GP PLANNING LTD

ENVIRONMENTAL SETTING & SITE DESIGN

INERT LANDFILL PERMIT

COLSTERWORTH TRIANGLE QUARRY, CRABTREE LAND, STAINBY, LINCOLNSHIRE, NG33 5BH

CESL LTD

DEC 2024

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PERMIT APPLICATION - ESSD		
Stainby Quarry – Inert Landfill	CESL	C022-02

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1 Source

1.1 Introduction & Context

1.1.1 This Environmental Setting and Site Design (ESSD) follows the Environment's Agency's template and supports a Bespoke Environmental Permit Application submitted to the Environment Agency (EA) for an Inert Landfill operation to restore 'Colsterworth Triangle Quarry'; a limestone quarry operated by Construction and Environmental Services Limited (CESL).

1.2 The Site & its Development

1.2.1 The site is located two kilometres west of Colsterworth village, one kilometre south of Skillington village and two kilometres north of Stainby village as shown on drawing D-ESSD1. Colsterworth landfill site, which is currently active, abuts the eastern boundary of the site. This boundary is formed largely of an exposed limestone face to a height of approximately 21 metres. The southern boundary abuts the embankment of a disused railway line with a mature planted hedge interspersed with mature trees. The remaining boundary abuts Crabtree Road and is marked by a mature hedgerow to a height of two metres.

1.2.2 The proposed inert landfill area comprises a currently operational limestone quarry excavation. The current void has reached its permitted plan extents and is now being deepened in the current phase of extraction. The layout of the site is shown on drawing ESSD 5 appended to this report. The area to be landfilled comprises a roughly triangular void surrounded on all sides by limestone faces, but with an open gap in the northern part of the east side that has a limestone face below it that drops down to the 121mAOD level of the adjacent landfill site. To the immediate east of the proposed landfill area is an existing landfill site in a former quarry (Colsterworth Landfill Site) that is operated by FCC Environment Ltd.

1.3 Environmental Site Setting

1.3.1 The enclosed drawing D-ESSD2 shows the environmental site setting (such as Local Wildlife Sites, protected habitats, water courses, residential properties etc) that are potentially vulnerable to pollution and emissions. The following sensitive locations identified on drawing D-ESSD2:

Table T-EESD1

Receptor	Distance
Local Wildlife Site- Crabtree Road Verges	65m north
Local Wildlife Site - Woolsthorpe Road Verge, West	165m south
Local Wildlife Site- Skillington to Gunby Road Verges	645 metres east
Local Wildlife Site- Woolsthorpe Line	750 metres south-east
Protected Habitat	255m south-east
Aerodrome Farm	700m south-west
Cotswold Farm	1.6km north east
Cringle Brook	650 metres north-west
Sroxton Quarry SSSI	3.3km north west
FCC Non-Hazardous Inert & Waste Management	Immediately east
King Luds Entrenchment & The Drift SSSI	3.5km north west
Ground water abstraction (Licence AN/030/0001/002)	200 metres east

1.4 Cultural & Natural Heritage

1.4.1 The enclosed drawing D-ESSD3 shows features of historical and natural interest within the locality of the inert landfill site. There are no important heritage designations (such as Scheduled Ancient Moments, World Heritage Site etc) within the vicinity of the site. Listed buildings can be found in the villages of Skillington and Woolsthorpe-by-Colsterworth at a distance of 1.5-2km from the site.

1.5 Landfill & Ecological sites

1.5.1 The enclosed drawing D-ESSD 4 shows the existing permitted landfill sites and historical landfill sites within proximity of the Application site. This drawing also shows important ecological designations (e.g. SSSI) and former ironstone workings in the area.

1.6 Historical Development

1.6.1 Colsterworth Triangle Quarry obtained Planning permission S22/0289/05 on 8 June 2006 for the extraction of limestone and subsequent restoration of the land using imported inert wastes from a 4.8 hectare triangular area of land abutting the western boundary of Colsterworth Landfill site. Prior to mineral extraction, the land was in agricultural use.

1.6.2 To the immediate east of the proposed landfill area is an existing landfill site in a former quarry (Colsterworth Landfill Site) that is operated by FCC Environment Ltd which is undergoing restoration. The site ceased accepting waste in January 2019. A landfill gas management system is located

approximately 115 m east of the site. Skillington Road forms the eastern limit of the Colsterworth Landfill, beyond which is agricultural land.

1.6.3 Based on Environment Agency data, a number of such 'strips' of historical landfill exist to the southwest, south and east of the site. These were landfilled and the licences surrendered by 1994. They received inert waste, with the exception of two sites, 'Corner of The Drift and Crabtree Road', which was also licensed to receive household waste, and 'Disused Railway Cutting', which was licensed to receive inert, industrial, commercial and household wastes.

1.6.4 Three larger historical landfills are noted in the vicinity of the site, their details are summarised below:

Name	Licence ref	Type of waste	Key dates	Distance/direction from site
Crabtree Road Landfill	EAHLD00338	Inert Household	First input - 1995 Last input - ND	Adjacent to east
Crossway Farm	EAHLD00307	Inert Household Commercial Special	First input - 1986 Surrendered - 1994	1.6 km southeast
Crabtree Road	EAHLD35244	Inert Household	First input - ND Last input - ND	1.3 km southwest

1.7 Proposed Development

1.7.1 The final proposed limestone extraction level is anticipated to vary across the site from around 132mAOD in the west to around 123mAOD in the east. The site will be infilled generally from east to west in three 3m lifts. Before each lift, the dividing bund will be constructed. Backfilling operations in each lift will commence with the construction of the barrier where this quarry void joins with the adjacent landfill site (FCC); the barrier will be constructed prior to each 3m lift from suitably cohesive inert waste to achieve the required stability and integrity. The approved phasing scheme relating to the planning permission is shown on the enclosed drawing ESSD 7.

1.7.2 An artificial geological barrier (AGB) will be necessary to comply with the Landfill Directive. It is intended that clays from the Grantham Formation underlying the base of the quarry are extracted and reworked to form the AGB. If insufficient Grantham Formation clay is available this will be supplemented with selected inert materials. The AGB will be placed to achieve a layer 1 m thick with a maximum permeability of 5 x 10-7 m/s or equivalent, in accordance with Landfill Directive requirements. Construction details for the basal and side slope engineering are provided in the

accompanying Stability Risk Assessment undertaken by Greenfield Associates. It should be noted that the Northampton Sand will not be disturbed as part of the engineering works.

1.7.3 A Waste Acceptance Plan has been prepared which sets out the procedures in place for waste acceptance to ensure only these waste types are taken, and measure in place for dealing with non-conforming wastes. The Waste Acceptance Plan is enclosed at Appendix 5 to the EMS (document reference GPP/CESL/EMS). Once the basal liner is place, the void will be filled and compacted in 3m lifts until the maximum waste thickness, including the engineered geological barrier and replaced soils, will be 17-20m across the site.

1.7.4 No capping system is required due to the nature of the waste. The basal and side slope lining will comprise of suitably compactable inert waste, as set out in the Stability Risk Assessment. The quarry void will be restored to original grounds levels which will be generally flat with levels informed by the surrounding landscape in accordance with the approved restoration scheme. The approved restoration levels/scheme is shown on the enclosed drawing ESSD6.

1.8 Waste Quantities

1.8.1 In order to achieve the restoration of the site, the quarry void will be infilled and restored with approximately 850,000-900,000 tonnes of inert waste. As the restoration is likely to take approximately 6 years, an average of approximately 150,000 tonnes of waste will be imported each year.

1.9 Waste Storage and Acceptance

1.9.1 The waste types accepted at the site will be solely inert, comprising of the following Waste Codes:

Table T-EESD2

List of Waste Code	Description	Exclusions
10 11 03	Waste glass-based fibrous materials	
15 01 07	Glass packaging	
17 01 01	Concrete	
17 01 02	Bricks	
17 01 03	Tiles and Ceramics	
17 01 07	Mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	
17 02 02	Glass	
17 05 04	Soils and stones other than those mentioned in 17 05 03	Excludes topsoil and peat

19 12 05	Glass (from waste management facilities)	
19 12 09	Minerals (for example sand, stones – from waste management facilities)	
20 01 01	Glass	
20 02 02	Soil and stones	Excludes topsoil and peat

2 Pathways and Receptors

2.1 Geology

2.1.1 The conceptual stability site model has been developed on the basis of geological information and cross-sections presented in the HRA report prepared by Hafren Water, issued in June 2024, plus information gathered during a site visit and topographic survey carried out by Greenfield Environmental (in November 2019) and the Geotechnical Assessment (GA) for the site (A Geotechnical Assessment Review of Stainby Quarry, Nr Colsterworth, Lincolnshire, dated January 2020), by Greenfield Environmental.

2.1.2 The site is an active limestone quarry, triangular in shape, that extracts limestone (of the Lower Lincolnshire Limestone Member) to be crushed for aggregate. The site comprises an excavation area in the western part of the site that at the time of the 2019 topographic survey had a base level of approximately 128mAOD (see Figure 2) in which the basal clay/mudstone had been exposed (although further excavation has taken place since then), with a slightly lower central and eastern zone with ground levels falling from approximately 126mAOD from the central area to 123mAOD in the east. In the central and western parts of the quarry, the limestone has mostly been completely removed, leaving the top of the clay/mudstone subgrade exposed, however, in localised processing areas and haul roads the quarry floor has been left just above the base of the limestone to provide a stable running surface.

2.1.3 The geological maps published by the British Geological Survey (BGS), indicate that the bedrock geology comprises the Lower Lincolnshire Limestone of Middle Jurassic age (see Figure 3), with no cover of superficial deposits indicated on or adjacent to the site. The Lower Lincolnshire Limestone is described by the BGS as comprising limestones dominated by low-energy calcilutite, and peloidal wackestone and packstone, commonly including sandy limestone or calcareous sandstone in the basal part. Underlying the Lower Lincolnshire Limestone are the mixed strata of the Grantham Formation (formerly the Lower Estuarine Series), described by the BGS as comprising mudstones, sandy mudstones and argillaceous siltstone-sandstones, and the Northampton Sand Formation, which underlies the Grantham Formation, where it is present, and is described as comprising greenish grey sandy ironstone, weathering to brown limonitic sandstone, with the uppermost beds generally comprising ferruginous sandstone.

2.1.4 The geological mapping indicates that the Grantham Formation is discontinuous in the area and may pinch out in some areas, however, observations of the completed cut faces on the adjacent landfill site suggest that the Grantham Formation mudstones are likely to be consistent across the site. The geological mapping indicates that the geology of the site is further complicated by two SE-NW trending normal faults, which are indicated to affect the western part of the site. The downthrow is on the eastern side of these faults, and some visual evidence of this faulting was noted during the site inspection for the 2020 GA report.

2.1.5 The 2024 HRA report by Hafren Water has involved a very comprehensive review of BGS archive borehole logs and other borehole logs in the area of the site, which has been used to develop geological cross-sections for the site, which are presented in the HRA report. The cross-sections indicate that the Lower Lincolnshire Limestone dips towards the east at around 2° and that the downthrows of the two faults are between 1-3m. The combination of the dip and the faulting suggests that the base level of the Lower Lincolnshire Limestone is at around 130-132mAOD in the extreme western corner of the site (as confirmed at the location of the Grantham Mudstone clay sampling trial pit dug in 2022 - details in Appendix A of the SRA report), dropping to around 126mAOD in the central part of the site and 123mAOD at the eastern edge of the site.

2.1.6 Discussions with CESL in 2024 have confirmed that at the time of the 2019 topographic survey the quarry base in the eastern part had been excavated to finished level (around 123-124mAOD), with a thin layer of limestone left in the base as a running surface. The central part of the quarry was subsequently worked the same way with a thin limestone layer left in the base. The western area, where the Grantham Formation clay was exposed at higher level due to the faulting, was worked to the same level as the central area to win clay for the AGB liner – Northampton Sand material was not encountered in the base of the clay excavation area. On completion of clay excavation, surplus quarry spoil was placed as subgrade fill over the clay/mudstone to form the subgrade for the AGB liner.

2.1.7 The final extraction level is therefore anticipated to have varied across the site from around 128mAOD in the west to around 123mAOD in the east (see schematic cross sections, Figure 4 of the SRA report).

2.1.8 As noted in Section 2.1.6, in the western part of the quarry site, the quarry was extended down below the base of the limestone to win clay from the Grantham Formation mudstone for use in the basal and sidewall liner layers and the dividing bund between the site and the adjacent FCC landfill. The Grantham Formation is underlain by ironstone of the Northampton Sand Formation, however, the excavation was terminated before ironstone was encountered in the base.

2.1.9 The 2020 GA report anticipated that the clay excavation would extend to around 116mAOD, however, that assumption was based on limited geological information and an expectation that clay extraction would only take place in the central and eastern parts of the site, where the base of the Grantham Formation mudstone is deeper. The 2024 HRA cross-sections suggest that the top of the Northampton Sands ironstone in the western part of the site may occur at between 125-128mAOD.

2.1.10 The crest levels of the perimeter quarry faces range from 137-138mAOD, indicating depths of around 6-15m to the base of the limestone quarry faces increasing in height from west to east, although the proposed clay extraction in the western part of the site, below the base of the limestone, will result in overall completed quarry face heights of 10-12m in that area. It should be noted that in the northern/central part of the eastern face the workings have broken through the face into the adjacent FCC Colsterworth landfill site, with the quarry floor linking through. The angles of exposed faces on the site range between 45° to subvertical and generally appeared to be stable with only very small-scale rockfalls of small blocks and small-scale toppling failures observed, however, a zone of weak sandy limestone was observed in the central part of the Southern face which had resulted in some limited face failure and undermining of a soil bund at the crest of the face due to degradation and weathering of the weaker material.

2.1.11 The exposed quarry faces on the three sides of the quarry comprised medium bedded buff coloured limestones, with thin sandy limestone interbeds around 100mm thick, considered to be of the Lower Lincolnshire Limestone. The dip of the strata is gentle towards the east and there are subvertical joint sets that are generally medium spaced that are cut off by occasional more massive medium to thick beds that have a medium to wide joint spacing. The more thickly bedded strata become more frequent further down the sequence/quarry face. The limestone at the top of the faces is typically capped by a weathered surface layer of heavily weathered limestone cobbles in a sandy clay matrix around 1m thick.

2.1.12 Once the limestone has been fully extracted, in the western part of the site the base of the excavation was extended into the underlying mudstone. Arisings of mudstone clay from the floor of the quarry, supplemented by selected suitable material won from the incoming inert waste, will. Arisings of mudstone clay from the floor of the quarry will be used to form the artificial geological barrier clay lining system around the quarry base and side slopes, with placement of inert landfill waste into the void following on. The side slopes of the proposed landfill will therefore on most sides comprise in-situ Lower Lincolnshire Limestone, with Grantham Formation mudstone only exposed in the base of the face in

the western areas taken down to win clay. In the northern/central part of the eastern face, towards the latter stages of the landfilling, it is proposed that clay won from the base of the quarry or selected suitable material won from the incoming inert waste will also be used to form a dividing bund of compacted clay material to provide the side slope of the proposed CESL Ltd landfill and separation between it and the FCC Colsterworth landfill to the east in this section.

2.1.13 The waste material to be imported into the site that is to be applied for on the landfill licence will be a variety of the forms of Inert Waste listed in the European Waste Catalogue. The site will only accept materials classified as non-hazardous, and will exclude wastes that are solely or mainly of dusts, powders or loose fibres, and not in a form that is either sludge or liquid. The waste materials could comprise a variety of materials: glass; concrete; bricks; tiles and ceramics; waste mineral in the form of sand and stones; and soil and stones.

2.1.14 On completion of the placing of the inert waste, it is proposed to install two gas monitoring standpipes within the waste mass to facilitate long-term monitoring of gases.

2.1.15 The limestone bedrock is classified as a Principal Aquifer, overlying Secondary Aquifer (Grantham Formation and Northampton Sand Formation), as indicated by the Environment Agency/DEFRA aquifer designation and groundwater source protection maps. The site does not lie within a groundwater Source Protection Zone. The Groundwater Vulnerability is defined as high for the limestone, and intermediate to high for the underlying strata. At the GA site inspection in 2019, no surface water or groundwater seepages were observed in the quarry or the adjacent landfill site, and the review of groundwater levels in the monitoring boreholes on the site presented in the 2024 HRA indicates that groundwater is present towards the base of the Northampton Sands, perched on the underlying Lias Clay, and that the overlying Grantham and Lower Lincolnshire Limestone strata are essentially dry.

2.2 Hydrological Conceptual Model

2.2.1 The proposed landfill is planned to restore Colsterworth Triangle Quarry with inert material placed in the void created by limestone extraction at the quarry. It is expected for the majority of the waste to comprise inert clay with some granular content.

2.2.2 The waste stream used at the site will be inert and therefore no discernible concentrations of hazardous substances should be introduced to the site. Waste will not be accepted unless defined as inert and meets the maximum leachable concentration limits defined by the Landfill Directive.

2.2.3 A fault zone, shown on BGS maps as two faults, has been mapped crossing the southern site boundary, orientated southeast to northwest. Strata is downthrown to the east. Cross-sections along the northern (southwest to northeast) and southern (northwest to southeast) boundaries have been produced and are presented as Drawings 3601/HRA/05 and 3601/HRA/06 to the HRA report. An extract of the southern boundary cross-section has been enlarged to allow more detail to be shown and this is provided as Drawing 3601/HRA/07 to the HRA report. The location of the lines of cross-section are shown on Drawing 3601/HRA/04 to the HRA report.

2.2.4 A Hydrological Conceptual Model is enclosed at Appendix 11 to this ESSD report (reference 3601/HRA/11). Hydrological Conceptual Model shows a schematic model for the site from west to east, i.e. in the direction of groundwater flow. The Hydrological Conceptual Model is also covered in more detail in the Hydrological Risk Assessment report.

2.2.5 The Stainby Landfill located to the west and south of the site is located cross/slightly down hydraulic gradient and may impact groundwater quality at the site, particularly in relation to the observed ammoniacal nitrogen and chloride concentrations observed within boreholes WP3 and WP6 monitoring the south-eastern boundary.

2.3 Hydrology & Surface Water

2.3.1 The nearest sensitive surface water features down hydraulic gradient of the Site are unnamed drains south and south east of the Site. The closest of which is located approximately 200m south of the site at its closest point.

2.3.2 The closest watercourse, Cringle Brook, is currently up-gradient of the site and is separated from it by backfilled, deep, ironstone workings. Cringle Brook is located 640m northwest (see drawing D-ESSD2) of the site and flows towards the north east before joining the River Witham approximately 6km north east of the site. Springs flowing into Cringle Brook are noted on mapping approximately 600m to the northwest at an elevation of around 112m AOD, approximately 9m below the base of the proposed landfill.

2.3.3 The River Witham is the nearest named down hydraulic gradient surface water receptor over 3km south east from the site.

2.3.4 The Site is not situated within a groundwater source protection zone (SPZ). The closest SPZ is 2,760 m east and relates to a designated total catchment for groundwater abstractions located at Sleights Wood, some 5,900 m east-northeast of the Site.

2.3.5 Surface water does not need actively managing during the infilling of the quarry void. Upon restoration, the profile of the restored surface will be domed to enable surface water to fall by gravity to an existing (and proposed new surface water drainage ditch on the eastern boundary). The proposed Surface Water Management Plan is enclosed at Appendix ESSD 10.

2.4 Hydrogeology

2.4.1 The Lincolnshire Limestone Formation is classified by the Environment Agency as a Primary aquifer. This fabric of the oolitic limestone results in a relatively low primary intergranular porosity and permeability (geometric mean of 1.3 x 10-4 m/d (Allen et al 1997)). However, the presence of macro and micro fractures results in a higher secondary permeability with a resultant interconnected porosity of 10 to 25% (Smith-Carrington et al, 1983), storage coefficient of 4.9 x 10-5 to 5.2 x 10-4 (interquartile range, Allen et al 1997) and transmissivity 665 m2/d (geometric mean) and range of 259 to 2265 m2/d (interquartile range, Allen et al 1997). Groundwater flow is almost entirely through fractures and bedding planes joints. Sirius reported (HRA, December 2021) that pumping tests undertaken by Anglian Water at Kirkby la Thorpe, which is located approximately 18 miles from Colsterworth Landfill Site indicated a transmissivity of 700 to 1280 m2 /d (Griffiths et al, 2006).

2.4.2 The Northampton Sand Formation is classified as a Secondary A aquifer. Groundwater flow is likely to be a combination of matrix, or granular flow and fracture flow. Due to the extensive ironstone mining in the area, blasting may have increased the number and size of fractures in the remaining Northampton Sand rendering fracture flow the more dominant flow mechanism locally. Published data indicates that where a fully saturated, 6 m thickness of the Northampton Sand Formation is present, transmissivity is around 60 m2 /d (Allen et al 1997).

2.4.3 The Northampton Sand is often in hydraulic continuity with the overlying Lincolnshire Limestone Formation. However, due to the confirmed presence of the Grantham Formation locally both the Lincolnshire Limestone and the Northampton Sand Formations could be considered hydraulically separate. This will be affected by the presence of historical mine workings that extended through the lower permeability Grantham Formation into the Northampton Sand. Allen et al (1997) report that

"…ironstone workings have had a profound and irreversible effect on the hydrogeological regime within the aquifer."

2.4.4 Post-mining, increased recharge of the Northampton Sand can be expected from infiltration via spoil infill material. This is likely to mean that present day water levels are higher than those existing in the ironstone prior to mining and by 1982, the water level was to be "at least partly in the overlying beds, with unconfined conditions beneath permeable spoil in the worked out areas…" (Stanyer, 1982) and water within the spoil material may act as a storage reservoir for the aquifer, accumulating infiltration and feeding the unworked aquifer at a fairly constant rate.

Groundwater Levels & Flow

2.4.5 Groundwater levels are recorded in ten monitoring boreholes installed around the adjacent periphery of the site. A summary of the borehole details and response zone is provided in Table 3601/HRA/TS of the HRA report, and their locations are shown on Drawing 3601/HRA/02.

2.4.6 Groundwater level data from these monitoring boreholes are available from November 2019 to September 2020 and then monthly since March 2023. The reliability of the data from 2019- 2020 is uncertain due to confusion at the time regarding borehole references and datum elevations. As a result, this data has not been used in the HRA assessment.

2.4.7 Boreholes in the north of the site, which penetrate the full thickness of the Lincolnshire Limestone (and into the Grantham Formation below) have been dry since monitoring recommenced in March 2023. Groundwater levels have been recorded in boreholes with response zones that extend further into the Northampton Sand, underlying the Lincolnshire Limestone and Grantham Formation. Little variation is seen in the hydrographs for boreholes WP3, WP4B and WP5. However, a greater response to seasonal variation in rainfall is seen at boreholes WP4 and WP6, which are both drilled deeper within the Northampton Sand. A summer decline in water elevation was observed in these boreholes, followed by general increase up to March 2024 resulting in a seasonal fluctuation of between 2.5 and 2.8 m.

2.4.8 Borehole WP4A is drilled significantly deeper that the other site boreholes and has a response zone within the Marlstone Rock, an aquifer unit at depth below and separated from the Lincolnshire Limestone and Northampton Sand Formation by the Lias Clay. The groundwater level within the Marlstone Rock is between 95.5 and 97.7 mAOD, over 20 m below the groundwater within the

shallower aquifers, and completely isolated from near surface activities of former ironstone mining. The location of the monitoring wells is shown on Figure ESSD 8.

Groundwater Quality

2.4.9 Groundwater quality has been determined based on monthly samples from on-site boreholes since March 2023. Boreholes WP1, WP1A, WP2, WP2A and WP5 are up-gradient of the site. However, as no infilling has taken place within Colsterworth Triangle, all data recorded represents background groundwater quality. Boreholes WP1, WP1A, WP2 and WP2A have remained dry throughout the monitoring period. Samples have been collected from boreholes WP3, WP4, WP4A, WP4B, WP5 and WP6. The results of the analyses are provided in Appendix 3601/HRA/A3 to the HRA report and are summarised in Table ESSD 3 below.

Table T-EESD3

3601/HRA/T6: Groundwater quality (2023-24)						
	Count	Maximum	Minimum	Mean	Count >LDL	Count >DWS
pH	48	8	6.8	7.2	-	0
EC (µS/cm)	48	1660	585	1213	-	0
Chloride (mg/l)	48	78	21	45.2	-	0
Ammoniacal Nitrogen (mg/l)	48	6.2	0.01	0.61	41	9
Nitrate as NO3 (mg/l)	48	308	4.7	43.2	46	16
Total Sulphur as SO4 (mg/l)	48	429	76	241	-	28
3601/HRA/T6: Groundwater quality (2023-24)						
	Count	Maximum	Minimum	Mean	Count >LDL	Count >DWS
Total Organic Carbon (TOC) (mg/l)	48	44.5	1.06	7.26	45	-
COD (Settled) (mg/l)	48	35	5	7.23	15	-
BOD (5 day) (mg/l)	48	10.1	1.2	1.89	8	-
Arsenic as As (mg/l)	48	0.005	0.001	0.001	6	0
Cadmium as Cd (mg/l)	48	0.00039	0.00002	0.00004	16	0
Copper as Cu (mg/l)	48	0.007	0.001	0.001	5	0
Lead as Pb (mg/l)	48	0.023	0.002	0.002	3	1
Mercury as Hg (mg/l)	48	0.00004	0.00004	0.0003	1	0
Nickel as Ni (mg/l)	48	0.02	0.002	0.005	32	1

Selenium as Se (mg/l)	48	0.003	0.001	0.001	5	0
Total Chromium as Cr (mg/l)	48	0.007	0.001	0.001	13	0
Zinc as Zn (mg/l)	48	0.042	0.003	0.01	44	0
Boron as B (mg/l)	48	0.018	0.01	0.08	41	0
Iron as Fe (mg/l)	48	6.62	0.001	0.24	47	5
LDL = Lower Detection Limit DWS = Drinking Water Standard						

2.4.10 Water quality at borehole WP5 tends to exhibit lower conductivity, chloride and sulphate concentrations than boreholes WP3, WP4 and WP6. However, pH is higher than elsewhere on- site.

2.4.11 Total Organic Carbon concentrations tended to be stable in boreholes WP6 and WP4, however were 'spiky' at boreholes WP3 and WP5 at the southern site boundary.

2.4.12 Ammoniacal nitrogen was low in all boreholes except borehole WP6 in the southeastern site corner. At this borehole concentrations spiked in October 2023 and then increased from below the detection limit, steadily to a peak of 6.2 mg/l in March 2024. This is the only parameter showing a rising trend at the site.

2.4.13 It has previously been hypothesised that water quality at the site may be being impacted by leachate migration from the Stainby Landfill located west of the site. Groundwater contours indicate that impact on the southeastern boundary would be possible from waste deposited in the north of Stainby Landfill. An element of northward flow will be induced as a result of dewatering at the FCC Colsterworth Landfill, east of Colsterworth Triangle.

Man-made subsurface pathways

2.4.14 There are no man-made pathways such as field drains, buried services, mine workings, or boreholes.

Receptors and compliance points

2.4.15 The compliance point for non-hazardous substances is usually taken as the hydraulic down-gradient installation boundary, which should be located approximately 10m from the cell boundary. For modelling purposes this is a monitoring point known as the 'monitoring well'. The monitoring well locations are shown on drawing ESSD 8.

Groundwater

2.4.16 Due to the inert nature of the waste to be disposed of at the landfill, the Groundwater Regulations are not considered to be applicable. However, the groundwater within the underlying Grantham and Northampton Sand Formation aquifer represents the principal groundwater receptor for the purposes of ongoing potential risk and compliance monitoring.

2.4.17 Therefore, groundwater monitoring will continue to be undertaken at boreholes WP1-WP6 to allow comparison of future groundwater quality data with background data. A groundwater monitoring scheme is proposed in the HRA report.

Surface Water

2.4.18 The site is located within the catchment of the River Witham, which is located approximately 2.7 km east of the site. Cringle Brook, the nearest watercourse and tributary of the Witham, flows northeastward approximately 620 m north of the site. Drainage adjacent to the site flows to the west and north towards Cringle Brook. South of the site drainage is to the south-southeast.

2.4.19 Two springs are identified on the OS map on the southern banks of Cringle Brook at elevations of approximately 115 mAOD, 640 m north of the site. Further springs are noted on the western banks of the River Witham to the east of the site.

2.5 Licensed Groundwater Abstractions and Private Water Supplies

2.5.1 One licensed groundwater abstraction has been identified by the Environment Agency within a 2 km radius of the site, as shown on the enclosed drawing ESSD 2 (Licence AN/030/0001/002), issued to LincWaste in March 2022, is located east of Colsterworth Triangle. It permits the transfer of water from dewatering activities at Colsterworth Landfill from a single point, NGR SK 60365 24294. There is no volumetric limit on the licence.

2.6 Landfill Gas

2.6.1 Due to the non-putrescible nature of the proposed waste types to be disposed of at the landfill, it is not considered necessary to identify potential residential landfill gas receptors. Landfill gas will, however, be monitored within the ten perimeter boreholes and two in-waste wells as detailed in the Landfill Gas Risk Assessment. The ten perimeter boreholes and two in-waste wells are sited in the locations shown on drawing D-ESSD8.

2.6.2 Landfill gas monitoring will be carried out using a portable infra-red gas analyser, at the frequencies as required by schedule 4 of the Environmental Permit.

2.6.3 If gas migration is identified, then the action plan will be prepared and agreed with the Environment Agency; it will include gas monitoring a more frequent basis. The monitoring frequency will be subject to regular review and may be subject to change in consultation with the Environment Agency.

Local Amenity

2.6.4 Potential human receptors are identified at the locations listed in Table ESSD1 and shown on drawing ESSD2. The nature of the proposed site operations (inert landfill development) is considered very similar to current operations (mineral extraction and processing).

2.6.5 CESL has confirmed that there have been no problems with or complaints about dust at the current site. The prevailing wind direction is westerly/south westerly and therefore it is considered that there are no significant receptors to the northeast of the site in relation to potential dust impact. Consequently, no detailed impact assessment of impact upon potential human receptors is considered necessary.

Ecology & Habitats

2.6.6 The Local Wildlife Site in the vicinity of the site are grass verges of the local highway network and a protected woodland to the south east. The quarrying operations have been operating for a number of years without adverse impacts upon these designations. On site dust mitigation measures will ensure that local features of nature conservation interests will not be adversely affected by the inert landfilling operations.

2.7 Amenity

2.7.1 The land immediately adjacent to the east includes a number of waste management activities including an inert landfill, limestone quarry, non-hazardous landfill, small scale inert waste processing and landfill gas management. These land uses are entirely compatible adjacent to the inert waste landfill proposed at the site.

2.7.2 Potential human receptors are identified at the locations identified on drawing ESSD2. The nature of the proposed site operations (inert landfill development) is considered very similar to current operations (mineral extraction and processing). There have been no problems with or complaints about dust or noise at the current site.

2.7.3 The prevailing wind direction is westerly/south westerly, and the nearest human receptors located more than 750 metres to the west (off Crabtree Road). No noise or dust impacts are therefore likely to arise. Consequently, no detailed impact assessment of impact upon potential human receptors is considered necessary. Notwithstanding this, the operator adopts a range of mitigation measures in order to ensure that airborne dust from the operations on-site does not have an adverse impact beyond the site boundary. The dust mitigation measures include daily visual inspections, review of weather conditions and wind

direction, minimising loading/tipping heights, the training of staff particularly and the use of clean water for dust suppression.

3 Pollution Control Measures

3.1 Site Engineering

Basal Lining System

3.1.1 The basal lining system will comprise an artificial geological barrier (AGB) comprising suitable cohesive materials won from the base of the excavation, where necessary supplemented by chemically and physically suitable imported cohesive inert wastes, compacted to achieve an appropriate maximum permeability or lower: the AGB layer shall have a permeability equivalent to 1x10-7m/s at a thickness of 1.0m. If the permeability of the compacted liner materials is higher than this, the liner thickness will be adjusted to achieve the same effective permeability/thickness ratio (i.e. 5.0m thick at 5x10-7m/s). The proposed landfill design proposes a minimum AGB thickness of 1.0m.

3.1.2 It is proposed that the clay lining material will be won from the Grantham Formation clay/mudstone underlying the limestone in the base of the western part of the quarry and will be supplemented by chemically and physically suitable imported cohesive inert waste. For clay material to be considered suitable for use as a liner it must have the following properties, and the site won material and any imported waste used to form the AGB liner layer will be tested to confirm compliance:

- no evidence of stones over 125mm,
- no water be seen to leach from the material,
- be possible to roll into a 3mm thick rod without crumbling and
- have a minimum shear strength of 45kN/m2

3.1.3 The testing results of the underlying Grantham Formation mudstones have been undertaken and are set out in the accompanying Stability Risk Assessment.

Side Slope Lining System

3.1.4 The side slope AGB lining system will comprise suitable site-won mudstone clay materials (as discussed in Section 2.5 of the SRA report), where necessary supplemented by chemically and physically suitable imported cohesive inert wastes, spread and compacted in layers to achieve a permeability less than or equivalent to 1 x 10^{-7}m/s at a minimum thickness of 1m, although greater thicknesses may be used to

achieve the same equivalent permeability/thickness ratio if more permeable/variable materials are used (i.e. 5m thick at $5x10^{-7}$m/s). The barrier will be constructed in 3m high lifts against the quarry face side slopes ahead of the deposit of waste in the landfill body.

3.1.5 A minimum AGB layer thickness of 1m is proposed at a maximum permeability of $1x10^{-7}$m/s. Where the side slopes comprise quarry rock faces, which are generally relatively steep imported cohesive subgrade fill will be placed against the faces to create a 1 in 1 subgrade side slope, and the AGB liner layer will be constructed on its sloping surface. In the section where the dividing bund will be placed on the eastern boundary of the site, the inside face of the bund will also be constructed to a side slope of 1 in 1, enabling the AGB layer to be constructed in the same way.

3.1.6 As per Section 2.4 of the SRA report, the AGB layer will comprise engineered compacted clay material of low permeability, formed using site-won materials, supplemented if necessary, using selected physically/chemically suitable imported cohesive inert waste. As the construction of the liner progresses in advance of the level of the landfill mass, it will be unconfined for a short period of time above the level of the adjacent waste and will be subject to undrained strength parameters in this condition. The rate of progress of placing of the landfill waste will be such that, within a short period, while the clay liner remains in an undrained state, waste will be compacted against the liner to ensure that is confined and supported by the fill, ensuring long-term support against the liner.

3.1.7 Full details can be found in the Stability Risk Assessment (reference GPP/CESL/SRA) and Hydrogeological Risk Assessment (reference GPP/CESL/HRA).

Capping

3.1.8 As the permitted waste at the site will comprise solely inert waste types, there is no capping required.

3.2 Restoration

3.2.1 The maximum gradient of the final waste slopes will be no greater than 1v in 6h, which, taking into account the nature of the waste, is considered to be a stable gradient without the requirement for stability analysis.

3.2.2 As the waste to be deposited within the landfill is inert, and the rate of filling relatively slow, any settlement is expected to occur largely concurrent with filling. Any long-term settlement is expected to be insignificant, consequently excessive total or differential settlement of the waste body is considered to be very unlikely. No settlement analysis is therefore considered to be necessary.

3.2.3 As the waste will be inert, there is no risk of instability causing a release of potentially polluting substances to air or to controlled waters.

3.2.4 In accordance with the extant planning permission, the site will be restored (see drawing ESSD6) to a landform in keeping with the surrounding land. This is generally flat at approximately 137-136mAOD across the site.

3.2.5 The site will be returned to agricultural use.

3.2.6 No allowance has been made for any material settlement due to the waste types.

3.3 Post Closure Controls (Aftercare)

Post Closure Site Management

3.3.1 After completion of landfill operations and site restoration, minimal site management is likely to be required. Vegetation should establish itself and surface run-off will be controlled by the existing system.

Design Requirements

3.3.2 The engineering design of the landfill is simple due to the low pollution potential of the proposed waste. The detailed stability analysis is set out in the SRA accompanying the Permit Application (document reference GPP_CESL_SRA). The engineering design is considered compliant with the Landfill Regulations and no cap is required; topsoil will be placed on the finished landfill and vegetation planted. The site will be restored in accordance with the planning permission as shown on the approved restoration levels drawing ESSD6.

Potential for future Subsidence

3.3.3 The completed site (i.e. after restoration of the landfill) is considered very unlikely to experience subsidence within the waste mass due to its placement on competent bedrock and its granular nature, as discussed in the SRA Report.

3.3.4 On completion of the restoration process, the final ground level will be surveyed to ensure that the proposed elevations have been reached and to provide for comparison with future ground level survey data.

On-Going Groundwater & Landfill Gas Monitoring

3.3.5 During the operational and post-closure stages of the landfill, it is proposed that groundwater sampling and landfill gas monitoring will be undertaken at five boreholes around the perimeter of the landfill together with two in-waste landfill gas monitoring boreholes. Ongoing groundwater monitoring is described in more detail in the accompanying HRA report and landfill gas risk assessment and monitoring set out in the accompanying Landfill Gas Risk Assessment report (Appendix 9 to the EMS).

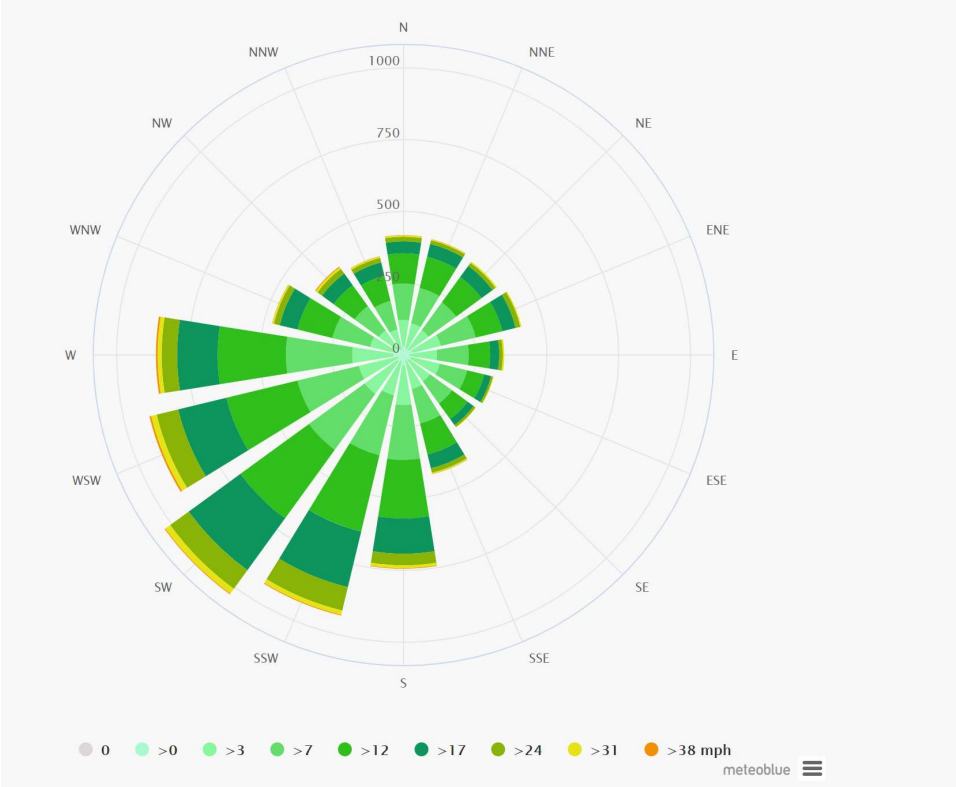
Permit Surrender

3.3.6 On completion of waste disposal operations, the site will be completed using cover topsoil and surveyed. Post-closure monitoring will continue for a period of 12 months prior to application to the EA for surrender of the Permit (assuming no problems arise with compliance).

4 Monitoring

4.1 Weather

4.1.1 The wind rose data for Grantham below shows that the wind direction in the locality is predominantly a south westerly wind.



5 Site Condition Report

5.1.1 The site history, current use and surround area is detailed in this document, including geology, hydrogeology and hydrology. There are no historic incidents of contamination, and no waste activities have taken place at the site.

5.1.2 Adjacent land under waste management use will operate under their own permit and conditions to prevent any impact on this site.

5.1.3 The groundwater monitoring wells set out in this report will monitor the site during the permitted period, closure and surrendering the permit.

5.1.4 A detailed Site Condition Report (SCR) is not considered material to the Permit application due to the proposed permitted activity (landfill) being limited to the area of the quarry workings in the Colsterworth Triangle Quarry. No waste disposal activities outside the Permit application boundary are proposed to be undertaken within existing CESL operations areas. There is therefore no significant area of land within the quarry site that will remain unexcavated/infilled.

5.1.5 Baseline groundwater conditions are defined by pre-application monitoring as described in the HRA report. The EA's Site Condition report template has been completed and is shown on Table T-ESSD4 below.

Table T-EESD4

1.0 SITE DETAILS	
Name of the applicant	CESL Ltd
Activity address	Colsterworth Triangle Quarry, Crabtree Road, Stainby, Grantham, Lincolnshire, NG33 5BH
National grid reference	SK901244 E 490146, N 324421

Document reference and dates for Site Condition Report at permit application and surrender	N/A

Document references for site plans (including location and boundaries)	GPP/CESL/SQ/P/21/01

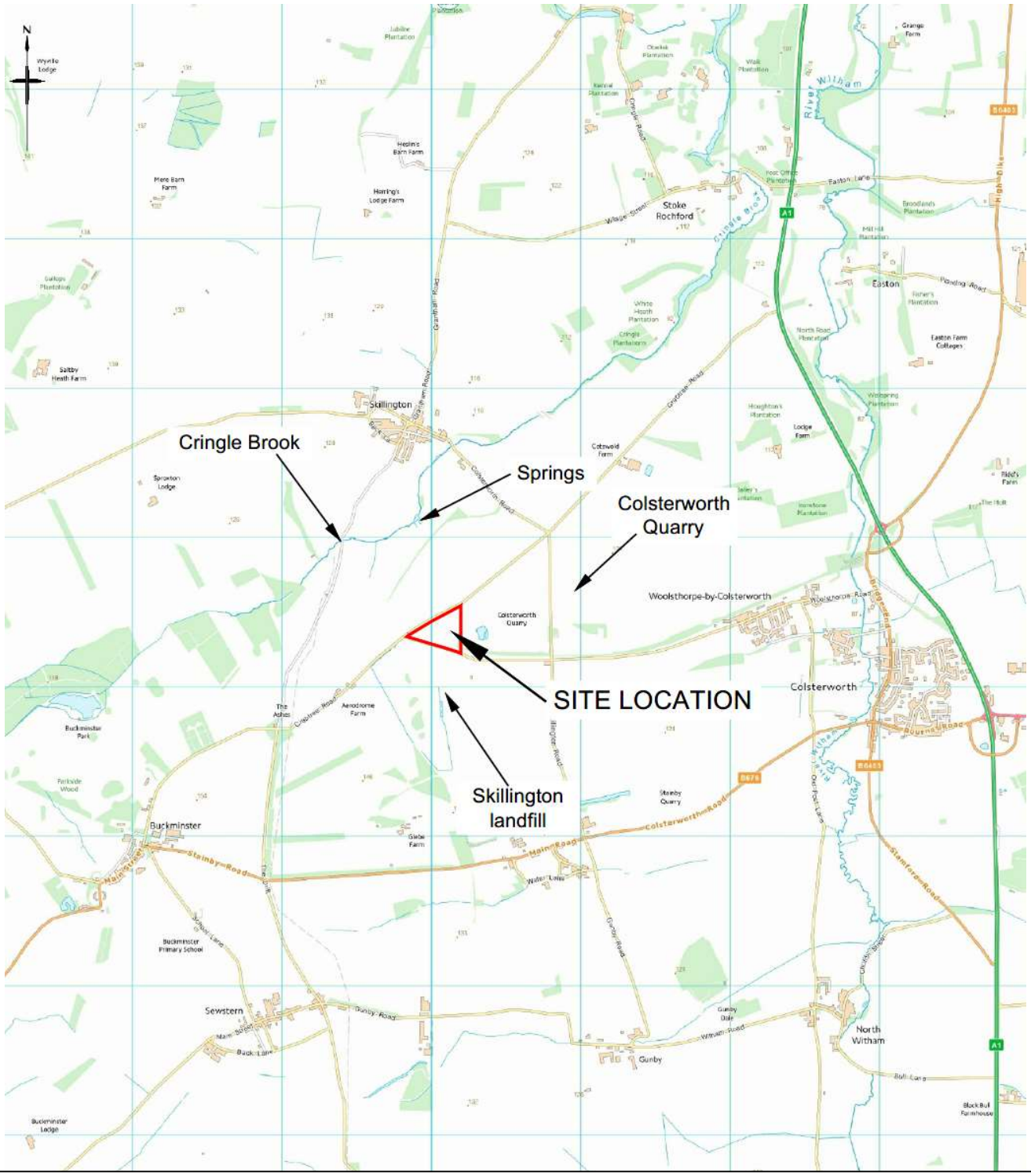
2.0 Condition of the land at permit issue	
Environmental setting including: • geology • hydrogeology • surface waters	**Geology** The geological map published by the British Geological Survey (BGS), indicates that the bedrock geology comprises the Lower Lincolnshire Limestone of Middle Jurassic age. The Lower Lincolnshire Limestone is described by the BGS as comprising limestones, dominated by low-energy calcilutite, and peloidal wackestone and packstone, commonly including sandy limestone or calcareous sandstone in the basal part. Underlying the Lower Lincolnshire Limestone are the mixed strata of the Grantham Formation (formerly Lower Estuarine Series), described by the BGS as comprising mudstones, sandy mudstones and argillaceous siltstone-sandstones, and the Northampton Sand Formation, which is described as greenish grey sandy ironstone, weathering to brown limonitic sandstone, with the uppermost beds generally comprising ferruginous sandstone. No superficial deposits are indicated on or adjacent to the site. The geological mapping indicates that the Grantham Formation is discontinuous in the area and may locally pinch out in some areas, however, observations of the completed cut faces on the adjacent landfill site indicated that the Grantham Formation mudstones are consistent across that site. The exposed quarry faces on the three sides of the quarry comprised medium bedded buff coloured limestones, with thin sandy limestone interbeds around 100mm thick, considered to be of the Lower Lincolnshire Limestone. The dip of the strata is sub horizontal and there are subvertical joint sets that are generally medium spaced that are cut off by occasional more massive medium to thick beds that have a medium to wide joint spacing. The more thickly bedded strata become more frequent further down the sequence/quarry face. The limestone at the top of the faces is typically capped by a weathered surface layer of heavily weathered limestone cobbles in a sandy clay matrix around 1m thick. **Hydrogeology** The EA has designated the LLL as a principal aquifer. This classification is attributed to

	formations, which predominantly comprise high permeability rocks that generally provide a high level of water storage. Principal aquifers may support water supply and/or river base flow on a strategic scale. The underlying ironstone (NSF) is designated as a secondary A aquifer. These aquifers generally comprise permeable layers, which are capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. Observations within the active quarry and groundwater depth measurements recorded in the perimeter wells confirm that the limestone beneath the site is unsaturated and that groundwater rests within the underlying clay of the Grantham Formation. Deeper groundwater levels at the site are anticipated to be below the base of the quarry excavation in continuity within the underlying clay and ironstone. The Site is not situated within a groundwater source protection zone (SPZ). The closest SPZ is 2,760 m east and relates to a designated total catchment for groundwater abstractions located at Sleights Wood, some 5,900 m east-northeast of the Site. Extraction takes place above the water table so is 'worked dry'. **Surface Water** The nearest sensitive surface water features down hydraulic gradient of the Site are unnamed drains south and south east of the Site. The closest of which is located approximately 200m south of the site at its closest point. Cringle Brook is located 640m northwest of the site and flows towards the north east before joining the River Witham approximately 6km north east of the site. Springs flowing into Cringle Brook are noted on mapping approximately 600m to the northwest at an elevation of around 112m AOD, approximately 9m below the base of the proposed landfill. The River Witham is the nearest named down hydraulic gradient surface water receptor over 3km south east from the site.
Pollution history including: • pollution incidents that may have affected land • historical land-uses and associated contaminants • any visual/olfactory evidence of existing contamination	There are no known pollution incidents within the land included in the extension. The land was previously undeveloped.

• evidence of damage to pollution prevention measures	
Evidence of historic contamination, for example, historical site investigation, assessment, remediation and verification reports (where available)	No historic contamination has been identified therefore no remediation is required.
Baseline soil and groundwater reference data	Hydrological Risk Assessment (GPP_CESL_HRA)
Supporting information	• Source information identifying environmental setting and pollution incidents • Historical Ordnance Survey plans • Site reconnaissance • Historical investigation / assessment / remediation / verification reports • Baseline soil and groundwater reference data

3.0 Permitted activities	
Permitted activities	Inert Landfill Operation
Non-permitted activities undertaken	N/A
Document references for: • plan showing activity layout; and • environmental risk assessment.	See drawings: • GPP/CESL/SQ/24/02 (see EMS) Documents: • GPP/CESL/SRA

APPENDIX ESSD 1: SITE LOCATION PLAN



D-ESSD 1			Client: **CESL Ltd**
Title: Site Location Plan			Project: **ESSD**
File Ref: C022-04	Rev: 1	Scale: NTS	Site: **Colsterworth Triangle Inert Landfill Permit**
Date: June 2024	Drawn: CS	Checked:	

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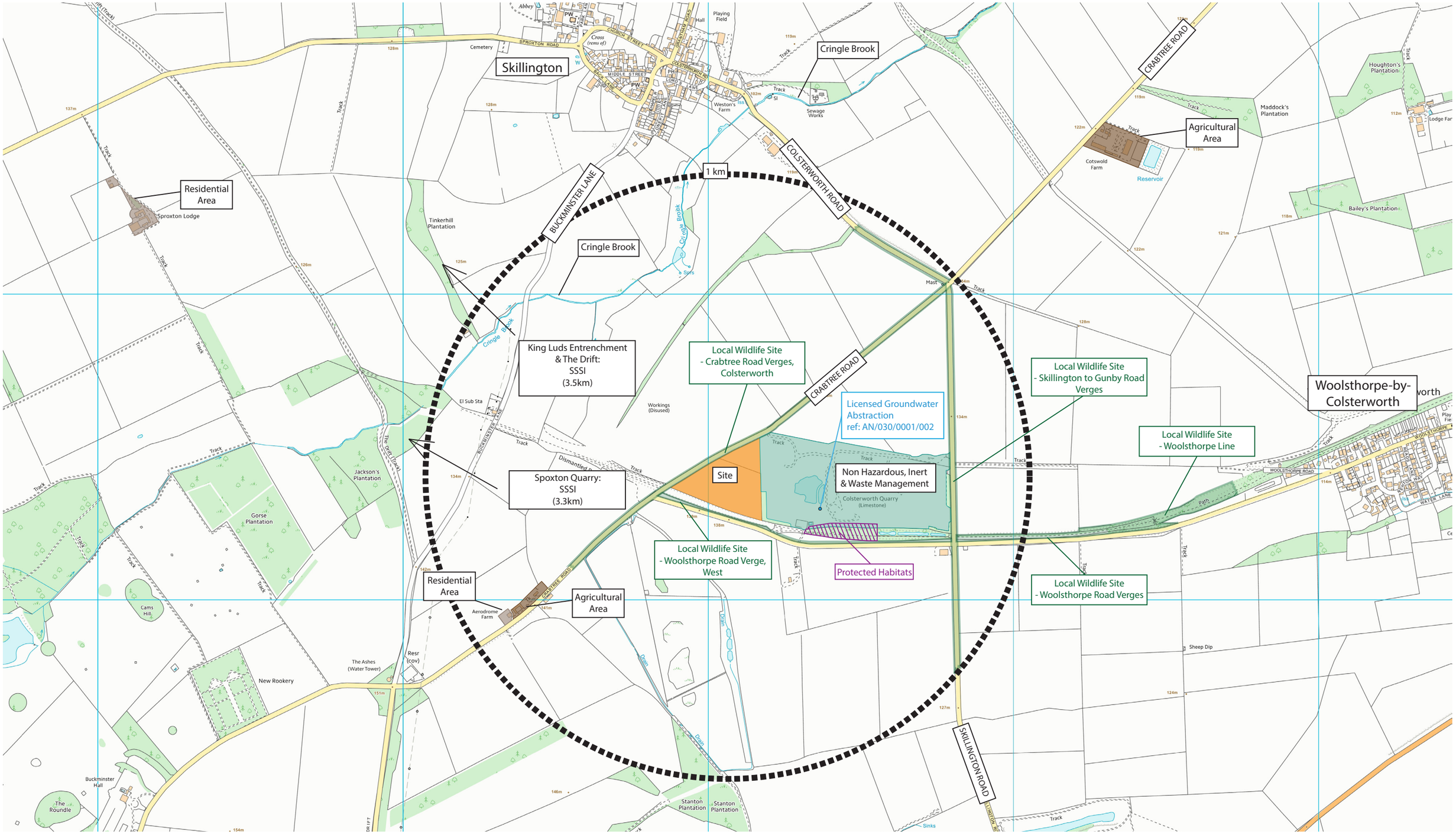
APPENDIX ESSD 2: ENVIRONMENTAL SITE SETTING



Stainby Quarry, Crabtree Road, Lincolnshire
CESL

DRAWING REFERENCE: D-ESSD2

ENVIRONMENTAL SITE SETTING PLAN

DRAWN BY:	KD	CHECKED BY:	CS
DRAWING NO.:	GPP/CESL/SQ/ILP/24/04	REV NO.:	1
SCALE:	NTS	DATE:	24/07/2024

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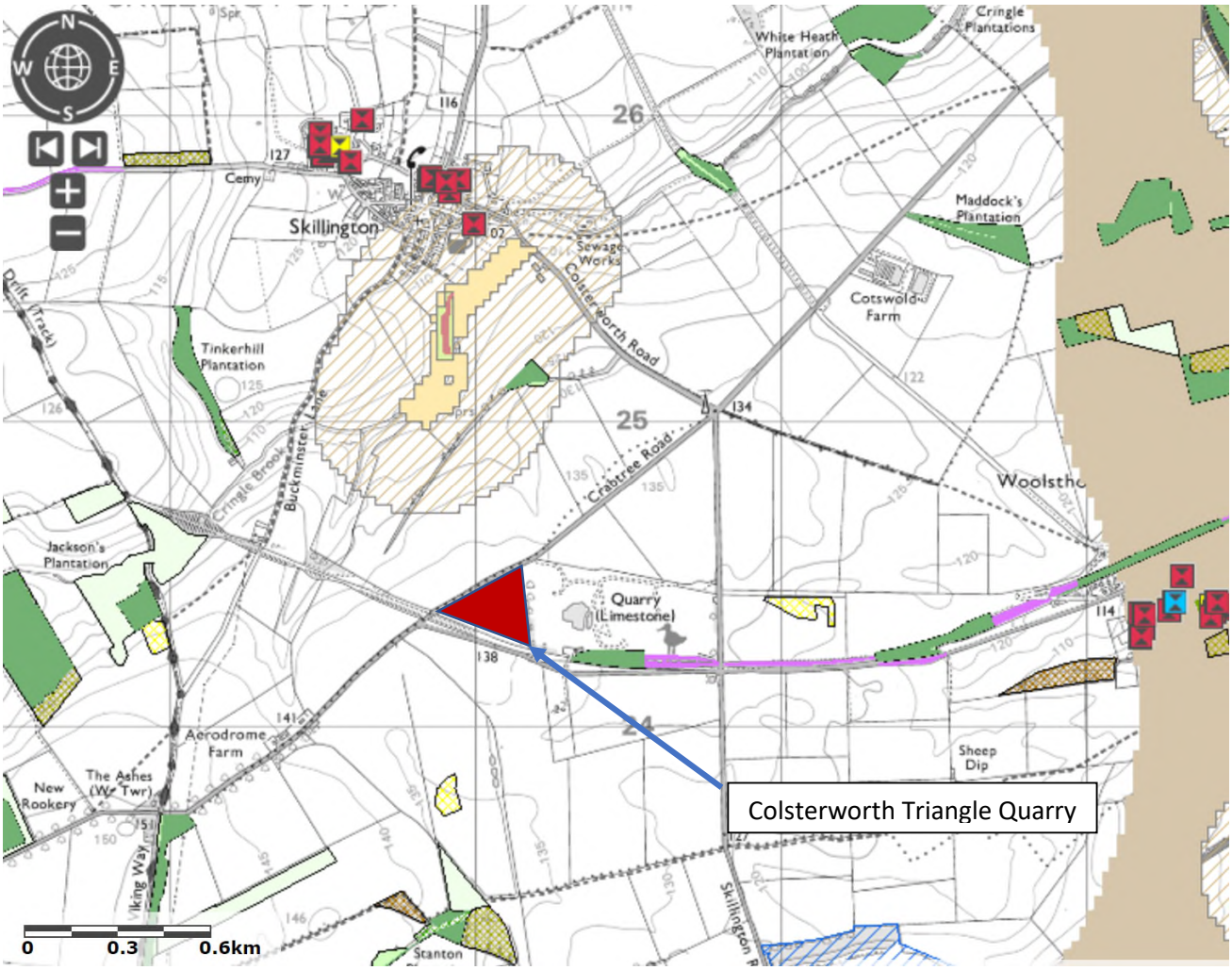
APPENDIX ESSD 3: CULTURAL & NATURAL HERITAGE



Historic Statutory

Scheduled Monuments (England)

Scheduled Monuments (England)

World Heritage Sites (England)

World Heritage Sites (England)

Buffer Zone

World Heritage Site

Listed Buildings (England)

I

II

II*

Ancient Woodland (England)

Ancient and Semi-Natural Woodland

Ancient Replanted Woodland

Priority Habitat Inventory - Deciduous Woodland (England)

Forestry Commission Legal Boundary (England)

National Forest Inventory (GB)

Assumed woodland

Broadleaved

Cloud \ shadow

Conifer

Coppice

Coppice with standards

Felled

Ground prep

Low density

Mixed mainly broadleaved

Mixed mainly conifer

Shrub

Uncertain

Windthrow

Young trees

Priority Habitat Inventory - Traditional Orchards (England)

Woodpasture and Parkland BAP Priority Habitat (England)

ESSD Figure 3			Client: **CESL Ltd**
Title: Cultural & Natural Heritage			Project: **ESSD**
File Ref: C022-04	Rev: 1	Scale: NTS	Site: **Colsterworth Triangle Inert Landfill Permit**
Date: June 2024	Drawn: CS	Checked:	

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APPENDIX ESSD 4: LANDFILL & ECOLOGICAL SITES

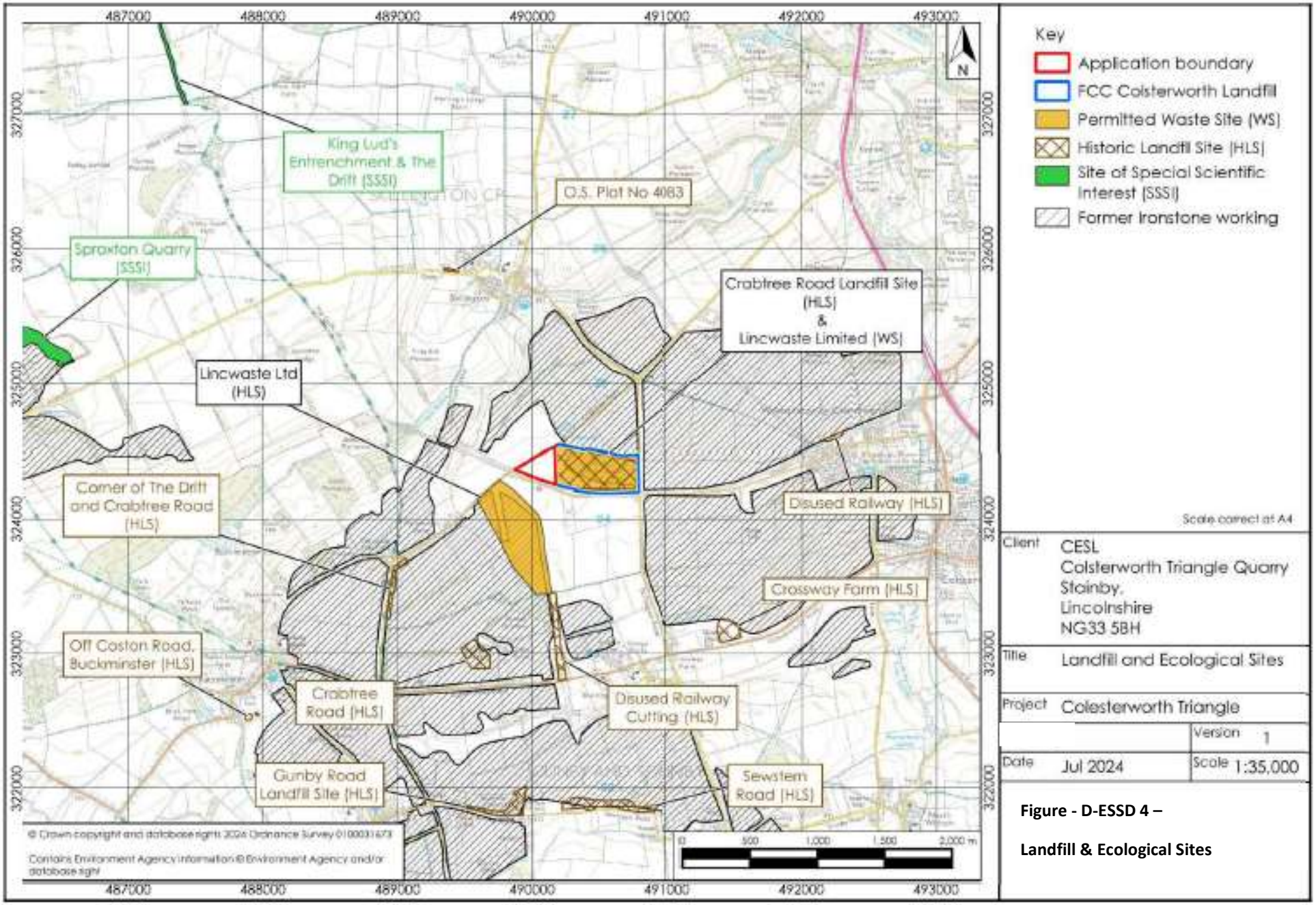

Figure - D-ESSD 4 –

Landfill & Ecological Sites

APPENDIX ESSD 5: SITE LAYOUT PLAN

Key

- Application boundary
- FCC Colsterworth Landfill
- 1m contour (mAOD)
- Monitoring borehole (id)
- Proposed direction of infilling

D-ESSD 4			Client: **CESL Ltd**	GPP GP PLANNING LTD
Title: - Site Layout & Borehole Locations			Project: **ESSD**	
File Ref: C022-05	Rev: 1	Scale: NTS	Site: **Colsterworth Triangle Inert Landfill Permit**	
Date: June 2024	Drawn: CS	Checked:		

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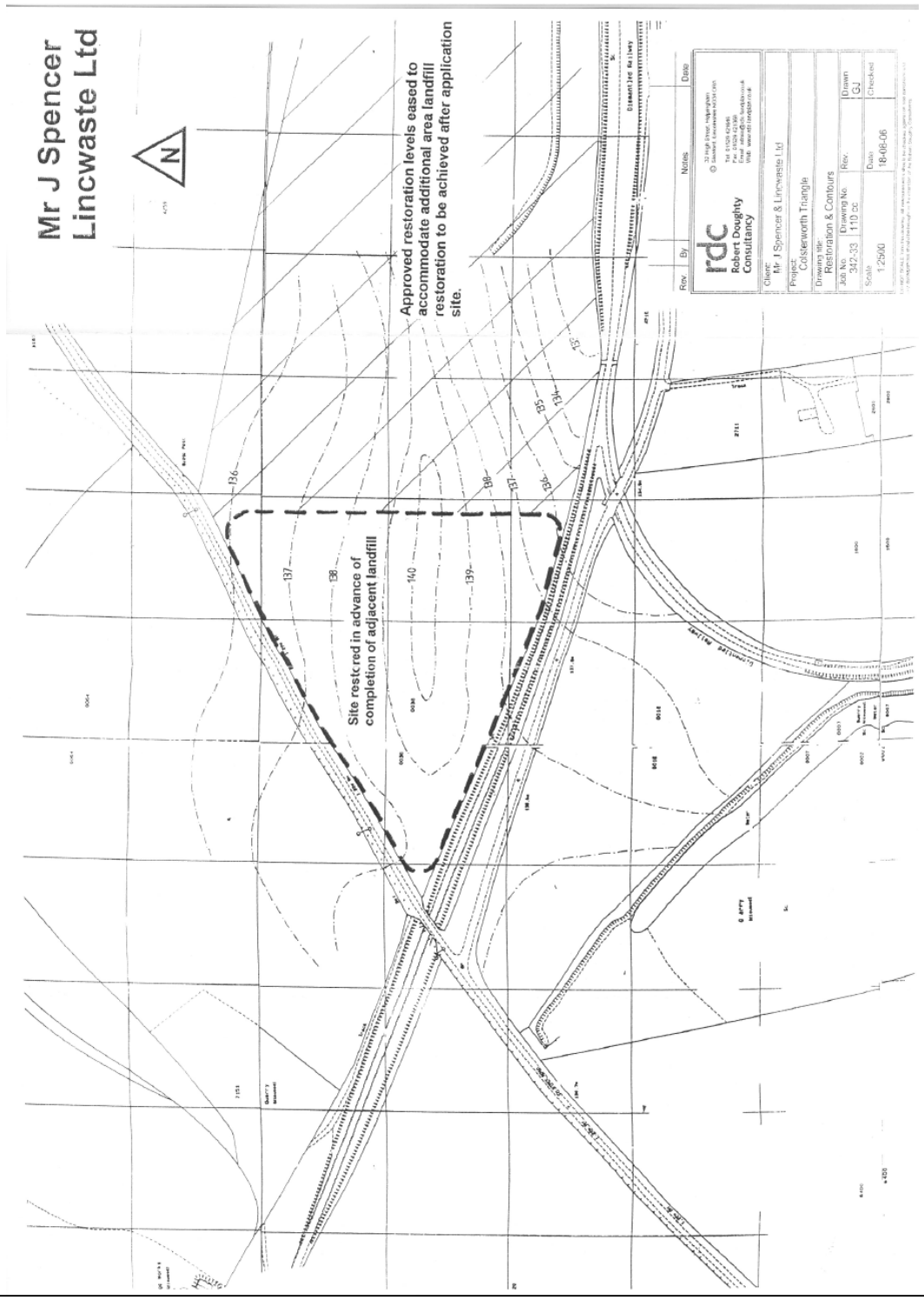
APPENDIX ESSD 6: APPROVED RESTORATION PROFILES



D-ESSD 5			Client: **CESL Ltd**
Title: Approved Restoration Levels			Project: **ESSD**
File Ref: C022-04	Rev: 1	Scale: NTS	Site: **Colsterworth Triangle Inert Landfill Permit**
Date: June 2024	Drawn: CS	Checked:	

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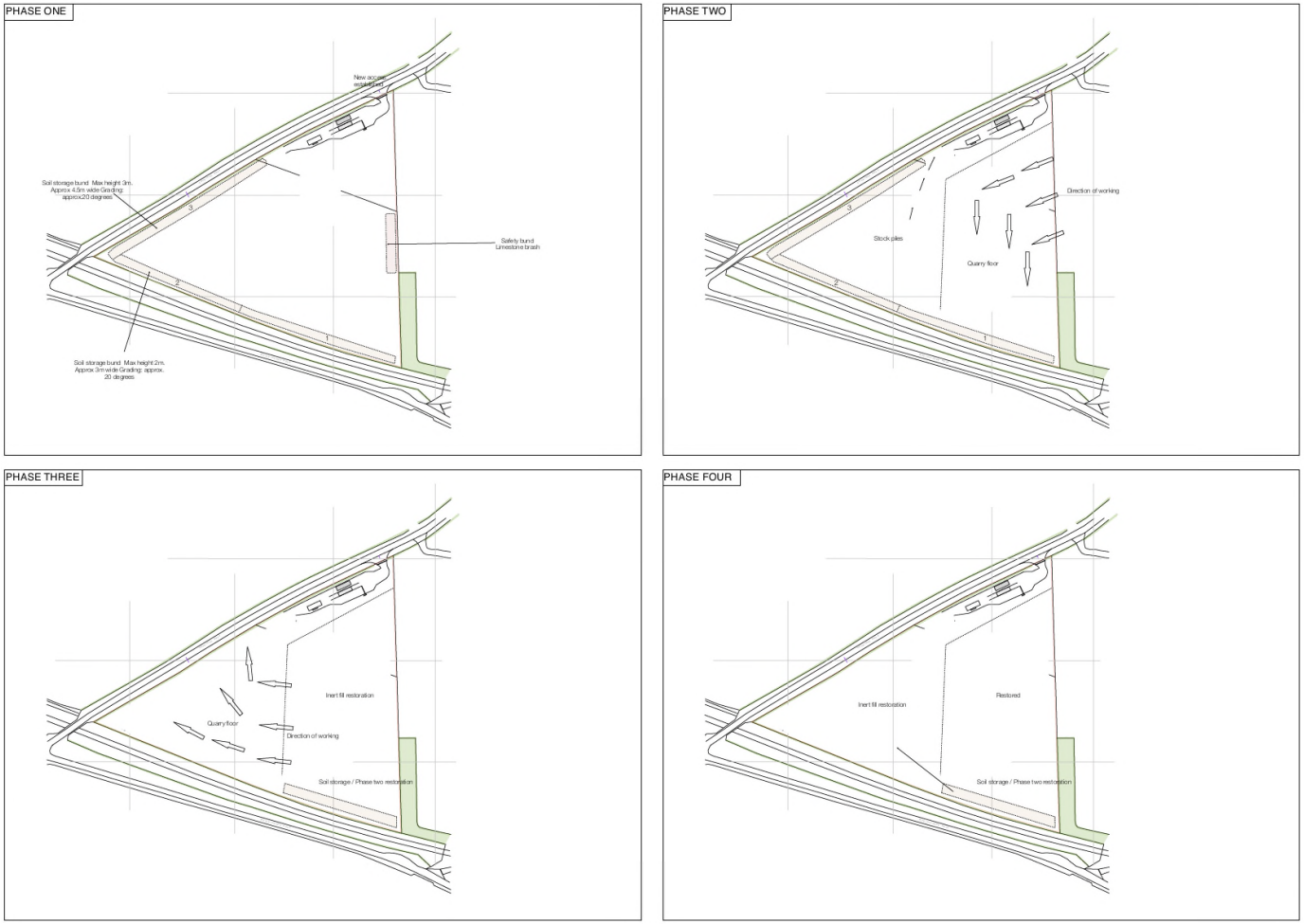
APPENDIX ESSD 6: APPROVED PHASING PLAN



ESSD Figure 6			Client: **CESL Ltd**
Title: Approved Phasing Plan			Project: **ESSD**
File Ref: C022-04	Rev: 1	Scale: NTS	Site: **Colsterworth Triangle Inert Landfill Permit**
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APPENDIX ESSD 8: WELL MONITORING LOCATIONS

ESSD Figure 8			Client: **CESL Ltd**
Title: Well Monitoring Locations			Project: **ESSD**
File Ref: C022-04	Rev: 1	Scale: NTS	Site: **Colsterworth Triangle Inert Landfill Permit**
Date: July 2024	Drawn: CS	Checked:	

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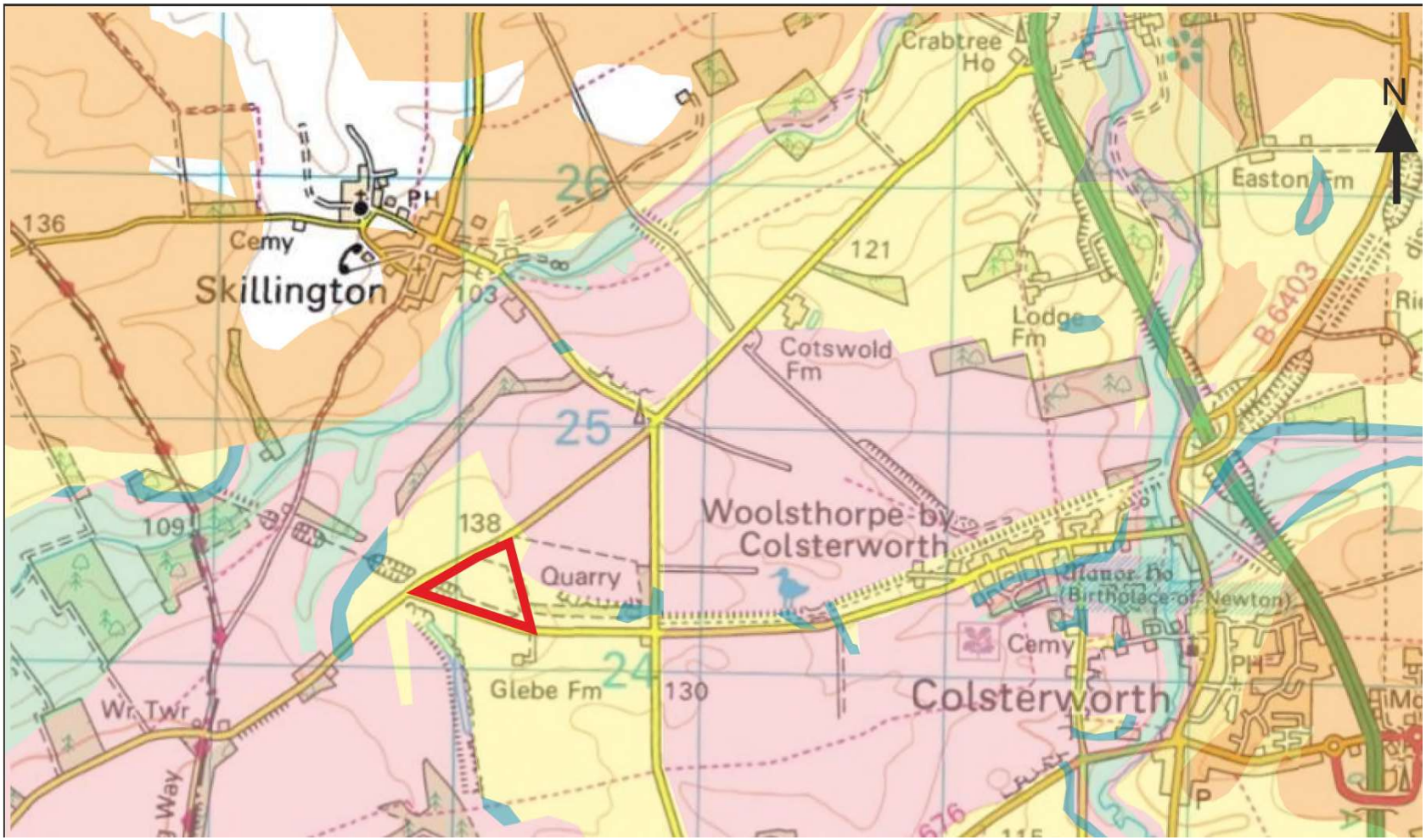
APPENDIX ESSD 9: LOCAL GEOLOGY



ESSD Figure 9			Client: **CESL Ltd**
Title: Geology			Project: **ESSD**
File Ref: C022-04	Rev: 1	Scale: NTS	Site: **Colsterworth Triangle Inert Landfill Permit**
Date: June 2024	Drawn: CS	Checked:	

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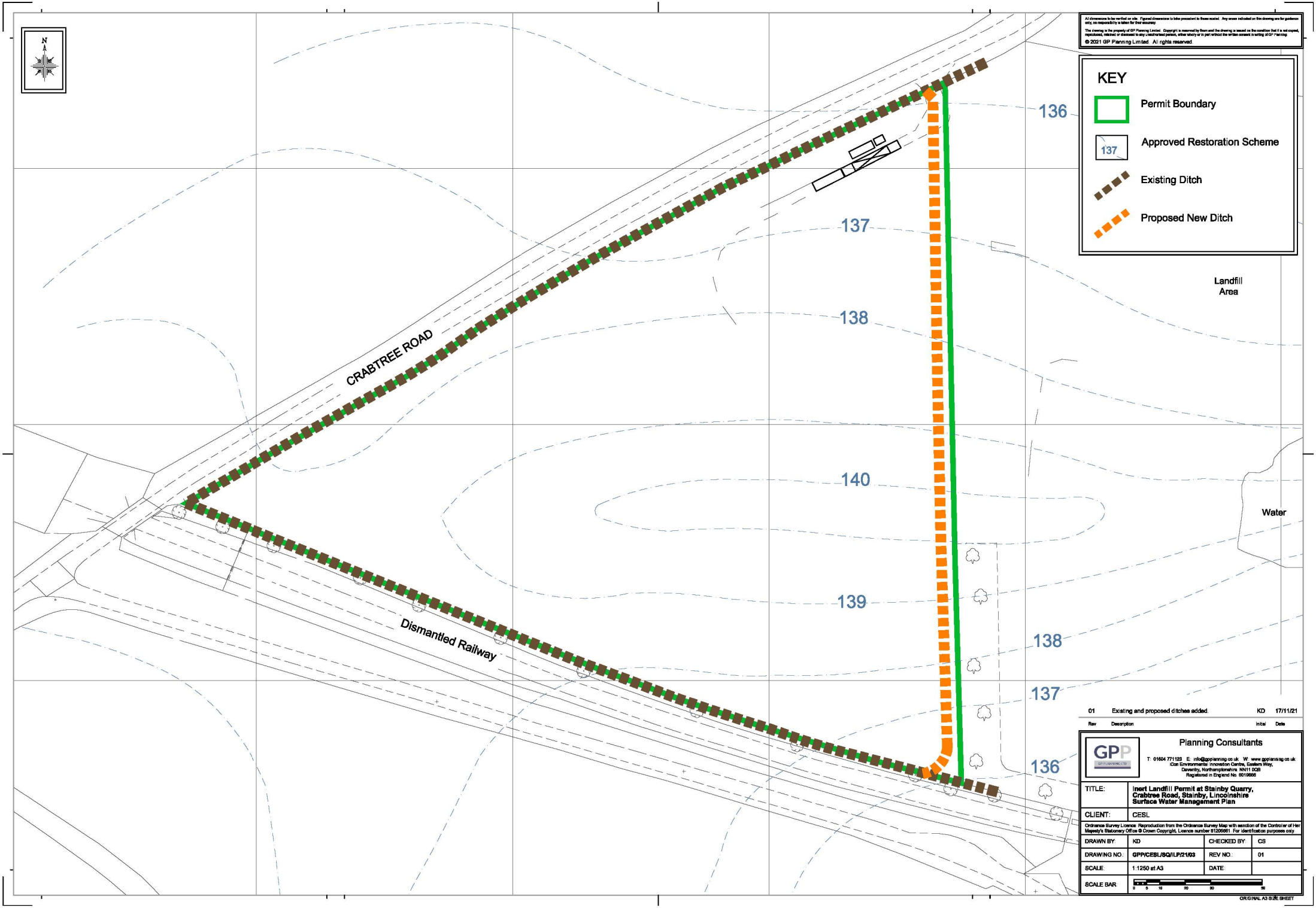
Key

Site Location

Geology

- Upper Lincolnshire Limestone Formation
- Lower Lincolnshire Limestone Formation
- Grantham Formation (Estuarine Series)
- Northampton Sand Formation
- Whitby Mudstone Formation (Lias)

APPENDIX ESSD 10: SURFACE WATER MANAGEMENT PLAN



Rev	Description	Initial	Date
01	Existing and proposed ditches added.	KD	17/11/21

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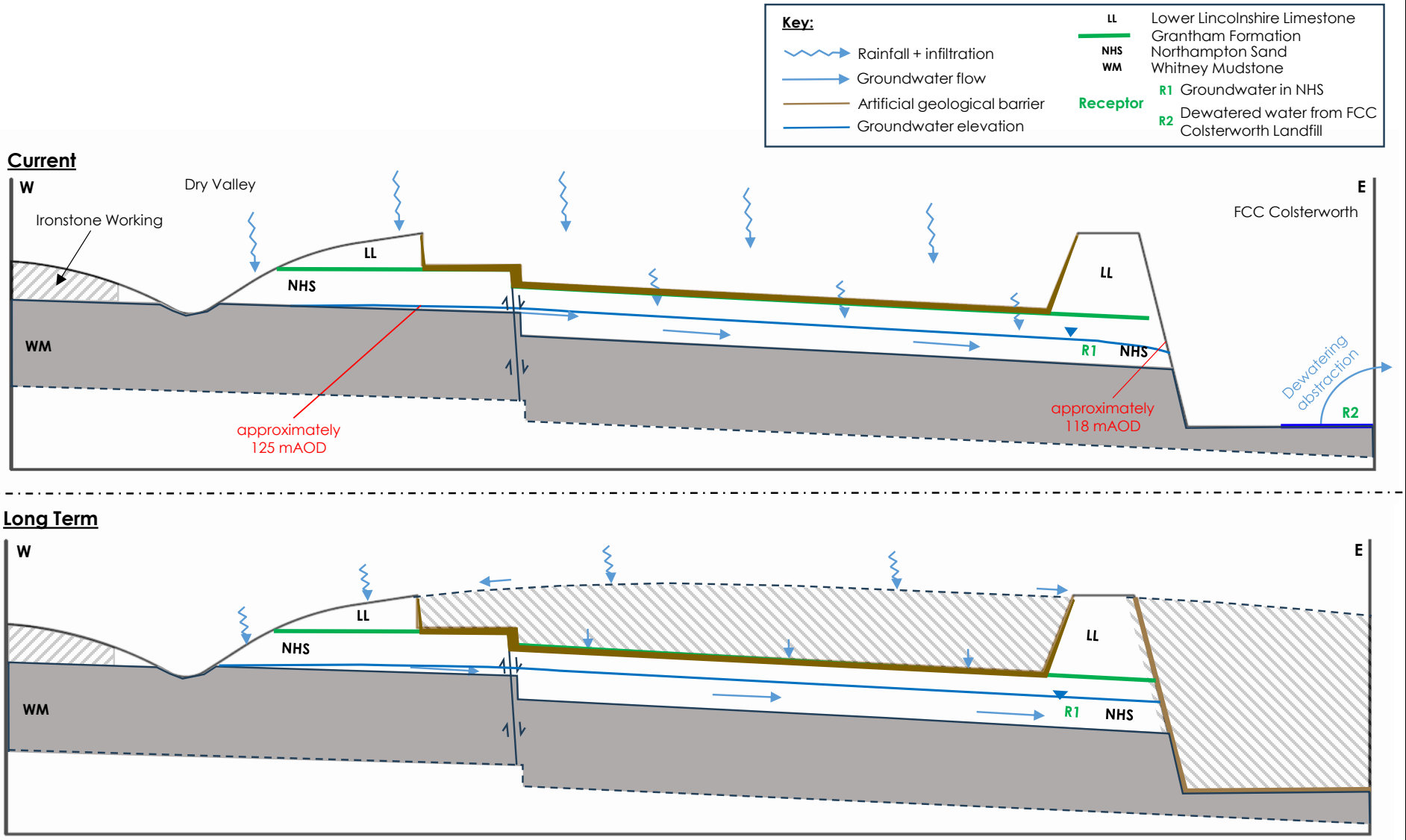
TITLE:	**Inert Landfill Permit at Stainby Quarry, Crabtree Road, Stainby, Lincolnshire Surface Water Management Plan**
CLIENT:	CESL

DRAWN BY:	KD	CHECKED BY:	CS
DRAWING NO.:	GPP/CESL/SQ/ILP/21/03	REV NO.:	01
SCALE:	1:1250 at A3	DATE:	
SCALE BAR:	0 5 10 20 30 50		

ORIGINAL A3 SIZE SHEET

APPENDIX ESSD 11 HYDROLOGICAL CONCEPTUAL MODEL



hafrenwater
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Barkers Chambers • Barker Street • Shrewsbury • United Kingdom • SY1 1SB
E: info@hafrenwater.com • T: 01743 355 770

Client	CESL Colsterworth Triangle Quarry Stainby, Lincolnshire NG33 5BH
Title	Source and Receptor Schematic Cross-section
Project	Colsterworth Triangle
Drawing	3601/HRA/11
Version	2
Date	Nov 2024
Scale	n/a

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Mr Christian Smith DipTP MRTPI MCMI
Miss Maureen Darrie BSc (Hons) MRTPI

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