

To achieve this objective the remediation and reclamation works are intended:

- to excavate any significant Organic Rich Material encountered within Made Ground present within Historic Pond 7 and subject sentenced materials to ex situ aerobic bioremediation in order to reduce the gassing potential of this material prior to placement (following any stabilisation required);
- to stabilise soil materials excavated from across the site, to improve compaction properties and to compact fill to reduce pore spaces and, therefore, reduce ground gas migration potential. It is also noted that high pH conditions created by lime and/or cement addition are likely to be strongly inhibitory towards microbial degradation processes generating ground gas;
- Placement of remediated / recovered Organic Rich Material is to be primarily within areas of Green Infrastructure and Public Open Space (POS) as a greater degree of stabilisation is required to achieve geotechnical suitability if placed in other areas and to provide additional confidence residential dwellings are protected from ground gas;
- to provide for gas monitoring prior to, during and following completion of the remediation and reclamation works; and
- to create a residential development platform where ground gas conditions are appropriate to Amber 1 and at most is not greater than Amber 2 (NHBC Traffic Light System).

2.5 Unanticipated Contamination

In the event that contamination is encountered at any time when carrying out the remediation and reclamation works that was not previously identified, an investigation and a risk assessment will be undertaken and where remediation is considered necessary a remediation scheme will be prepared and agreed with the relevant authorities.

Where unanticipated areas of contamination, similar to that encountered elsewhere within the site, are identified then the process set out here will be followed:

- excavation of materials;
- sampling for, and undertaking chemical analysis;
- assessment of chemical data; and,
- sentencing for remediation, as necessary.

The location of any such unanticipated contamination encountered will be recorded, including the results of chemical testing, the volumes sentenced for treatment by remediation, the validation data showing compliance with the relevant RTVs and the location of the area of use of the remediated material within the development platform.

3 Remediation Criteria

3.1 Remediation Criteria for Soils

The remediation criteria for soils remains in accordance with those defined within the 2015 RRS and accepted as part of the full planning permission granted for the proposed redevelopment (14/02798/FULM granted 15 September 2017). These remediation criteria are reproduced below for ease of reference.

The geochemical suitability of all earthworks materials to be used in the development within 1m of the anticipated formation level including garden areas and the footprint of buildings are to be assessed against site specific soil Remedial Target Values (RTVs) derived for risks to human health for a Residential with Plant Uptake End use as detailed in Table 1. Where soil materials are identified as having elevated concentrations of non-volatile hydrocarbons, in respect to the RTVs, they are to be placed below to top 1m of the development platform to break direct contact and plant uptake exposure pathways. Table 2 classifies the main contaminants as either volatile or negligible / non volatile.

The soil RTV for means of assessing human health risk from soils within 1m of the formation level at the site have been selected based on AECOM in-house Generic Assessment Criteria (GAC) derived using the CLEA v1.06 software (utilising toxicological and chemical parameter information from various sources including the EA, LQM/CIEH and CL:AiRE). The GAC provide a conservative Tier 1 screening assessment against which to compare the levels of contaminants recorded.

Determinant	Units	Residential with Plant Uptake End Use*		
Metals and Metalloids				
Arsenic	mg/kg	31		
Boron (water soluble)	mg/kg	291**		
Cadmium	mg/kg	11		
Chromium (III)	mg/kg	627		
Chromium (VI)	mg/kg	4.3		
Copper	mg/kg	2327**		
Lead	mg/kg	450		
Mercury (inorganic)	mg/kg	169		
Nickel	mg/kg	127		
Zinc	mg/kg	351		
Selenium	mg/kg	3750		
Cyanide (free)	mg/kg	1.2**		
PAHS	**At Organic Matter Content**	**1%**	**2.5%**	**6%**
Acenapthene	mg/kg	210	480	1000
Acenaphthylene	mg/kg	170	400	850
Anthracene	mg/kg	2300	4,900	9,200
Benzo(a)anthracene	mg/kg	3.1	4.7	5.9
Benzo(b)fluoranthene	mg/kg	5.6	6.5	7
Benzo(k)fluoranthene	mg/kg	8.5	9.6	10
Benzo(ghi)perylene	mg/kg	44	46	47
Benzo(a)pyrene	mg/kg	0.83	0.94	1
Chrysene	mg/kg	6	8	9.3
Dibenzo(ah)anthracene	mg/kg	0.76	0.86	0.9
Fluoranthene	mg/kg	260	460	670

Determinant	Units	Residential with Plant Uptake End Use*		
Fluorene	mg/kg	160	380	780
Indeno (123cd) pyrene	mg/kg	3.2	3.8	4.2
Naphthalene	mg/kg	1.5	3.7	8.7
Phenanthrene	mg/kg	92	200	380
Pyrene	mg/kg	560	1,000	1,600
TPH (Speciated)	**At Organic Matter Content**	**1%**	**2.5%**	**6%**
Aliphatic > C5-C6	mg/kg	30	55	110
Aliphatic > C6-C8	mg/kg	73	160	370
Aliphatic > C8-C10	mg/kg	19	46	110
Aliphatic > C10-C12	mg/kg	93 (48)#	230 (116)	540 (282)
Aliphatic > C12-C16	mg/kg	740 (24)#	1,700 (59)	3000 (142)
Aliphatic > C16-C21	mg/kg	45,000 (8.5)#	64,000 (21)	76000
Aliphatic > C21-C35	mg/kg	45,000 (8.5)#	64,000	76000
Aromatic > C5-C7	mg/kg	65#	130	280
Aromatic > C7-C8	mg/kg	120#	270	611
Aromatic > C8-C10	mg/kg	27	65	151
Aromatic > C10-C12	mg/kg	69#	160	346
Aromatic > C12-C16	mg/kg	140#	310	593
Aromatic > C16-C21	mg/kg	250#	480	770
Aromatic > C21-C35	mg/kg	890#	1100	1230
BTEX				
Benzene	mg/kg			0.33
Ethylbenzene	mg/kg			350
Toluene	mg/kg			610
Xylene (m)	mg/kg			250
Xylene (p)	mg/kg			240
Xylene (0)	mg/kg			230
OTHER				
Dioxins and Furans	µg/kg	8.5**		
Phenol	mg/kg	210	390	780
Asbestos	-	Presence not detected		

* These are values based on published SGVs or GACs derived using CLEA model based on a sandy loam soil

** URS derived GACs for residential with plant uptake end use

Note - Theoretical soil saturation limit given in brackets

Table 1 Soil Remedial Target Values (RTV) for Bulk Earthwork Material

The soil RTV are to be used as both 'suitable for reuse' criteria for soils located outside the EP boundary, which are proposed to be reused under the CL:AiRE Definition of Waste Code of Practice (DoW CoP), as well as soil Compliance Criteria supporting the bespoke waste recovery permit in relation to waste deposited within the EP boundary (as part of the recovery of these wastes in line with a Deposit for Recovery Permit). Therefore,

while different regulatory regimes are required to enable the recovery and reuse of material present on site to create the development platform, the 2020 RRSA aims to align the scope of works and remediation criteria such that the protection of human health and environmental receptors is ensured. See section 3.1.2 for the re-use of soil at depths greater than 1 m below the formation level.

Determinant		Nature of Contaminant Volatile / Non Volatile
Arsenic (inorganic form)	Anthracene	
Boron	Benzo(a)anthracene	
Cadmium	Benzo(b)fluoranthene	
Chromium	Benzo(k)fluoranthene	
Copper	Benzo(ghi)perylene	
Lead	Benzo(a)pyrene	Negligibly / Non Volatile
Mercury (inorganic)	Chrysene	
Nickel	Dibenzo(ah)anthracene	
Zinc	Fluoranthene	
Mercury (inorganic form)	Indeno (123cd) pyrene	
pH	Naphthalene	
TPH Carbons Bands >C16	Phenanthrene	
Ammonia, Ammoniacal Nitrogen	Naphthalene	
Cyanide (free)	Fluorene	
Total Phenols	Acenaphthylene	
Benzene	Acenaphthene	Volatile*
Ethylbenzene		
Toluene		
Xylene		
Formaldehyde		
TPH Carbon Bands <C16		

* Generally exhibits a Henrys Law Constant (dimensionless) > $2.5x10^{-3}$

Table 2 Nature of Contaminant Volatility / Non-Volatility

3.1.1 Non-Aqueous Phase Liquids

Where specific organic determinants are recorded at concentrations below the RTV but above the theoretical soil saturation limit (see Table 1) then assessment shall be made as to the presence of Non-Aqueous Phase Liquid (NAPL) within the soil matrix.

No site won materials and/or imported soils or materials shall be used within the bulk earthworks, where NAPL is identified.

3.1.2 Contaminant Odour & Volatility

Materials exhibiting exceedances of metal / inorganic or non/negligibly volatile organic RTV for residential with gardens end use shall be deemed geochemically suitable for use at depths greater than 1m below the formation level. Materials containing potential volatile contaminants exceeding the relevant RTV may not be present at any depth within the development platform unless subject to further site specific risk assessment indicating that the potential risk is acceptable. Any change to the RTV must be agreed with the client or the client's representative and the EA.

Table 2 classifies the main contaminants as either volatile or negligible / non volatile. The list of determinants in the table is not exhaustive and where exceedances of organic determinants not included in the table are

identified during geochemical testing an assessment as to their potential volatility shall be made before determining final placement or disposal options for the material in question.

No material shall be used in the works within 1 m of the formation level, irrespective of whether the concentrations of organic determinants are within the RTV, should this material have the potential to give rise to odour nuisance.

3.1.3 Material Reuse as Plant Growth Media

During the remediation and reclamation works, excavated material which is considered potentially suitable for reuse as plant growth media (topsoil type material) within future residential gardens and/or within Public Open Space (POS) will be identified, segregated and assessed in order to maximise the reuse of this material and minimise off-site disposal.

The overall approach in reusing material currently on site within the proposed development footprint as plant growth media is intended to be in accordance with the Waste Strategy for England 2007 (Defra, 2007) as well as the strategic objectives outlined in the Construction Code of Practice for the Sustainable Use of Soils on construction sites (Defra, September 2009) to 'increase diversion of non-municipal waste (including soil) from landfill and to secure better integration of treatment processes with the aim of reducing waste by making products with fewer natural resources'.

An initial survey of potentially suitable material has been undertaken by Arcadis (Ground Investigation Factual Report, Arcadis, August 2019) with laboratory analysis undertaken on 9 soil samples (collected from the top 0.6m bgl) for comparison with the specifications detailed within British Standards Institution (BS) Specification for Topsoil (BS 3882:2015).

It is noted that BS 3882:2015 specifies requirements for natural and manufactured topsoils that are moved or traded for creating soil profiles intended to support plant growth. The standard is not applicable to subsoil, or to topsoil that is to remain in situ, such as potentially suitable material currently present on site. BS 3882:2015 is not intended to preclude the use of topsoil that is already on site and suitable for its intended purpose. This standard specifies requirements for multipurpose topsoil, which is fit for the majority of needs.

Therefore, the specifications for multipurpose topsoil within BS 3882:2015 will be used as an initial screen to inform the suitability of site soils for reuse as plant growth media. However, the specific end use and location for deposit of plant growth media will also be considered with a view to maximising reuse of material which may fail some of the BS 3882:2015 specifications, this will ensure suitable topsoil material on site can be classified as suitable for a specific purpose.

Table 3 below summarises the results of the topsoil analysis undertaken and the strategy employed to facilitate on site reuse.

Soil Sample ID	BS 3882:2015 Pass / Fail?	Reason for Fail	Strategy to Facilitate Reuse
AUK-TP-27 (0.0-0.6m bgl)	Fail	Texture Organic Silty Clay	Likely suitable in areas with low footfall such as sloped banking with trees or shrubbery
AUK-TP-28 (0.2m bgl)			
AUK-TP-23 (0.2m bgl)	Pass Multipurpose	-	Suitable for general purpose use
AUK-TP-08 (0.0-0.1m bgl)	Fail	pH, K and Mg	Likely suitable in grassed areas of Public Open Space and/or in areas with specific species of trees and shrubs
AUK-TP-32		K and Mg	

Soil Sample ID	BS 3882:2015 Pass / Fail?	Reason for Fail	Strategy to Facilitate Reuse
(0.0-0.3m bgl)			
AUK-TP-03 (0.0-0.3m bgl)		K and Mg	
AUK-TP-04 (0.0-0.3m bgl)	Pass Specific Purpose: Low Fertility	-	
AUK-TP-01 (0.0-0.3m bgl)			

Table 3 Summary of Topsoil Analysis and Reuse Approach

The results of the ground investigation works, initial soil survey and the strategy outlined here in relation to plant growth media will be incorporated into Materials Management Plan (MMP) and it is recommended that a Soil Resource Plan be developed as part of works implementation (either as a standalone document or as an update to the MMP) showing the areas and type of topsoil and subsoil to be stripped, haul routes, the methods to be used, and the location, type and management of each soil stockpile

3.2 Remediation Criteria for Soil Leachates

The chemical suitability of soil leachate (solutes from soil pore water) concentrations is to be assessed against the Tier 3 criteria for ammoniacal nitrogen (representative of ammonia and ammonium) detailed in Table 4 below.

Averaging Area	RTV for Leachate* (mg / l)
AA1a	46
AA1b	12
AA2	3
AA3a	5
AA3b	2
AA4a	2
AA4b	26

* the variation in RTV values is due to the differing distances to the receptor (River Ouse) and the variation in the length of each area.

Table 4 Soil Pore Water (Leachate) Remedial Target Values for Ammoniacal Nitrogen

Review of the RTV calculated for ammoniacal nitrogen in soil pore water (URS 2015) was undertaken by Arcadis (Updated HRA, January 2020), to confirm that the RTV will support the SSACs derived for the protection of groundwater. The RTV were derived by AECOM (formerly URS) using the EA's Remedial Target Worksheet (RTW,) in line with the Arcadis assessment of groundwater, and included Level 1 soil (predicted pore water concentration resulting from a soil source), Level 2 soil (dilution of pore water concentrations within

the underlying aquifer) and Level 3 soil (lateral migration within the underlying aquifer). It is noted that Level 3 soil is equivalent to Level 3 groundwater within RTW (i.e. both sheets derive an attenuation factor associated with lateral migration in the dissolved phase).

To review the RTV in the context of the Arcadis groundwater model; the attenuation factor calculated in the most conservative groundwater model (Source 1 with an aquifer compliance point of 250m) has been multiplied by the compliance criteria (0.5 mg/l) and by the dilution factor calculated in the RTW Level 2 soil model (URS 2015) for each averaging area. The range in acceptable pore water concentrations calculated in the context of the revised groundwater model is 269 mg/l to 545 mg/l.

Given that the acceptable pore water concentration calculated in the context of the groundwater model are one to two orders of magnitude higher than the existing RTVs within the 2015 RRS, the existing RTVs are considered to be supportive of achieving the SSAC for the protection of groundwater.

It is noted that while the soil RTV comprises a single criteria value for each parameter across the entire site, the soil pore water RTV for ammoniacal nitrogen varies according to the Averaging Areas. Therefore, excavated material will be sentenced for remediation based on comparison of the concentration of ammoniacal nitrogen in soil leachate with the RTV of the Averaging Area from which the material was excavated. In addition, prior to placement and/or following any remediation or soil stabilisation, further soil leachate testing must be undertaken, as required, to demonstrate compliance with the RTV of the destination Averaging Area. This is to ensure material is not merely moved from one area to another but that genuine source reduction is achieved across the site as a whole. It is noted that the Green Infrastructure and areas of POS, where Organic Rich Material is to be primary placed, are located within and across multiple Averaging Areas.

3.3 Remediation Criteria for Ground Gas

The focus of the remediation works in relation to ground gas will concern Organic Rich Material located within Historic Pond 7 where two Amber 2 classifications are observed.

Therefore, the remediation criteria to manage potential ground gas risks at the site are as follows:

- Ground gas monitoring will be undertaken across the development platform following the remediation works to confirm that ground gas conditions are appropriate to Amber 1 and at most is not greater than Amber 2 (NHBC Traffic Light System).
- Ground gas monitoring following remediation works will also be used to demonstrate that where methane and carbon dioxide concentrations exceed 1.5%v/v and 5%v/v respectively (Scenario 1, EPR 5.02, EA Guidance) hazardous gas flow rates (Qhgs) will be calculated in line with Scenario 2 (EPR 5.02) in accordance with the required permit surrender Completion Criteria provided by the EA in Pre-Advice Letter (EAWML68681, EA, 28th August 2015 provided in Appendix B).
- Organic Rich Material within Historic Pond 7 will be targeted for ex situ aerobic bioremediation to reduce the readily degradable organic matter content. This will be demonstrated through carbon dioxide and methane concentrations recorded during bioremediation as well as other parameters (as detailed in Table 12, Section 5.1) which will provide lines of evidence to allow validation of the bioremediation works. Reductions in the TOC (total organic carbon) content, as well as forensic organic matter testing of the material may also be used as a line of evidence to support the reduction in readily degradable organic matter content.

The NHBC traffic light classification system is summarised and applied in the 2020 RRSA in accordance with the NHBC “Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present” 2007. The EP Scenario 1 and Scenario 2 completion criteria for ground gas are outlined below and detailed within the ‘Landfill (EPR 5.02) and other permanent deposits of waste, How to surrender your environmental permit’ (EA additional guidance, LIT 5144 / 1056_12, Version 2, Issued 13/12/2012).

Scenario 1 Completion criteria

Gas concentration

Maximum methane concentration is less than 1.5%v/v

Maximum carbon dioxide concentration is less than 5%v/v

Scenario 2 Completion criteria

Gas concentration

Maximum methane concentration is less than 5%v/v and

Maximum carbon dioxide concentration is less than 10%v/v

Flow rate

Qhgs is less than 0.7l/h

Maximum flow in any borehole is less than 70l/hr

As described in Section 5.2, ground gas monitoring will be undertaken at monthly intervals post works completion for a period of 24 months. Should 12 consecutive monthly monitoring visits indicate ground gas compliance criteria have been met then it is understood that this will be accepted by the EA (Pre-application Advice, August 2015) with no further ground gas monitoring required.

3.4 Assessment Criteria for Groundwater

The updated HRA concluded measured concentrations of ammoniacal nitrogen were not considered to represent a significant risk to water resources and no active remediation of groundwater is considered necessary.

Therefore, the objective of the works in relation to groundwater will be to minimise any temporary adverse effects to groundwater during the works, ensure there is no significant deterioration in groundwater quality following remediation, and to reduce ammoniacal nitrogen leachability to the groundwater.

To support this objective, groundwater assessment criteria will focus on groundwater quality trend analysis with reference to pre remediation concentrations to demonstrate there has been no significant deterioration in groundwater quality following remediation and thus there remains no significant risks to identified water resource receptors. Groundwater assessment criteria will also attempt to align as far as practicable with the provisions of the EP Variation (EPR/QP3593NF/V002) and the updated EP Variation Working Plan (URS, October 2015).

Groundwater assessment criteria may include assessment of trends or statistics, in combination with comparison with set values, and are as follows:

- **During remediation** - to assess the groundwater quality in existing groundwater monitoring wells (defined in Section 5.3) against Control Levels defined within the updated EP Variation Working Plan (URS, October 2015) to determine whether the results are indicative of the prevailing groundwater conditions or whether the remediation and reclamation works have impacted the groundwater regime as a result of mobilisation of contamination. These control levels are based on the upper 95th percentile of monitoring data collected between 2010 and 2014, therefore, data collected subsequent to this period will also be considered. This could include assessment of the groundwater quality observed during the 3 monthly visits undertaken immediately prior to commencing remediation works to update this ‘baseline’;
    - Should this assessment conclude that the results are potentially indicative of a mobilisation of contaminants then the frequency of monitoring will be increased and a repeat monitoring round shall be undertaken. It is anticipated that disturbance of the sub surface during remediation may result in short term changes in groundwater conditions, such as a one-off “pulse” of mobilised contaminants. However, where the results consistently indicate elevated concentrations of determinants then additional mitigation measures may be required to limit the potential risks to groundwater arising from the works.

- **Post remediation** – to assess groundwater quality trends within replacement monitoring wells (defined in Section 5.3) following remediation works to demonstrate there are no significant sustained increases in concentrations of ammoniacal nitrogen and other metal or metalloids contaminants listed in the EP Variation. Assessment of trends may include statistical analysis where appropriate, or comparison with simple descriptive statistics.
  - For replacement monitoring wells which are direct replacements for existing monitoring wells (listed within the EP Variation working Plan (URS, February 2015)) and for which representative data is likely available for pre remediation conditions, then reference will also be made to these pre remediation concentrations (including Control Levels) to demonstrate there is no significant deterioration in groundwater quality following remediation;
  - For replacement monitoring wells which are not direct replacements for existing monitoring wells and for which representative data is not likely available for pre remediation conditions then, if a sustained increasing trend is observed, reference will also be made to the updated SSAC (Updated HRA, Arcadis, 2020) provided these replacement wells are associated with identified Sources (Updated HRA, Arcadis, 2020). Where these wells are not associated with a Source, then further risk assessment may be undertaken if deemed required, including reference to EQS and/or DWS standards, if relevant.

The Updated SSAC for Groundwater derived as part of the updated HRA (Arcadis, 2020) are shown below. Source 1 and Source 2 referenced within the table below are shown in Figure 3 of the Update HRA (Arcadis, 2020).

Contaminant of Concern	Updated Water Resources SSAC (mg/l)			
	Source 1 - Aquifer	Source 1 - Surface Water	Source 2 - Aquifer	Source 2 - Surface Water
	250m Compliance Point	400m Compliance Point	250m Compliance Point	250m Compliance Point
Ammoniacal Nitrogen	256	3520	308	370

Table 5 Update Site Specific Assessment Crities (SSAC) for Groundwater (mg/L) (Updated HRA, Arcadis 2020)

As described in Section 5.3, groundwater monitoring will be undertaken at monthly intervals during the works, then at post completion for a period of 24 months within a network of replacement wells installed across the site. Should 12 consecutive monthly monitoring visits (post completion) indicate ground monitoring compliance criteria have been met then it is proposed that this will be accepted by the EA and no further monitoring required.

3.5 Criteria for Off Site Disposal

In accordance with the 2015 RRS, materials displaying characteristics that render them unsuitable for use in the development platform shall be segregated and sentenced for off-site disposal. It is envisaged that the volume of such material will be relatively small and all excavated material will be recovered / remediated and reused on site wherever possible.

Prior to the off-site disposal of material the concentrations of the contaminants in the material shall be reviewed to determine whether the material would be classified as Hazardous Waste in accordance with the Hazardous Waste Regulations (England & Wales) Regulations, 2005 and associated guidance. Note that this determination is relevant only where it is intended to discard material as waste. It is not relevant to materials, including waste material within the EP boundary, undergoing recovery and remediation processes which will be reused to construct the development platform.

All wastes to be disposed of off-site shall be subject to basic waste characterisation (e.g. source and origin of waste, composition of the waste, and the relevant European Waste Code (EWC)) and classified as being potentially inert, non-hazardous or potentially hazardous. Following this characterisation should the waste be

potentially hazardous (or inert) then waste acceptance criteria (WAC) testing will also be undertaken to determine the suitability of the material for disposal to either an inert or hazardous landfill facility. The required testing will be carried out at the frequencies given in Table 12 (Section 5.1) in accordance with the Environmental Permitting (England & Wales) Regulations (2010), the List of Wastes (LoW) (England) Regulations (2005) and the Technical Guidance (WM3) on the classification and assessment of waste (Version 1.1, 2018).

The following EWC / LoW codes have been identified for waste currently deposited within the EP boundary which are considered likely relevant for soils located outside the EP boundary should these not be suitable or required for reuse within the development platform.

General Description	EWC Waste Code	EWC Description	Comments
Granular Made Ground	17 05 (03 / 04)	Soil and stones	Asbestos has been identified in 6 soil samples across the site
Cohesive Made Ground			
Organic Rich Material	02 04 01	Soil from cleaning and washing beet	Includes current and historic lagoon sediments. Plant remains observed historically in some locations.
Sugar Factory Lime Material	02 04 02	Off-specification calcium carbonate	
Oversized Material	17 01 07	mixtures of, or separate fractions of concrete, bricks, tiles and ceramics	
Recovered Material	19 13 02	solid wastes from soil remediation	soils subject to a remediation process, meeting risk-based criteria and then suitable for re-use in the works, and generated entirely from within the site

Table 6 European Waste Catalogue (EWC) Codes for Waste Currently Deposited within the EP Boundary

The statutory limits that apply to the waste acceptance criteria are presented in Table 7 below (transposed from Council Decision annex 2003/33/EC). Waste materials shall only be disposed of at the appropriate classification of landfill for that type of waste. The landfill operator shall be issued with the basic characterisation and WAC testing results for review prior to disposal.

Parameter	Inert waste landfill	Stable non-reactive	Hazardous waste landfill
Parameters determined on the waste - total concentration			
Total organic carbon (% w/w)	3%	5%	6%*
Loss on ignition (% w/w)			10%*
BTEX (mg/kg)	6		
PCBs (7 congeners) (mg/kg)	1		
Mineral oil C10-C40 (mg/kg)	500		
PAHs (mg/kg)	100		
pH		>6	
Acid neutralisation capacity		To be evaluated	To be evaluated

Parameter	Inert waste landfill	Stable non-reactive	Hazardous waste landfill
Limit values (mg/kg) for compliance leaching test using BS EN 1247 at L/S 10 l/kg			
As (arsenic)	0.5	2	25
Ba (barium)	20	100	300
Cd (cadmium)	0.04	1	5
Cr (chromium (total))	0.5	10	70
Cu (copper)	2	50	100
Hg (mercury)	0.01	0.2	2
Mo (molybdenum)	0.5	10	30
Ni (nickel)	0.4	10	40
Pb (lead)	0.5	10	50
Sb (antimony)	0.06	0.7	5
Se (selenium)	0.1	0.5	7
Zn (zinc)	4	50	200
Cl (chloride)	800	15,000	25,000
F (fluoride)	10	150	50
SO_4 (sulphate)	1000	20,000	50,000
Total dissolved solids (TDS)	4,000	60,000	100,000
Phenol index	1		
Dissolved organic carbon at own pH or pH7.5-8.0	500	800	1,000

* Either loss on ignition or total organic carbon testing must be used for Hazardous Wastes

Table 7 Waste Acceptance Criteria (WAC)

3.6 Earthworks Criteria

The proposed performance criteria are summarised as follows.

Materials placed as compacted fill should comply with the properties of Class 2A/B/C and / or Class 1A/B/C.

- It is intended that the density for compacted material should be a specified minimum of 95% of the maximum dry density (4.5 kg test); and should be a specified maximum of 5% air voids where the particle density has been measured.
- Extraneous non-mineral materials such as fragments of plastic, wood and textile fragments and the like should be removed from the material before compaction as far as practicable. Durable materials including brick, concrete and masonry may be retained within the fill provided their largest particle dimension is no greater than two-thirds of the layer thickness being compacted and in any case no greater than 200 mm. Particles larger than 200 mm will be segregated, crushed and used in the fill.
- Plate bearing tests on the completed formation using the 600mm diameter plate should be considered acceptable where settlement under a sustained load equivalent to 100 kN/m² is less than 25 mm.
- Hand shear vane tests shall be undertaken at formation level and at the bases of excavations in cohesive materials. Soils used for fill should reach at least firm consistency with a minimum undrained strength Cu of 60 kN/m2 if cohesive and/or be engineered to a relative density of at least medium dense if granular (may require stabilisation / modification; the extent of this will depend on the condition of the fill).

- Where the natural formation is found to consist of compressible or highly plastic soils, additional earthworks, modification, or an alternate foundation solution will be adopted.

All specified geotechnical tests would be undertaken to the proposed frequencies referred to in Table 1/5a and to satisfy any requirements for the classification of materials in accordance with Series 600 earthworks specifications. Classification of material will comprise both geotechnical and geochemical references.

The type and frequency of testing detailed in Table 8, has been determined on the basis of past experience of earthwork schemes in a variety of conditions. The frequency is sufficient to ensure that the characteristics and acceptability of the fill materials are confirmed with a reasonable degree of confidence relative to the proposed volume of fill to be placed.

The frequency of testing should not be considered exhaustive; additional testing may be necessary where materials are shown to be marginal, or where localised pockets of unsuitable material are encountered.

The geotechnical acceptability criteria, for compacted material to be used in the development, are set out in Table 8.

Accurate records will be kept of materials encountered, general locations (i.e. grid cells and depth) and approximate volumes throughout the excavation phase of works operations.

All earthworks materials will be classified in accordance with the Specification for Highways Works as detailed in Appendix A.

Where required in Appendix A unacceptable material will be processed by mechanical, chemical or other means to render the material acceptable for use in the works as per the requirements of Table 6/1 and Appendix A or sent for disposal off-site.

All earthworks materials shall be subject to classification and geochemical testing from stockpiles following excavation and segregation according to material type as well as from stockpiles of remediated or imported material prior to placement. Accurate records will be kept of materials encountered, locations and approximate volumes throughout the excavation phase of earthworks operations.

Any sampling locations required for classification purposes will need to be established in advance of works commencing. The rate of testing required will be sufficient to ensure the correct classification of materials, taking specific account of the variability of materials properties.

Potentially geotechnically marginally unsuitable materials, such as may occur through moisture content higher than the range specified for compaction, may be rendered suitable through stabilisation, blending with suitable material, and/or by placing the material in discrete layers (300mm maximum) towards the base of the filled area. All such materials stabilized and / or blended would require testing to ensure compliance with the earthworks specification, in particular the end-product compaction criteria.

Extraneous non-mineral materials will be removed from the material before compaction as far is practicable. Durable materials including brick, concrete and masonry may be retained within the fill provided their largest particle dimension is no greater than two-thirds of the layer thickness being compacted and in any case no greater than 200 mm. Particles larger than 200 mm will be segregated, crushed and used in the fill.

Clause	Work, Goods or Material		Test	Frequency of Testing	Test Certificate	Comments
Series 600						
601, 631 to 637 & 640	Acceptable material		For site-won aggregate, see sub-clauses 601.12 and 601.18. Cross-reference should be made to any requirements in Appendix 6/1			
	Class	General Description				
	1	General granular fill	Grading / uniformity coefficient	Twice a week	Required	
			MC (N)	1 per 250m³		
			OMC, Max DD and particle density (N)	1 per 2,000m³		
		1C only	Los Angeles coefficient (N)	Weekly		
	2	General cohesive fill	Grading	Twice a week per source	Required	
			MC (N)	1 per field hand shear vane determination [see below]		
			MC/PL/LL (N)	From 10 locations in planted areas: each sampled and tested at 0.25m, 0.5m and 1.0m depth		To assess desiccation and heave potential
			OMC, max DD and particle density (N)	1 per 2,000m³		
			Field undrained shear strength of remoulded material (N)	Minimum of 5 determinations [sets of 3no readings] per day		[Field Hand Shear Vane] See Notes 8 & 9 to Table 6/1
			Laboratory undrained shear strength of remoulded material (N)	1 per 250m³ (with a minimum of 2 tests per week)		[Laboratory multistage Triaxial] See Note 9 to Table 6/1
	4	Fill to Landscape Areas	Grading	Daily	Required	
			MCN (V)	Daily		
	5	Topsoil	Grading	Daily	Required	
	6 (except 6F4, 6F5)	Selected granular fill	Grading/ uniformity coefficient	1 per 250m³	Required	
			PL/LL (N)	Daily		
			Los Angeles coefficient (N)	Weekly (on-site source); Monthly (imported)		
			OMC/MC (N)	1 per week per source	Required	
			Bitumen content	Weekly		
			Class A (asphalt) content	Weekly		
612	Compaction of fills				Required	See Note 12 to Table 6/1
		Method compaction	Field dry density (N)	Frequency as required in compaction trial.		
-	All Classifications of Material		BRE/TRL Sulphate Analysis Suite	1 per 2500m³	Required	See Note g)

Work, Goods or Material	Test	Frequency of Testing
Point of Placement Geotechnical Tests on CLASS 1 and CLASS 2 Materials		
Compacted Fill (including Blended and/or stabilised Fill)	Nuclear Density Gauge Tests to BS1377 (1990) part 9 (including confirmatory laboratory mc for each NDG test).	6no. tests per 1000m^3
Compacted Fill (including Blended and / or stabilised Fill)	Sand Replacement Density tests	1no. test per 12 no. Nuclear Density Gauge tests
Compacted Fill (including Blended and /or stabilised Fill)	Particle Density test	1no. test per Sand Replacement test
Compacted Fill (including Blended and / or stabilised Fill)	Grading MC (N) PL/LL (N) OMC, max DD and particle density (N)	1 no. test per 900 m^2 @ Formation Level and Formation Level -1m (see note h)
Development Platform	Plate bearing tests on a 30m grid positions varies with successive layers. All tests to be conducted using 600mm diameter plate, at a test load equivalent to 100kN/m^2	1 test per 900m^2 @ Formation Level, Formation Level -1m and formation level -2m
Road Corridors	CBR testing	Allow for 15no. CBR tests @ Formation Level along anticipated road corridors across development
Fill Areas subject to prior excavation and compaction	Rod - & - plate settlement monitoring with base plate set at base of excavated sub-formation	Allow for 20no R&Ps, locations to be confirmed on inspection of sub-formation, to be monitored commencing with base readings and continuing weekly for minimum 3months then monthly until 6 months after reaching formation level

Notes applying to the Table 1/5a

a) (N) indicates that a UKAS accredited laboratory sampling and test report or certificate is required.

b) Unless otherwise shown in this Table test certificates for work, goods or materials are required for all such work, goods or materials in the Works.

c) Testing specified in this Table is to be undertaken on all relevant materials.

d) Testing to be carried out will be undertaken in accordance with the Specification for Highways Works, 600 Series.

e) All geotechnical testing to be carried out by a NAMAS accredited laboratory. All chemical analysis will be UKAS and MCERTS accredited as appropriate.

f) All sampling will be carried out in accordance with the `Specification for Ground Investigation' (Publication No 3 in the site investigation in construction series) published by Thomas Telford Ltd, 1993. Reporting will be in digital form in addition to paper records as specified in Appendix III of the aforementioned documents.

g) Sulphate testing suite to be performed according to BRE Special Digest 1 (SD1:2005) as well as to any TRL report recommendations for brownfield land that may contain pyrite.

h) Inclusion of geotechnical testing of all hard material encountered and crushed to ensure materials suitability for future inclusion in works.

i) Data to be used to assess desiccation and heave potential of cohesive materials placed as fill

Table 8 Geotechnical Testing to be Carried out on all Earthworks Materials and Wastes

3.7 Slope Stability

Slopes have been designed based on RRa maximum gradient of 1 vertical to 3 horizontal. Detailed slope stability calculation is being carried out to confirm the suitability of the design in the permanent condition.

Temporary slopes on site will be no steeper than 1 vertical to 2 horizontal. Such slopes will be subject to regular inspection by a competent person.

3.8 Validation of Compaction

Confirmation that adequate compaction has been achieved (95% of MDD, <=5% air voids) will be achieved by undertaking nuclear density testing and sand replacement density or core cutter testing (subject to material type).

4 Materials Management

This section details the procedures and measures that shall be taken to classify, track, store, use and dispose of the materials that will be encountered during the remediation and reclamation works and is intended to inform the production of a Materials Management Plan (MMP) which will be produced prior to commencing works.

4.1 Material and Waste Volumes

The total quantity of the waste located within the EP boundary requiring excavation and recovery has been modelled and calculated using Geographic Information System (GIS) software based on the 2019 topographical survey and previous site investigation data. This volume is estimated at **746,800m3** based on the excavation to the base of the Made Ground (i.e. excavation of the entire thickness of waste).

The bulk density of the waste in situ, i.e. including entrained moisture, is variable broadly ranging from about 1.7 – 2.1 tonnes per cubic metre. Using an average of 2.0 tonnes per cubic metre gives an estimated total tonnage of 1,493,600 tonnes.

The reclamation works and WRP rely on a cut-fill balance as a sustainable approach to providing the development platform needed to enable residential redevelopment. Therefore, GIS modelling software has also been used to determine the volume of material required to construction the development platform within the EP Boundary and across the entire site using the elevations and contours defined within 'Proposed Contours -DR-CE-00602 P5' Approved Plan 14/02798/FULM, presented in Appendix A). The volume of material required to construct the development platform within the current EP boundary is estimated to be 513,500m3 with 446,100m3 required to construct the development platform outside the current EP boundary.

Therefore, in order to construct the required development platform across the site, it is proposed to permanently deposit **513,500m^3** of recovered waste within the current EP boundary with the remaining **233,300m^3** of recovered waste proposed to be permanently deposited across the proposed extended EP boundary. Made Ground soils originating from outside the EP boundary are proposed to be reused under the CL:AiRE DoWCOP framework to make up the remaining volume of required construction fill (212,800m3).

The approximate volumes of other key material types present within waste deposited in the current EP boundary were estimated and are shown in Table 9 below.

	Location	Total Excavated Volume (m^3)	Organic Rich Material (ORM) (m^3)	Ammoniacal Nitrogen Contaminated Material (m3)	Overlap Between ORM & Ammoniacal Nitrogen Contaminated Material* (m^3)	Potential Topsoil Type Material (m^3)	Sugar Factory Lime (SFL) (m^3)	Granular and Cohesive Made Ground (m^3)	Sediment (m^3)	Total Petroleum Hydrocarbon (TPH) Contaminated Material (m^3)
EP Boundary	Central Tank Bund	16,800	-	-	-	-	-	10,900	-	5,900
	NWWTP Lagoon Bunds	140,550	6,500	18,300	-	900	2,100	109,650	3,000	-
	Limex Pond	5,800	-	-	-	-	-	1,500	4,300	-
	Historic Pond 7	6,200	1,400	3,100	1,300	-	-	2,800	300	-
	Historic Pond 4	39,300	5,400	3,300	1,100	200	100	31,200	100	-
	Historic Pond 5	46,500	7,000	7,500	3,100	300	400	34,200	200	-
	Limex Pond Bund	85,400	5,400	17,100	-	0	100	62,500	-	-
	Weigh Bridge Area	74,900	5,000	10,700	900	100	100	59,800	100	-
	Soil Conditioning Area	188,600	53,800	45,800	21,800	3,500	13,400	94,000	-	-
	Tank Farm Bund	100,400	28,600	24,400	11,600	1,800	7,100	50,000	-	-
	Ponds and Lagoons	42,350	-	-	-	-	-	-	35,250	-
	Inside EP Boundary Total	**746,800**	**113,100**	**130,200**	**39,800**	**6,800**	**23,300**	**456,550**	**43,250**	**5,900**

***While a significant volume of Organic Rich Material is contaminated with ammoniacal nitrogen this is not the case in all locations and the degree of overlap is presented to avoid double counting of ORM and ammoniacal nitrogen contaminated material.**

Table 9 Calculated Approximate Volumes of Material Types within Waste Deposited in the EP Boundary

4.2 Materials Management Strategy

4.2.1 Materials Classification

All excavated materials and waste will be segregated based on visual assessment and classified into the following material types detailed in Table 10 below.

Material Type	Classification	Anticipated Final Destination of Material
Granular Made Ground	GMG (W)	Use as general fill (in accordance with acceptability criteria)
Cohesive Made Ground	CMG (W)	Use as general fill (in accordance with acceptability criteria)
Organic Rich Material	ORM (W)	Use primarily within green infrastructure and Public Open Space (POS). Additional stabilisation required if used as general fill
Sugar Factory Lime (SFL)	SFL (W)	Use as general fill (in accordance with acceptability criteria)
Lagoon Sediment	LS (W)	Use as general fill (in accordance with acceptability criteria)
Cohesive Natural Ground	CNG (W)	Use as general fill (in accordance with acceptability criteria)
Plant Growth Media	PGM (W)	Use primarily within green infrastructure and Public Open Space (POS). Limited imported topsoil may be required.
Concrete & Aggregate	CA (W)	Use primarily as secondary aggregate in e.g. founding layer for roads and hard standings and as general fill (in accordance with acceptability criteria).

Table 10 Materials Management – Material Types and Classification

These material types have been selected to support appropriate materials processing, remediation, soil stabilisation and end use.

The material classification system shall enable the identification of different sources of the same type of material. This shall be achieved by designating each source with a unique number. Excavated waste from within the EP boundary will be further classified denoted by (W) as shown in the table above and segregated from soils excavated from outside the EP boundary throughout the entire material handling process.

Where a particular material is not suitable for its proposed use destination then the material will be used at an alternative location on-site in accordance with the appropriate geochemical and geotechnical acceptability criteria.

4.2.2 Materials Tracking and Storage

An MMP will be produced to detail provisions outlined below including materials segregation and data management as well as to provide lines of evidence regarding material quantities, suitability and certainty of use to support soils reuse under the DoWCoP framework.

The first stage of the tracking process is the identification and classification of the various separate works materials. This shall be undertaken accordingly to material types listed in Table 10 as well as following the system detailed in section 3.6.

A system will be put in place to identify and track all earthwork material movements including excavated materials, imported materials, material undergoing on-site remediation, and if material is sentenced for off-site disposal.

This will include the creation of a site-specific coordinate grid-system or end-use area system to geographically locate the areas of material excavation and use within the development area. For example, remediated soils originating outside the current EP boundary will be reused and placed within the DoWCoP Zone shown on Figure 3. Recovered waste will be permanently deposited across the remaining development footprint, outside the DoWCoP Zone.

The tracking system will include the facility to identify the excavated materials that are to be temporarily stored separately on-site in the designated stockpiling area whilst awaiting the results of testing, waiting to be used on site or if waiting for any off-site disposal. The tracking system will be maintained utilising an electronic database (e.g. excel, access) and key material movements will be tracked by a combination of GPS and database collation, allowing temporary stockpiles to be easily located and referenced to the applicable testing data for the material. The tracking system will be a dynamic system that will be updated daily.

Any areas of the site where soils containing asbestos have been permanently placed should have this clearly indicated on the soil audit and also be included on a marked up site plan indicating location, depth and extent of any asbestos containing soils.

In order to track material movements around the site efficiently a site-specific material transfer pro-forma will be implemented for the use of on-site personnel responsible for moving materials. An example of this pro-forma is shown in Table 11 below.

Site Specific Material Transfer Pro-forma		
Reference Number:		
Place of collection (grid / GPS reference / stockpile reference):		
Date of excavation / collection:		
Description of material being transferred:		
Classification of material:		
Volume / Mass of Material Transported:		
How is material contained?	Loose	
	Skip	
	Drum	
	Covered lorry	
	Other	
Point of temporary placement (which stockpile):		
Date of temporary placement:		
Date of Anticipated Future Move:		
Anticipated Future Destination:		
What contaminants (if any are known) are present:		
Additional Comments:		
Point of final placement (including depth):		
Date of final placement:		

Table 11 Site Specific Material Transfer Pro-forma

As part of this database management system it would be prudent to have one person appointed as responsible for record keeping on site. This resident “land quality engineer” would be responsible for acquiring and collating all material movement and site testing data throughout the works.

Where materials that exhibit exceedances of determinands have been segregated and deemed suitable for on-site remedial treatment the tracking system shall record the progress of the material through the specific remedial process including all associated testing required to validate the material as part of that process.

Where materials that exhibit exceedances of determinands have been segregated and deemed unsuitable for on-site remedial treatment the tracking system shall record temporary storage of the material prior to off-site disposal including all associated testing and documentation required (see sections 5 and 6).

The records of all materials movements on-site and off-site will be kept in paper and electronic format for a minimum period of 2 years (for non-hazardous and inert waste) or 3 years (for hazardous wastes) following completion of the works and production of the Validation / Verification Report.

A Materials Management Flowchart has been produced and is shown in Figure 4.

5 Testing and Monitoring

5.1 Geochemical Testing of Materials

Testing of all earthwork materials shall be undertaken at a minimum frequency listed in Table 12 below.

All earthworks materials shall be subject to geochemical testing from stockpiles following excavation and segregation according to material type as well as from stockpiles of remediated material prior to placement. Additional testing is to be undertaken on materials undergoing treatment via aerobic bioremediation. Geotechnical testing shall be done on a volumetric basis, rather than on a site area basis, to reflect the varying thicknesses of deposited material requiring placement in different areas.

Materials will be sentenced for remediation and other material handling processes based on the material types identified (see Section 4.2.1) and the results of geochemical testing which will be assessed against the Remediation Criteria detailed in Section 3.

Where concentrations of contaminants are measured above the respective RTV and/or are from the specific locations, hotspots or material types defined within the Remediation Criteria these will be sentenced to remediation. Additional stockpile sampling may be undertaken where considered appropriate to reflect the heterogeneity of the material within a particular stockpile in order to assist in obtaining a representative average (mean) result for all samples collected from that stockpile which can be then compared with Remediation Criteria.

Work, Goods or Material	Test	Frequency of Testing
Chemical Control Testing (Notes a, b, c, d, and g)		
All material requiring excavation (excluding potential Plant Growth Media / Topsoil)	Soil Analysis Suite (Note d) and soil Leachability Suite (Note e) Screening test for asbestos	1 test per 2,000 m^3 (including a minimum of three samples where potential contamination is suspected)
All potential Plant Growth Media / Topsoil material requiring stripping	Soil Analysis Suite (Note f)	1 test per 500 m^3 (with minimum of 3 samples per source)
All material, as required, to demonstrate compliance with soil pore water RTV of destination Averaging Area prior to placement	Leachability Suite (Note e)	1 test per 2,000 m^3
Additional Chemical Control Testing (Note a, b, c, d and g)		
All imported materials for each individual source and type	Soil Analysis Suite (Note d) and soil Leachability Suite (Note e)	1 test per 500 m^3 with minimum 12 tests per material source
Imported landscape fill (topsoil/subsoil) for each individual source and type	Soil Analysis Suite (Note d) and soil Leachability Suite (Note e)	2 tests per 500 m^3 with minimum 12 tests per material source
All materials sentenced for remediation within bioplies	Soil Analysis Suite (Note d). Soil Leachability Suite (Note e) and Bioplie Physical Characterisation Laboratory Suite, Biopile Chemical Characterisation Laboratory Suite (Note h).	1 test per 300 m^3
All materials undergoing treatment within Biopiles	Soil Analysis suite (Note h) (including Organic matter content, moisture content, and Phosphorous as Orthophosohate)	Fortnightly

Work, Goods or Material	Test	Frequency of Testing
	Temperature °C (Biopile and Air) Carbon dioxide concentrations (% v/v) Methane concentration (% v/v) Oxygen concentrations (% v/v) pH, Weather conditions	Daily (minimum five points acrossthe biopile/window)
All materials having undergone successful treatment within biopiles	Soil Analysis suite (Note d) and soil Leachability Suite (Note e) and Biopile Physical Characterisation Laboratory suite (Note h).	1 test per 300 m3
All materials sentenced for remediation by stabilisation/solidification	Soil Analysis Suite (Note d), Soil Leachability Suite (Note e) (additional testing to be determined following laboratory trials)	1 test per 300 m^3
All materials having undergone treatment by stabilisation/solidification following maturation of a minimum of 7 days	Soil Analysis Suite (Note d), Soil Leachability Suite (Note e) (Additional testing to be determined following laboratory trials)	1 test per 500 m^3 of material placed into permanent works
All materials sentenced for off-site disposal	WAC testing Suite	1 test per 100 m^3 with minimum of 3 test per batch of material

Notes:

a) Testing specified in this table is to be undertaken on all materials.

b) All chemical analysis shall be UKAS and MCERTS accredited as appropriate.

c) All sampling shall be carried out in accordance with the BS 5930:2015, the code of practice for site investigations. Reporting shall be in digital form, which is compatible with Microsoft Excel, Esdat or Access, in addition to paper records.

d) Soil analysis suite to include the following determinants:

Polycyclic Aromatic Hydrocarbons (speciated USEPA 16)
Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG)
Ammoniacal Nitrogen
Total Organic Carbon
Asbestos Screen
Asbestos Identification and Quantification (if asbestos screen proves positive)

e) Leachate analysis suite to include the following determinants:

Ammoniacal Nitrogen

f) Analysis to enable Topsoil classification in accordance within (BS 3882:2015) to include the following determinants:

Texture Class (clay, silt, sand)	Carbonate	Carbon: Nitrogen Ratio
Organic Matter Content	Nitrogen	Exchangeable Sodium Percentage
Particle Size Distribution (>2mm, >20mm,>50mm)	Phosphorus	Zinc

Soil pH	Potassium	Copper
	Magnesium	Nickel
	Available sodium	Visible Contaminants
	Available Calcium	

g) The limits of detection for the analyses shall be as specified within the 2015 RRS or lower;
h) Materials sentenced for treatment within biopiles shall be subjected to testing of the following additional determinants as well as those detailed in Note d): Soils Analysis Suite:

Particle Size Distribution (Dry or wet sieving – dependant on silt/clay content) BS1377-2:1990
Determination of permeability (constant head method) BS1377-5:1990
Compaction Test 2.5kg ('Proctor' Test) BS1377-4:1990
Moisture content
Total Organic Carbon
Soil Organic Matter content
Ammoniacal nitrogen
Phosphorous as Orthophosphate

Table 12 Schedule of Geochemical Testing of Materials

5.2 Ground Gas Monitoring

A programme of ground gas monitoring shall be carried out prior to the commencement of the remediation and reclamation works, during those works and post completion at the frequencies given in Table 13 below.

Scope of Monitoring	Test	Frequency of Testing
GROUND GAS MONITORING		
Ground gas monitoring prior to and during works will be taken from 36 wells currently monitored as part of the EP monitoring programme (tables S3.1 and S3.3 within the EP Variation (EPR/QP3593NF/V002). This includes 11 wells located within the EP boundary and 25 wells located outside the EP boundary. Locations shown on Figure 5. Ground gas monitoring following works will be taken from 36 replacement wells located within the EP boundary (listed within tables S3.2 and S3.4 in the EP (EPR/QP3593NF/V002). This includes 11 wells located within the EP boundary and 25 wells located outside the EP boundary. Locations shown on Figure 6.	Including peak and field stable measurements of carbon dioxide, carbon monoxide and methane concentrations, total gas flow, atmospheric pressure and conditions during monitoring.	Standpipe installations located around the site to be sampled prior to the works (3 monthly visits), then at monthly intervals during the works, then at monthly intervals post works completion for a period of 24 months. Post completion should 12 consecutive monthly monitoring visits indicate ground gas compliance criteria have been met then it is understood that this will be accepted by the EA (Pre-application Advice, August 2015) with no further ground gas monitoring required.

Table 13 Ground Gas Monitoring Schedule

Where the concentrations of ground gases (and flow rates) recorded during the programme of monitoring are substantially elevated above levels previously recorded additional monitoring / increased frequency may be required at selected locations. However, the Remediation and Reclamation Strategy is intended to mitigate the ground gas risk to Amber 1, with the proviso that it is no greater than Amber 2. Where monitoring locations are within areas of the development that will be subject to earthworks excavations, placement of materials or construction, the monitoring locations shall be preserved and monitored for as long as reasonably practicable.

5.3 Water Monitoring

A programme of groundwater, surface water and water arisings monitoring shall be carried out prior to commencement of the remediation and reclamation works, during those works and post completion for the suite of determinants and frequencies given in Table 14 below.

Scope of Monitoring	Test	Frequency of Testing
GROUNDWATER MONITORING		
Groundwater monitoring prior to and during works will be taken from 23 wells currently monitored as part of the EP monitoring programme (table S3.5 within the EP Variation (EPR/QP3593NF/V002). This includes 11 wells located within the EP boundary and 12 wells located outside the EP boundary. Locations shown on Figure 5. Groundwater monitoring following works will be taken from 14 replacement wells located within the EP boundary (listed within tables S3.6 in the EP (EPR/QP3593NF/V002). This includes 4 wells located within the EP boundary and 10 wells located outside the EP boundary. Locations shown on Figure 6.	Representative samples of groundwater submitted for laboratory analysis of parameters required by the EP (EPR/QP3593NF/V002) which are listed in Note b.	From 23 existing monitoring wells located around the site to be sampled on 3No (monthly) occasions prior to the works, then at monthly intervals during the works, then from 14 replacement wells post completion for a period of 24 months. Should 12 consecutive monthly monitoring visits, post remediation, indicate groundwater assessment criteria (Section 4.3.4) have been met then it is proposed that this will be accepted by the EA and no further monitoring required.
SURFACE WATER MONITORING		
Surface water monitoring (sampling and laboratory testing) shall be undertaken from the River Ouse including at a minimum, upstream and downstream locations, and one intermediate location along the length of the River opposite the site.	Representative samples of surface water submitted for laboratory analysis of parameters listed in Note b.	Samples to be obtained on 1No occasion prior to the works, then at monthly intervals during the works, then at monthly intervals during and post completion for a period of 12-months
ANY HOLDING TANK/ LAGOON FOR INCIDENTAL ARISINGS OF WATER (PRE & POST TREATMENT)		
Holding tank/ lagoon water (where site waters have been collected) prior to treatment and discharge	Representative samples of holding tank / lagoon water submitted for laboratory analysis of parameters listed in Note b plus any other parameters required to demonstrate compliance with a discharge consent	Samples to be taken before and post treatment on a monthly basis during the works or at the frequency required in the water discharge activity

Scope of Monitoring	Test	Frequency of Testing
	including those listed in Tables 2.12 and 2.13 of the Guidance for the Recovery and Disposal of Hazardous and Non Hazardous Waste, S5.06, EA, 2004.	environmental permit (WDA-EP) and/or trade effluent consent.

Notes:
a) All chemical analysis shall be UKAS and MCERTS accredited as appropriate
b) Water analysis suite to include the following determinants:

Arsenic Cadmium Nickel	Ammoniacal Nitrogen Sulphate Nitrate Nitrite	pH Temperature Electrical Conductivity Dissolved Oxygen Redox Potential	Total Petroleum Hydrocarbons (carbon banded C5 – C40) Phenols Polycyclic Aromatic Hydrocarbons (speciated USEPA 16)

Table 14 Groundwater, Surface Water and Holding Tank / Lagoon Water Monitoring Schedule

6 Validation / Verification Strategy

6.1 Demonstrating Effective Removal of Contamination

Contaminated materials will be identified through excavation of identified hotspots, visual segregation of materials according to specific material types and the material testing regime specified in Table 12. The sampling and testing is required to confirm that the underlying materials comply with the RTVs for the residential development and associated uses of the site.

All earthworks materials shall be subject to geochemical testing from stockpiles following excavation and segregation according to material type as well as from stockpiles of remediated material prior to placement. Where the materials comply with the RTVs at point of excavation then the material may be used within the works. However, the materials must also comply with the geotechnical acceptability criteria. Where at point of excavation the materials do not meet the RTVs then the material will be segregated and sentenced to bioremediation, stabilisation/solidification or off-site disposal. Additional stockpile sampling may be undertaken where considered appropriate to reflect the heterogeneity of the material within a particular stockpile in order to assist obtaining a representative average (mean) result for all samples collected from that stockpile which can be then compared with Remediation Criteria.

The method(s) for validating treated materials is presented in Sections 3 and 5. Materials which fail the acceptability testing for use within 1m depth of the formation level can be used at depths greater than 1m below the formation level, where failure is due to non-volatile or negligibly volatile determinants. This includes materials where free asbestos fibres have been identified noting that visible ACM material will be identified and segregated by handpicking for off-site disposal as far as practicable. For volatile contaminants and material where residual free phase product is identified the material will be subject to ex situ bioremediation.

During excavation visual inspections of the cut areas will be undertaken and any observations of areas of contamination and any odours, such as hydrocarbon odours, indicating the presence of potential contamination will also be recorded.

Unacceptable materials will be segregated and stored in a dedicated stockpile for remediation or disposal. Confirmatory sampling and chemical testing will be undertaken from stockpiles of remediated material prior to placement. Where failures in comparison to the RTVs are identified the soil materials will be removed and sentenced to either further remediation for volatile substances or to placement at depths greater than 1m below formation level for non-volatile and negligibly volatile substances or to off-site disposal.

6.2 Demonstrating Effective Treatment of Contamination

Where excavated materials contain volatile hydrocarbons at concentrations exceeding the soil RTVs and/or ammoniacal nitrogen at concentrations exceeding the soil leachate RTVs and/or comprise Organic Rich Material from Historic Pond 7 they shall be recovered / rendered suitable for use by remediation within biopiles and/or windrows.

During the bioremediation process monitoring via field measurements and laboratory sampling of the materials within the biopile/windrow shall be undertaken as described in Table 12. During treatment testing will be undertaken at approximately fortnightly intervals and at a rate of 1 set of results per 300 m^3 of material in treatment; field measurements will be taken on a daily basis from a minimum of five points across the biopile/windrow.

Weather conditions will also be recorded on a daily basis.

The results of the laboratory testing and field measurements will provide lines of evidence to allow validation of the bioremediation works in addition to comparison of contaminant concentrations against the RTVs. The metal determinants are required in the fortnightly testing schedule as a control to provide evidence that the concentration of biodegradable contaminants have been reduced by bioremediation and not through dilution. The validation of the materials treated within each biopile/windrow batch will be undertaken before the treated

material can be used in the development. Where materials cannot be validated as having been treated to the required standard they will either be sentenced for further treatment within the biopile/windrow or if this is considered to be impractical the material will be sentenced for off-site disposal.

It is noted that while soil RTVs comprise a single criteria value for each parameter across the entire boundary, soil pore water RTV for ammoniacal nitrogen vary according to the Averaging Areas. Therefore, excavated material will be sentenced for remediation based on comparison of the concentration of ammoniacal nitrogen in soil leachate with the RTV of the Averaging Area from which the material was excavated. In addition, prior to placement and/or following any remediation or soil stabilisation, further soil leachate testing must be undertaken, as required, to demonstrate compliance with the RTV of the destination Averaging Area. This is to ensure material is not merely moved from one area to another but that genuine source reduction is achieved across the site as a whole. It is noted that the Green Infrastructure and areas of POS, where Organic Rich Material is to be primary placed, are located within and across multiple Averaging Areas.

6.3 Demonstrating Effective Treatment of Ground Gas

Data on the chemical and geotechnical composition of the excavated and placed materials, collected via the testing requirements specified in Tables 12, will be used to increase the confidence of the engineering ground model and conceptual site model.

The specific remediation objectives with regarding to ground gas include excavating any significant Organic Rich Material encountered within Made Ground present within Historic Pond 7 and subjecting this material to ex situ aerobic bioremediation in order to reduce the gassing potential of this material prior to placement (following any stabilisation required).

As well as the lines of evidence collected during bioremediation described in the previous Section, reductions in the TOC content, as well as forensic organic matter testing of the material, may also be used as a line of evidence to support the reduction in readily degradable organic matter content and hence demonstrate a reduction in ground gas generating potential.

It is intended that the excavated Made Ground materials which are acceptable for use will be placed and compacted as bulk fill to formation level. The material is intended to be compacted to 95% MDD and 5% air voids. Gas monitoring (detailed in Section 5.2) will be undertaken across the site, before, during and after the works. Before and during the works selected existing monitoring wells will be used. New monitoring wells will be installed during the works as the original set of monitoring wells are destroyed by the progress of the works. The new monitoring wells will continue to be monitored following completion of the works.

The information from the testing and gas monitoring undertaken during excavation and placement of works materials and the data from the remedial treatment will be used to confirm that the ground gas remediation and reclamation objectives have been achieved.

Ground gas data will be used to demonstrate that ground gas conditions following remediation are appropriate to Amber 1 and at most is not greater than Amber 2 (NHBC Traffic Light System). In addition, where methane and carbon dioxide concentrations exceed 1.5%v/v and 5%v/v respectively (Scenario 1, EPR 5.02, EA Guidance) hazardous gas flow rates (Qhgs) will be calculated in line with Scenario 2 (EPR 5.02) in accordance with the required permit surrender Completion Criteria provided by the EA in Pre-Advice Letter (EAWML68681, EA, 28th August 2015). Assessment of hazardous gas flows rates based on geographical zoning of the site will be undertaken where appropriate and with agreement of the EA.

An assessment of the ground gas regime will inform the level of gas protection measures required for the new properties to be built on the residential development platforms.

6.4 Assessment of Groundwater Quality Post Remediation

As described in Section 3.4, ground water assessment post remediation may include assessment of trends or statistics, in combination with comparison with set values, and are as follows:

- Post remediation – to assess groundwater quality trends within replacement monitoring wells (defined in Section 5.3) following remediation works to demonstrate there are no significant sustained increases in concentrations of ammoniacal nitrogen and other metal or metalloids contaminants listed in the EP Variation. Assessment of trends may include statistical analysis where appropriate, or comparison with simple descriptive statistics.
  - For replacement monitoring wells which are direct replacements for existing monitoring wells (listed within the EP Variation working Plan (URS, February 2015)) and for which representative data is likely available for pre remediation conditions, then reference will also be made to these pre remediation concentrations (including Control Levels) to demonstrate there is no significant deterioration in groundwater quality following remediation;
  - For replacement monitoring wells which are not direct replacements for existing monitoring wells and for which representative data is not likely available for pre remediation conditions then, if a sustained increasing trend is observed, reference will also be made to the (SSAC (Updated HRA, Arcadis, 2020) provided these replacement wells are associated with identified Sources (Updated HRA, Arcadis, 2020). Where these wells are not associated with a Source, then further risk assessment may be undertaken if deemed required, including reference to EQS and/or DWS standards, if relevant.

6.5 Monitoring

As described in Section 5.2, ground gas monitoring will be undertaken at monthly intervals post works completion and for a period of 24 months. Should 12 consecutive monthly monitoring visits indicate ground gas compliance criteria have been met then it is understood that this will be accepted by the EA (Pre-application Advice, August 2015) with no further ground gas monitoring required.

As described in Section 5.3, groundwater monitoring will be undertaken at monthly intervals during the works, then at post completion for a period of 24 months within a network of replacement wells installed across the site. Should 12 consecutive monthly monitoring visits (post completion) indicate ground monitoring compliance criteria have been met then it is proposed that this will be accepted by the EA and no further monitoring required.

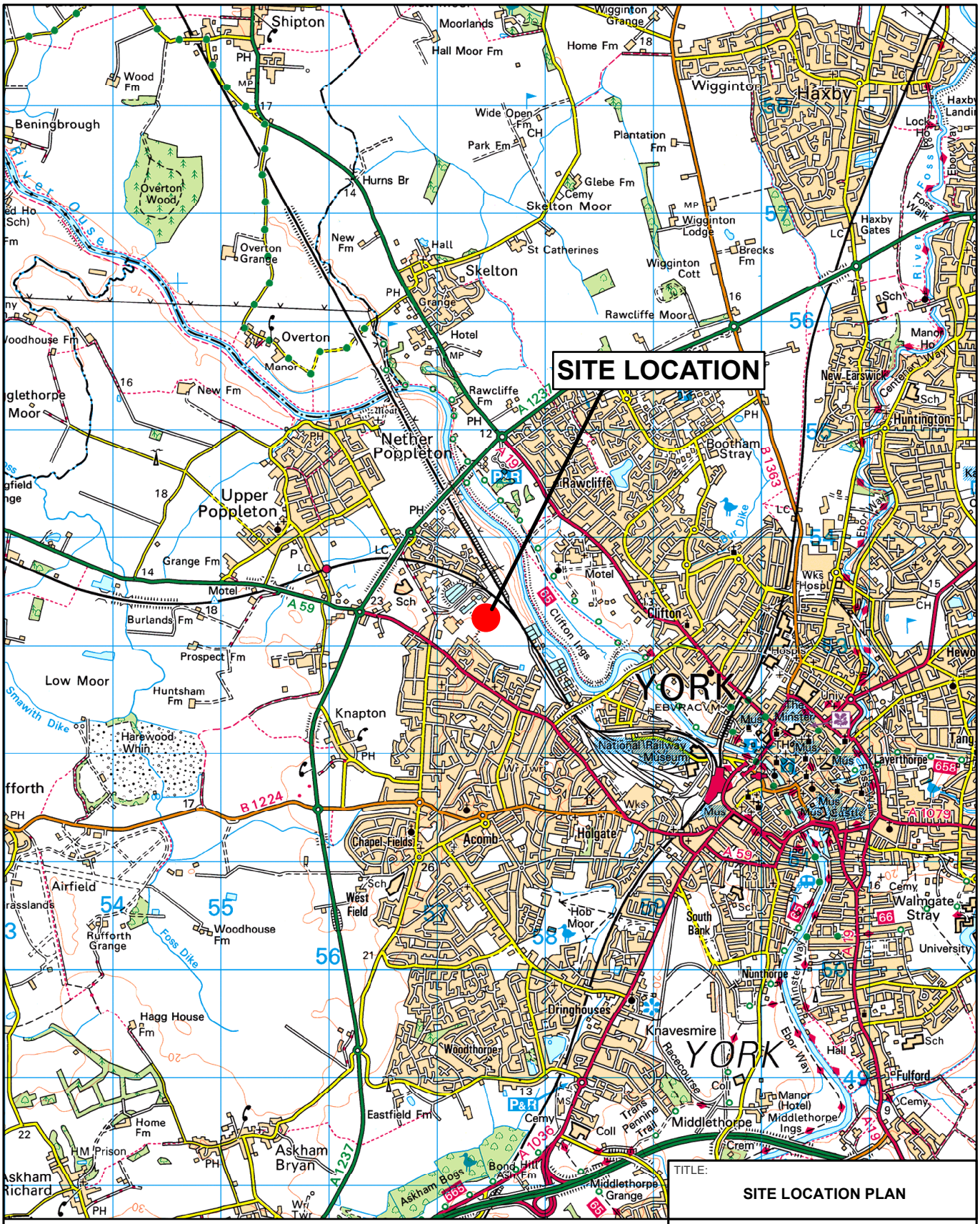
6.6 Validation / Verification Reporting

The Validation Report for the British Sugar Former Factory Site Remediation and Reclamation Works shall include the following.

- A general description of the remediation and reclamation works.
- Details of all excavated material classifications including site location references and volumes.
- Details of all imported material classifications and volumes.
- Details of bioremediation works, laboratory testing results, field measurement data, the assessment of remediation of each biopile batch and sentencing of materials for use as fill within the residential development.
- Results of all geochemical and geotechnical testing relating to all imported and treated materials.
- Results of any compaction trials.
- The results of the assessments of material acceptability.
- Details of all geotechnical and geochemical remedial treatment undertaken (including process details, volumes, specific materials undergoing treatment, results of the treated material).
- Details of the final placement of excavated, treated and imported materials (linked to the assessment of material acceptability).
- Details of the materials sentenced for off-site disposal; including waste classification, volumes and disposal location.
- Results of all waste acceptance criteria (WAC) testing.

- All waste transfer documentation for the materials disposed of off-site.
- Details of any WDA-EP or trade effluent consents required as part of the works.
- The Environmental Permit details as applicable relating to (i) any on-site remedial treatment processes and (ii) any landfill operators accepting wastes from site.
- The monitoring records and laboratory analysis results for all the ground gas, groundwater and surface water monitoring.
- Details of any alterations / amendments made to the Remediation and Reclamation Strategy.
- Details of any contingencies undertaken during the works.
- Details of all correspondence with the regulatory authorities during the works.
- As-built drawings showing surveyed levels of base of temporary excavations, temporary side slopes of excavations, positions of samples and tests carried out, and the MPM grid system.
- As-built drawings showing surveyed formation ground levels and positions of point-of placement samples and tests carried out.

FIGURES



LEGEND

SITE LOCATION

NOTES

SYMBOLS FOR BOREHOLES, TRIAL PITS AND OTHER SPECIFIC FEATURES ARE REPRESENTATIONS OF LOCATION ONLY AND UNLESS OTHERWISE SPECIFIED, DO NOT REPRESENT THE TRUE SIZE OF THE FEATURE.

0 0.2 0.4 0.8 1.2 1.6 2 Kilometres

N

TITLE: **SITE LOCATION PLAN**

SITE : **BRITISH SUGAR YORK**

CLIENT : **BRITISH SUGAR**

PROJECT : **10024487** | **FIGURE 1**

DATE : 30/07/19 | DRAWN BY : AP

DRG No. : 10024487-AUK-XX-XX-DR-ZZ-0002-P1.GIS

SCALE : **1 : 50,000** | PRINT : **A4**

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N

Legend

- Site Boundary
- Current Environmental Permit Boundary
- Proposed Extended Environmental Permit Boundary
- DoWCop Zone

Under the Microsoft® BingTM Maps

Issued for Information			
Design	S.Sohni	30-11-2021	
Drawn	S.Sohni	30-11-2021	
Checked	J.Hurst	30-11-2021	
Approved	C.Piddington	30-11-2021	
Scale	1:4,000	Datum	AOD
Original Size	A3	Grid	OS
Suitability Code:		Project Number	10024487

Client - British Sugar Plc

BritishSugar

Figure 2

PROJECT

British Sugar, York

TITLE

Site Layout and Environmental Permit Boundary Plan

ARCADIS Design & Consultancy for natural and built assets

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Drawing Number:
10024487-AUK-XX-XX-DR-ZZ-0047-P1-Site layout Plan

Legend

- Material Storage and Processing Area
- DoWCop Zone
- Green Infrastructure Area within the DoWCoP Zone
- Green Infrastructure Around the DoWCoP Zone
- Site Boundary

N

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Scale	1:4000	Datum	AOD
Original Size	A3	Grid	OS
Suitability Code:		Project Number	10024487

Client - British Sugar Plc

BritishSugar

Figure 3

PROJECT

British Sugar, York

TITLE

DoWCoP Zone and Materials Storage and Processing Area

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Drawing Number:
10024487-AUK-XXXX-DR-ZZ-0046-P1-DowCop Zone and Material Storage area

Excavated material
Material with non volatile contaminants
Organic Rich Material
Plant Growth Media
Made Ground, Natural Ground & Sediment
Concrete, aggregate and SFL
Waste

Excavated Waste from within EP Boundary

Excavated Soils from Outside EP Boundary

Lagoon Sediment

Potential for some imported topsoil if required

EP Waste and DowCoP Soils in segregated stockpiles throughout

Dewatered to <45% moisture

Materials Stockpiling and Processing Area

Oversized Material

Potential Plant Growth Media

Sugar Factory Lime (SFL)

Organic Rich Material

Granular Made Ground

Cohesive Made Ground

Cohesive Natural Ground

Lagoon Sediment

Organic Rich Material from Historic Pond 7

Ammoniacal Nitrogen Hotspots

TPH Hotspots

PAH Hotspots

Physical Processing

Topsoil / Subsoil Testing

Asbestos Quantification

Asbestos identified

Hazardous (Stable Non reactive) Waste

Off Site Disposal

Waste classification, pre-treatment and WAC testing before disposal

Geochemical & Geotechnical Testing

Drying to <45% moisture

Ex Situ Bioremediation

Geochemical & Geotechnical Testing

Soil Stabilisation

Geochemical & Geotechnical Testing

Compacted & placed in Green Infrastructure & Public Open Space

Compacted & placed at any Depth Within Development Platform

Compacted & placed <1m bgl in development platform

Legend

Material Management Flow Chart

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Drawn	S.Sohni	6-4-2020	
Checked	D.Calvert	6-4-2020	
Approved	C.Piddington	6-4-2020	
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Original Size	A3	Grid	OS
Suitability Code:		Project Number	10024487

Client - British Sugar Plc

BritishSugar

Figure 4

PROJECT

British Sugar, York

TITLE

Material Management Flowchart

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Drawing Number:10024487-AUK-XX-XX-DR-ZZ-0057-P1-Material Management Flowchart

Legend

Monitoring Locations

- Ground gas Monitoring Locations
- Groundwater and Groundgas Monitoring Well
- Groundwater Monitoring

- Site Boundary
- Permit Boundary

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N

Issued for Information			
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Original Size	A3	Grid	OS
Suitability Code:		Project Number	10024487

Client - British Sugar Plc

BritishSugar

Figure 5

PROJECT

British Sugar, York

TITLE

Existing Ground Gas and Groundwater Monitoring Well Location Plan

ARCADIS Design & Consultancy for natural and built assets

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Drawing Number:
10024487-AUK-XXXX-DR-ZZ-0043-P1-Groundgas and Groundwater monitoring Location Map

Legend

Proposed Ground Gas and Groundwater Monitoring Locations

- Proposed Ground Gas Monitoring Location
- Proposed Ground Gas Monitoring Location in Natural Strata
- Proposed Groundwater Monitoring Location
- Site Boundary

Under the Microsoft® BingTM Maps

N

Issued for Information			
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Scale	1:4000	Datum	AOD
Original Size	A3	Grid	OS
Suitability Code:		Project Number	10024487

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Figure 6

PROJECT

British Sugar, York

TITLE

Proposed Replacement Ground Gas and Groundwater Monitoring Wells

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Drawing Number: 10024487-AUK-XXXX-DR-ZZ0054-P1-Proposed Ground gas and Groundwater Monitoring Locations

Legend

- Proposed Dust, Noise and Vibration Monitoring Locations
- Proposed Odour Monitoring Locations
- Site Boundary

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N

Issued for Information

Design	Arya M S	4-5-2020	
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Scale	1:4000	Datum	AOD
Original Size	A3	Grid	OS
Suitability Code:		Project Number	10024487

Client - British Sugar Plc

BritishSugar

Figure 7

PROJECT

British Sugar, York

TITLE

Proposed Dust, Noise, Vibration and Odour Monitoring Locations

ARCADIS Design & Consultancy for natural and built assets

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Drawing Number:
10024487-AUK-XX-XX-DR-ZZ-0066-P1-Proposed Dust, Noise, Vibration and Odour Monitoring Locations

APPENDIX A

Requirements for Acceptability and Testing of Earthworks Materials

CLASS	GENERAL MATERIAL DESCRIPTION	TYPICAL USE	PERMITTED CONSTITUENTS (All subject to requirements of Clause 601 (SHW) and Appendix 6/1)	MATERIAL PROPERTIES REQUIRED FOR ACCEPTABILITY (in addition to requirements on use of fill materials in Clause 601 (SHW) and testing in Clause 631 (SHW)				COMPACTION REQUIREMENTS IN CLAUSE 612 (SHW)
				PROPERTY (See exception in previous column)	DEFINED AND TESTED IN ACCORDANCE WITH:-	ACCEPTABLE LIMITS WITHIN:		
						Lower	Upper	
1A	Well graded granular material	General fill	Any material, or combination of materials. Site-won aggregate.	(i) grading	BS 1377 Part 2	Tab 6/2	Tab 6/2	End product min 95% MDD and max 5% air voids
				(ii) uniformity coefficient	See Note 5	10	-	
				(iii) mc	BS 1377 Part 2			
1B	Uniformly graded granular material	General fill	Any material, or combination of materials. Site-won aggregate	(i) grading	BS 1377 Part 2	Tab 6/2	Tab 6/2	End product min 95% MDD and max 5% air voids
				(ii) uniformity coefficient	See Note 5	-	10	
				(iii) mc	BS 1377 Part 2			
1C	Coarse granular material	General fill	Any material or combination of materials Site-won aggregate	(i) grading	BS 1377 Part 2	Tab 6/2	Tab 6/2	End product min 95% MDD and max 5% air voids
				(ii) uniformity coefficient	See Note 5	5	-	
				(iii) Los Angeles coefficient	Clause 635	-	50	
2A	Wet Cohesive material	General fill	Any material, or combination of materials.	(i) grading	BS 1377 Part 2	Tab 6/2	Tab 6/2	End product min 95% MDD and max 5% air voids
				(ii) plastic limit (PL)	BS 1377 Part 2	-	-	
				(iii) mc	BS 1377 Part 2	PL-4%	PL x 1.3	
				(v) Undrained shear strength of remoulded material	Clause 633	60 kN/m^2	100 kN/m^2	

CLASS	GENERAL MATERIAL DESCRIPTION	TYPICAL USE	PERMITTED CONSTITUENTS (All subject to requirements of Clause 601 (SHW) and Appendix 6/1)	MATERIAL PROPERTIES REQUIRED FOR ACCEPTABILITY (in addition to requirements on use of fill materials in Clause 601 (SHW) and testing in Clause 631 (SHW)				COMPACTION REQUIREMENTS IN CLAUSE 612 (SHW)
				PROPERTY (See exception in previous column)	DEFINED AND TESTED IN ACCORDANCE WITH:-	ACCEPTABLE LIMITS WITHIN:		
						Lower	Upper	
2B	Dry Cohesive material	General Fill	Any material, or combination of materials.	(i) grading	BS 1377 Part 2	Tab 6/2	Tab 6/2	End product min 95% MDD and max 5% air voids
				(ii) plastic limit (PL)	BS 1377 Part 2	-	-	
				(iii) mc	BS 1377 Part 2	App 6/1	PL - 4%	
				(v) Undrained shear strength of remoulded material	Clause 633	100 kN/m^2	-	
2C	Stony Cohesive Material	General Fill	Any material, or combination of materials.	(i) grading	BS 1377 Part 2	Tab 6/2	Tab 6/2	End product min 95% MDD and max 5% air voids
				(ii) plastic limit (PL)	BS 1377 Part 2	-	-	
				(iii) mc	BS 1377 Part 2	-	-	
				(v) Undrained shear strength of remoulded material	Clause 633	60 kN/m^2	-	
2D	Silty Cohesive Material	General Fill	Any material, or combination of materials.	(i) grading	BS 1377 Part 2	Tab 6/2	Tab 6/2	End product min 95% MDD and max 5% air voids
				(ii) mc	BS 1377 Part 2	-	-	
				(iv) Undrained shear strength of remoulded material	Clause 633	60 kN/m^2	-	
4	Various	Fill to landscape areas	See App 6/1	(i) grading	BS 1377 Part 2	-	125mm	See Clause 620 and App 6/1
				(ii) mc	BS 1377 Part 2	-	-	

CLASS	GENERAL MATERIAL DESCRIPTION	TYPICAL USE	PERMITTED CONSTITUENTS (All subject to requirements of Clause 601 (SHW) and Appendix 6/1)	MATERIAL PROPERTIES REQUIRED FOR ACCEPTABILITY (in addition to requirements on use of fill materials in Clause 601 (SHW) and testing in Clause 631 (SHW)				COMPACTION REQUIREMENTS IN CLAUSE 612 (SHW)
				PROPERTY (See exception in previous column)	DEFINED AND TESTED IN ACCORDANCE WITH:-	ACCEPTABLE LIMITS WITHIN:		
						Lower	Upper	
5A	Topsoil, or turf, existing on site	Topsoiling	Topsoil or turf designated as Class 5A in the Contract	(i) grading	Clause 618	-	Clause 618	-
5B	Imported topsoil	Topsoiling	General purpose grade complying with BS 3882	-	-	-	-	-
5C	Imported Turf	Turfing	Material complying with BS3969	-	-	-	-	-
6A1	Selected well graded granular material	Below water	Natural gravel, natural sand, crushed gravel, crushed rock, other than argillaceous rock, crushed concrete, well burnt colliery spoil or any combination thereof	i) grading	BS1377 Part 2	As Class 6A. Tab 6/2	As Class 6A. Tab 6/2	No Compaction
				ii) uniformity coefficient	BS892	10	-	
				iii) plasticity index	BS1377 Part 2	Non Plastic	Non Plastic	
				iv) 10% fines	Clause 635	50kN	-	
6A2	Selected well graded granular material	Fill to soft areas and abandoned watercourses	Natural gravel, natural sand, crushed gravel, crushed rock, other than argillaceous rock, crushed concrete, well burnt colliery spoil or any combination thereof	i) grading	BS1377 Part 2	As Class 6A. Tab 6/2	As Class 6A. Tab 6/2	Tab 6/4 Method 5
				ii) uniformity coefficient	BS892	10	-	
				iii) mc	BS1377 Part 2 and Note 4	Optimum mc – 2.5%	Optimum mc	
				iv) plasticity index	BS1377 Part 2	Non plastic	Non plastic	
				v) optimum mc	BS1377 Part 4 Method 3.7	-	-	

CLASS	GENERAL MATERIAL DESCRIPTION	TYPICAL USE	PERMITTED CONSTITUENTS (All subject to requirements of Clause 601 (SHW) and Appendix 6/1)	MATERIAL PROPERTIES REQUIRED FOR ACCEPTABILITY (in addition to requirements on use of fill materials in Clause 601 (SHW) and testing in Clause 631 (SHW)				COMPACTION REQUIREMENTS IN CLAUSE 612 (SHW)
				PROPERTY (See exception in previous column)	DEFINED AND TESTED IN ACCORDANCE WITH:-	ACCEPTABLE LIMITS WITHIN:		
						Lower	Upper	
				vi) 10% fines	Clause 635	50 kN	-	
6B	Selected coarse granular material	Starter layer	Natural gravel, natural sand, crushed rock, crushed concrete, slag, well-burnt colliery spoil or any combination thereof	i) grading	BS1377 Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 5
				ii) plasticity index	BS1377 Part 2	Non plastic	Non plastic	
				iii) 10% fines value	Clause 635	50 kN	-	
6C	Selected uniformly graded material	Starter layer	Natural gravel, natural sand, crushed gravel, crushed rock other than argillaceous rock crushed concrete well-burnt colliery spoil or any combination thereof	i) grading	BS1377 Part 2	Tab 6/2	Tab 6/2	Tab 6/4 Method 3
				ii) uniformity coefficient	BS892	-	10	
				iii) plasticity index	BS1377 Part 2	Non plastic	Non plastic	
				iv) 10% fines	Clause 635	50 kN	-	
				v) mc	BS1377 Part 2 and Note 4	optimum mc - 2 %	optimum mc + 1%	
				vi) optimum mc	BS1377 Part 2	-	-	
6F1	Selected granular material (fine grading)	Capping	Any material, or combination of materials, other than unburnt colliery spoil and argillaceous rock	i) grading	BS1377 Part 2	As Class 6F1. Tab 6/2	As Class 6F1. Tab 6/2	Tab 6/4 Method 6
				ii) optimum mc	BS1377	-	-	
				iii) mc	BS1377 Part 2 and Note 4	-	Optimum mc +1%	
				iv) 10% fines values	Clause 635	30 kN	-	

CLASS	GENERAL MATERIAL DESCRIPTION	TYPICAL USE	PERMITTED CONSTITUENTS (All subject to requirements of Clause 601 (SHW) and Appendix 6/1)	MATERIAL PROPERTIES REQUIRED FOR ACCEPTABILITY (in addition to requirements on use of fill materials in Clause 601 (SHW) and testing in Clause 631 (SHW)				COMPACTION REQUIREMENTS IN CLAUSE 612 (SHW)
				PROPERTY (See exception in previous column)	DEFINED AND TESTED IN ACCORDANCE WITH:-	ACCEPTABLE LIMITS WITHIN:		
						Lower	Upper	
6F2	Selected granular material (coarse grading)	Capping	Any material, or combination of materials, other than unburnt colliery spoil and argillaceous rock	i) grading	BS1377 Part 2	As Class 6F2. Tab 6/2	As Class 6F2. Tab 6/2	Tab 6/4 Method 6
				ii) optimum mc	BS1377 Part 4 (vib Hammer)	-	-	
				iii) mc	BS1377 Part 2 and Note 4	-	optimum mc + 1 %	
				iv) 10% fines value	Clause 635	30 KN	-	
				v) chemical constituents	App 1/5 Table 1/5 Part B			
6F3	Selected Granular Material	Capping	Site-won or imported bituminous planings & granulated asphalt but excluding materials containing tar or tar / bitumen binders. Site-won aggregate.	i) grading	BS1377 Part 2	-	As Class 6F2. Tab 6/2	Tab 6/4 Method 6
				ii) uniformity coefficient	BS892	-	-	
				iii) optimum mc	BS1377 Part 4 Method 3.7	-	-	
				iv) mc	BS1377 Part 2 and Note 4	optimum mc - 2%	optimum mc	
				v) bitumen content	BS 598 PART102	-	10%	

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