Greenhouse Gas Assessment

Hilltop Coal Mine

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Turley

Contents

Rebecca Beeson
Associate Director, Turley Sustainability
rebecca.beeson@turley.co.uk

Colin Morrison
Director, Turley Sustainability
colin.morrison@turley.co.uk

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1. Introduction

1.1 This Greenhouse Gas (GHG) Assessment has been prepared by Turley Sustainability on behalf of Provectus Remediation Ltd to support the planning appeal (REF: APP/U1050/W/16/3166227) for the development of an open cast coal mine at Hilltop Farm, Derby Road, Clay Cross in North East Derbyshire.

1.2 This GHG assessment has been requested by the Planning Inspector as a supplementary technical document to support the public inquiry.

Purpose of the Greenhouse Gas Assessment

1.3 The aim of this report is to describe the potential GHG emissions from the Proposed Development, as well as the upstream and downstream emissions associated with the proposed extraction of coal at Hilltop Farm.

1.4 This document presents an independent technical assessment of the GHG emissions resulting from the proposed coal mining activities at the site. It does not provide any interpretation or evaluation of the significance of these emissions.

Structure of the Report

1.5 The remainder of the GHG assessment is structured as follows:

- **Chapter 2 Methodology -** explains the assessment methodology and steps followed in undertaking this assessment of GHG emissions.
- **Chapter 3 The Proposed Development -** sets out the activities within the Proposed Development.
- **Chapter 4 Scope 1 Emissions Sources –** details the direct GHG emissions that occur from sources owned or controlled by the company and that occur in relation to the combustion of fuels or release of gases.
- **Chapter 5 Scope 2 Emissions Sources** - details the indirect GHG emissions that occur from the generation of purchased electricity, heat or steam consumed by the company.
- **Chapter 6 Scope 3 Emissions Sources** – details the other indirect GHG emissions that occur as a result of the activities of the company, both upstream and downstream of the mining activity.
- **Chapter 7 Summary –** provides a summary of the emissions profile and a comparison with local, national and global emissions.

2. Methodology

Overview of Approach

2.1 This assessment of GHG emissions is guided by a number of principles as set out in the Greenhouse Gas Protocol Corporate Standard (World Resources Institute (WRI), 2004).

- **Relevance:** ensuring that the GHG inventory appropriately reflects GHG emissions and serves the decision-making needs of users
- **Completeness:** Accounts and reports on all GHG emission sources and activities within the chosen inventory boundary. Exclusions are disclosed and justified.
- **Consistency:** Use consistent methodologies to allow for meaningful comparisons of emissions.
- **Transparency:** Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources.
- **Accuracy:** Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable.

2.2 The Greenhouse Gas Protocol Initiative is a multi-stakeholder partnership of businesses, non-governmental organisations (NGOs), governments, and others covered by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Launched in 1998, the Initiative's mission is to develop internationally accepted GHG accounting and reporting standards for business.

2.3 The standard provides standards and guidance for organisations preparing GHG emissions inventories. It covers the accounting and reporting of the six greenhouse gases covered by the Kyoto Protocol:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_20)
- Hydroflourocarbons (HFCs)
- Perflourocarbons (PFCs)
- Sulphur Hexaflouride (SF_6)

2.4 Appendix D of the Corporate Standard identifies emissions scopes and sources specific to industry sectors and activities, including for coal mining. This identifies:

2.4.1 Scope 1 Emission Sources

2.4.1.1 Stationary combustion (methane flaring and use, use of explosives, mine fires)

2.4.1.2 Mobile combustion (mining equipment, transportation of coal on site)

2.4.1.3 Fugitive emissions (CH_4 emission from coal mines and coal piles)

2.4.2 Scope 2 Emissions Sources

2.4.2.1 Stationary combustion (consumption of purchased electricity, heat or steam)

2.4.3 Scope 3 Emission Sources

2.4.3.1 Stationary combustion (product use as fuel)

2.4.3.2 Mobile combustion (transportation of waste and distribution of coal, employee business travel, employee commuting)

2.4.3.3 Process emissions (gasification)

2.5 The basic approach to calculating GHG emissions is to multiply an appropriate emissions factor by the relevant activity data. The sources of this data are reviewed in detail in the following sections for each of the activities and emissions sources identified in Section 2.4

2.6 The GHG emissions profile developed for the activities identified in Section 2.4 is then compared with local and national emissions profiles to provide context for the scale of GHG emissions.

Limitations of the Assessment

2.7 As this is a predictive assessment, there is inherent uncertainty in the results. As far as practicable, data specific to the Proposed Development has been used to develop the emissions profile, but in some cases this is not possible and other external sources of data are used. In accordance with the principles of the GHG Protocol, all assumptions and data uncertainties are disclosed.

Emission Factors

2.8 The primary source for emissions factors used in this report is the *UK Government GHG Conversion Factors for Company Reporting* (BEIS[(2)], 2017), termed "*BEIS Emission Factors*" hereafter. The BEIS Emission Factors are produced annually and are provided for use by UK based organisations reporting on UK operations that occurred during the period 1st April 2016 to 31st March 2017.

2.9 Although the figures are designed for retrospective application to activity data that has already occurred, they have been applied in this instance to activities that will occur in the future. For most fuel types, there is little or no variation in emission factor year-by-year and this is appropriate. Where there is likely to be a significant impact on the level of emissions calculated, this is discussed further in the relevant section.

2.10 BEIS Emission Factors are based on various sources that are reviewed at different frequencies, some of which may not be annual. Where annual averages are provided, they may not be reflective of the actual supply that will be procured.

3. The Proposed Development

Site Description and Context

3.1 The proposed surface coal mining scheme is to be located in between the A61 (Derby Road) and east of the settlements of Holmgate and Woodthorpe in Derbyshire. It lies at the north western edge of Clay Cross and to the south of the village of Old Tupton. The site falls within the administrative boundary of North East Derbyshire District Council.

3.2 The application site covers and area approximately 28.53 hectares, with a further 4.67 hectares within the control of the applicant.

Proposed Development

3.3 The proposed surface coal mining scheme has been prepared to secure efficient working of the site to minimise environmental impact. The development will generally comprise:

- Coaling and backfilling activities
- Mineral screening and temporary stockpiling
- Improvements to site access point
- Internal haulage of material
- Water treatment and discharge
- Site restoration and post-restoration aftercare

3.4 The coaling scheme and backfilling activities will be phased over the operational life of the scheme. The material used to backfill the extraction void in order to achieve restoration will comprise solely of material originating at the Application Site. There will be no material imported to assist with the restoration of the site.

3.5 The duration of the development will be 3.5 years in total. Site preparation works will take approximately two months to complete, followed by three years of coal extraction activity, followed by four months of final restoration activity.

3.6 The proposed working hours of operation are:

- 0700 to 1900 hours Monday to Friday
- 0700 to 1300 hours on Saturdays
- Other than in case of emergency, no operations will take place on Sundays of Bank Holidays, except for the maintenance of plant and machinery, pumps and ancillary equipment. The pumping of water may take place outside the hours of operation.

Coaling and Backfilling Activities

3.7 The coaling and backfilling activities will be undertaken in 19 cuts, as shown on drawings 17929-SK-101 to 17929-SK-119. In order to assist the coaling and backfilling activities, overburden and soil storage will be undertaken on site. Storage arrangements are shown on drawing 17929-SK-201B Bund and Stockpile Plan.

3.8 Mineral will be extracted with an excavator and then loaded into dump trucks to transport the mineral to the processing area.

3.9 Coal processing activities will comprise of screening, prior to the loading of the coal into road going HGVs for distribution.

3.10 An internal haul road will be constructed to connect the site access point with the coal processing yard. This will be constructed with aggregate material.

3.11 The extraction of coal will generate an average of 12 articulated lorries per day (24 movements). There will be a peak flow of 40 movements per day during coaling periods.

3.12 A routing scheme will be enforced so that any coal lorries approaching and exiting the site will do is via the M1 and the A6175 through North Wingford. The proposed route is shown on drawing GPP/P/HF/14/07 HGV Routeing Plan.

3.13 Temporary works are those outside of normal mining activities and are considered to be:

- Topsoil and overburden stripping
- Lagoon construction
- Drainage enhancements/improvements
- Bund formation
- Final restoration
- Haul road construction and removal
- Hedgerow removal and replanting
- Services diversions
- Footpath diversions
- Tree felling
- Top soil and overburden stripping - undertaken in each of the phases

3.14 Prior to the commencement of extraction operations, soils will be stripped and placed into storage bunds located at the western side of the site, and at the proposed temporary stockpiling area at the centre of the site. Where required, stripped soils will also be used to construct temporary periphery attenuation bunds.

3.15 Soils will be stripped with an excavator and bulldozer. Where longer distances are required to be travelled for the placement of soil in storage bunds, it will be transported by dump truck.

3.16 The proposed coaling operations will be worked in a series of phases with the first phase at the northern end of the site and last phase at the southern end of the site. The location of the first and last phase are designed so that volumes of overburden are equal, ensuring that stockpiled materials are sufficient in avoiding either a shortfall or excess in material during the final restoration works.

Coal Processing Area

3.17 The processing area is located at the centre of the site. The area will be stripped of vegetation, top soil and sub soil, with the soils being used to create noise attenuation bunds around the yard. The bunds will be 5m in height. The stripped area will then be surfaced with crushed aggregate. The processing area will be approximately 7,600m^2 in size.

Site Office and other Facilities

3.18 Two single storey temporary buildings measuring 6.7m x 10.7m[1] will be utilised to provide office and canteen facilities on site and will be in operation for the duration of the development. Provectus have confirmed that the cabins will run from a grid supply which will be installed within the first week of site setup.

Attenuation Lagoons and Water Management

3.19 Prior to the commencement of soil stripping activities, attenuation lagoons will be constructed to capture and manage surface and ground water. The depth of groundwater at the site is 6m below the surface, although discrete inflows from bedding planes and fractures is expected. Water that is encountered will be removed from the excavation by pumping. The pump will operate continuously throughout the extraction phases.

Plant and Equipment

3.20 The following plant and equipment will be used on site:

- EX360C Volvo 30 tonne excavator
- A25T Volvo 25 Tonne dump truck (x2)
- D65PX Komatsu dozer
- EC700CL Volvo or CAT374LME Caterpillar 70 tonne excavator (x2)
- D85EX Komatsu dozer
- A40F Volvo 40 tonne dump truck (x7)
- EC360CL Volvo 21T excavator
- 140M2 CAT Motor Grader
- L150F Volvo 22 tonne loading shovel
- McCloskey triple deck screen (or similar)
- 120 HP tractor
- Sykes Wispaset 150 fully baffled water pump

Geology

3.21 The Geology Report identifies four main seams of coal available within the site. These are:

- Tupton
- Threeqaurters
- Yard
- Cannel (Blackshale)

There is no specific information available at this point as to the gas content of each seam type.

[1] Refer to drawings GPP/P/HF/15/5/18 & GPP/P/HF/15/19

4. Scope 1 Emissions

General Description

4.1 Scope 1 emissions are direct GHG emissions that occur from sources that are owned or controlled by the company and occur in relation to the combustion of fuels or release of gases.

4.2 In the context of the site, these emissions relate to the mining of coal and all associated works to facilitate the mining of coal at the Proposed Development.

4.3 As summarised in Section 2.4, the GHG Protocol identifies the following Scope 1 emissions sources associated with mining activity:

- Stationary combustion (methane flaring and use, use of explosives, mine fires)
- Mobile combustion (mining equipment, transportation of coal)
- Fugitive emissions (CH_4 emission from coal mines and coal piles)

These are explored further in the following sections.

Emissions from Stationary Combustion

4.4 **Methane Flaring and Use, Use of Explosives & Mine Fires**

4.4.1 Description of Process

Technical Note 3 – Mine and Stythe Gas (Provectus Remediation Ltd, 2017) states that methane will be managed by venting to the atmosphere; no flaring or use will take place. Emissions are therefore recorded in Section 4.7 CH_4 from Coal Mines & Coal Piles.

The use of explosives is not proposed at Hilltop Farm as the coal is expected to be at depths that are accessible using mechanical methods.

Health and safety procedures will be in place to reduce the potential for accidental mine fires and the risk of such an incident is considered to be very low.

Based on the above, it is not expected that there will be any emissions associated with stationary combustion at the site.

Emissions from Mobile Combustion

4.5 **Mining Activities**

4.5.1 Description of Process

An outline of the processes involved in mining the coal is provided in the description of the Proposed Development (Sections 3.3 to 3.21); those works that involve the direct combustion of fuel (for example, in engines) and are predominantly process related are included within this section. Works that predominantly relate to the movement of material around the site are discussed in section 4.6 and works that involve the consumption of electricity are evaluated in Section 5.

A list of the proposed mobile equipment is provided in Section 3.21 and the proposed hours of operation of the mine are outlined in Section 3.6.

Temporary Works: As outlined in Sections 3.14 and 3.15, prior to the commencement of coaling activities, soils will be stripped with an excavator and bulldozer. Where longer distances are required to be travelled for the placement of soil in storage bunds, it will be transported by dump truck (evaluated in Section 4.6).

Extraction of Coal: Mineral will be extracted with an excavator and then loaded into dump trucks to transport to the coal processing area.

Coal Processing Area: The processing area is approximately 7,600m^2 and is located at the centre of the site; it will be stripped of vegetation, topsoil and subsoil, with the soils used to create noise attenuation bunds around the coal processing yard. The stripped area will then be surfaced with crushed aggregate reclaimed from the works on site.

Coal Processing: The mineral will be screened in the screening area using a triple deck screen. Based on the sequence of works provided by Provectus (Provectus Remediation Ltd, 2017), the coaling period is expected to last for a period of 28 months.

Improvements to site access point and construction of internal haulage roads: An internal haul road will be constructed to connect the site access point with the coal processing yard. Provectus (Hunt, 2017) confirm that this will be a track constructed from a mix of crushed sandstone from the site and circa 500m^3 of imported crushed aggregate using a grader.

Lagoon construction: The lagoon will be constructed from clay originating from the site (Hunt, 2017).

Water treatment: Water that is encountered will be removed from the excavation by pumping. In the worst case, the pump is will operate continuously throughout the extraction phases.

During the coaling phase, the site will operate for 12 hours on weekdays and six hours on Saturdays, for 48 weeks of the year. However, it is anticipated that actual average working hours will be around 50 hours per week, and a review of material movements around the site assume a three-year operation based on a 50 hour working week (Provectus Remediation Ltd, 2017); this equates to 6,726 total working hours.

Provectus (Hunt, 2017) have confirmed that the following estimated operating hours for each piece of equipment are reasonable based on their experience at Biwater.

Table 1: Estimated Hours of Operation for Mining Equipment

Equipment Type	Estimated operating hours	Explanation
Excavators, bulldozers	5,380	Operation for 80% of working hours during temporary works in advance of coaling, and during excavation of coal (37 months).
Tractors	2,018	Operation for 30% of working hours during temporary works in advance of coaling and during excavation of coal (37 months).
Loading shovels	5,380	Operation for 80% of working hours during temporary works in advance of coaling, and during excavation of coal (37 months).
Grader	400	Operation for 50% of working hours for the duration of temporary works phase only (4 months).
Screen	2,682	Operation for 50% of working hours throughout the coal processing period, based on experience at Biwater.
Water Pump	18,816	Operation for 100% of the coaling phase (28 months), based on worst case scenario.

4.5.2 Data Sources

Where available, manufacturer data on estimated fuel consumption has been obtained; this is presented in Table 2.

Table 2: Manufacturer Data for Proposed Mining Equipment

Equipment Model	Qty	Operating Hours	Fuel Consumption [litres/hour]
EXCAVATION			
CAT374LME Caterpillar 70 tonne excavator	2	5,380	59.4[2]
120HP Tractor (no model specified)	1	5,380	7.73[3]
GRADING			
CAT 140M2 Motor Grader	1	400	6.7[4]

[2] Depending on the specific model of engine installed, hourly fuel consumption varies from 44.2 to 74.6 litres/hour at a 'High' load factor (defined on p1957 of the *Caterpillar Performance Handbook* (Caterpillar, 2015) as: *Continuous truck loading in rock or shot rock soils. Digging 90-95% of the daily work schedule. Large amount of travel over rough ground. Working on rock floor with constant high load factor and high impact.* . An average fuel consumption has been calculated and applied.

[3] No specific model has been determined for the tractor, so a consumption figure has been derived based on data presented in *Literature Review: Real-World Fuel Consumption of Heavy Duty Vehicles for tractors in Europe* (Sharpe & Muncrief, 2015). Within the report, estimates are obtained from various sources and are based on road-test data. The fleet-wide data reported by AEA-Ricardo results in fuel consumption of 30.9 litres/ 100km. An estimate of distance travelled is based on an average speed of 25 km/h, which is approximately 60% of the speed limit for this vehicle type on public roads. This results in a fuel consumption rate of 7.73l/h.

WATER PUMPING			
Sykes Wispaset 150 fully baffled water pump	1	18,816	4.1

However, fuel consumption is not always provided by manufacturers, mainly due to the number of operational variables that cannot be determined as average fuel consumption figures.

The on-board diagnostic program for Volvo equipment, Volvo Matris, collects technical information about Volvo Construction Equipment in use, providing this information to the operator. In some cases, such reports are available online. Where a Matris report specific to the vehicle engine is available, this has been used to estimate average fuel consumption figures and is summarised in Table 3.

Table 3: Matris Data for Proposed Volvo Mining Equipment

Equipment Model	Qty	Operating Hours	Average Fuel Consumption [litres/hour]
EXCAVATION			
EC360C Volvo 30 tonne excavator	1	5,380	19.6
EC360CL Volvo 21 tonne excavator	1	5,380	15.68[5]
LOADING			
Volvo L150G 22 tonne loading shovel	1	5,380	5.4
L150F Volvo 22 tonne loading shovel	1	5,380	17.8

We have been unable to obtain fuel consumption data in any form for the Komatsu D65PX dozer; it is assumed that this has a similar fuel consumption rate to the Volvo EC360C 21 tonne excavator.

Beyond this, there is a lack of empirical data on fuel consumption of mobile combustion equipment commonly used in mining activities.

A method for estimating the fuel consumption of the types of equipment that will be used in the mining operations at Hilltop Farm has been developed in the research paper *Fuel Consumption and Engine Load Factors of Equipment in Quarrying of Crushed Stone* (M. Klanfar). Relevant aspects of the research are detailed below.

[4] Average hourly fuel consumption at 'Medium' load factor (defined on p1950 of the *Caterpillar Performance Handbook* (Caterpillar, 2015) as: *Haul road maintenance. Road construction. Land forming, land levelling and elevating grader use*.

[5] Data specific to the EC360CL is not available, but is assumed to be circa 20% lower than the EC360C model due to smaller load capacity.

Specific Fuel Consumption (SFC) is the mass of fuel spent per unit of time and unit of power, with an engine operating at full rated power. It is usually expressed in kg/kWh and mainly depends on engine type and efficiency. Engine load factor is defined as a portion of the rated engine power that is utilized during work. It is specific to the equipment type and application/ operating conditions and dependent on the equipment size and rated power.

The average engine load factor determined by the Klanfar study for mobile screening plant is calculated as 0.49.

The Klanfar study explains that the calculation of fuel consumption requires an average load factor across a cycle, or a longer period of operation. It provides a basic approach for estimating fuel consumption, which involves an assumption of the specific fuel consumption according to the engine condition and type, the rated engine power known from equipment specifications, and the load factor for the specific equipment type and application/ operating conditions.

This takes into account the different levels of activity and engine load as the equipment is running, which might range from idling with the engine running to operating the machinery with a full load.

Some manufacturers provide SFC information for their engines at different power levels; as SFC defined in the Klanfar study relates to the engine operating at full power, the SFC provided at full power is the figure applied for the purpose of this assessment.

Table 5: Specific Fuel Consumption Data for Proposed Mining Equipment

Equipment Model	Qty	Operating Hours	Rated Power [kW]	Applied Load Factor	Specific Fuel Consumption [kg/kWh]
SCREENING					
McCloskey triple deck screen (or similar) [6]	1	2,682	96.5	0.49	0.231

An emission factor for diesel of 2.67193 $kgCO_2e$ per litre applied based on non-forecourt diesel figures from BEIS Emission Factors.

4.5.3 *Calculation Procedure & Estimated Emissions*

Where a fuel consumption average is not provided, the calculation methodology and load factors set out in the Klanfar study re used to calculate a fuel consumption rate using the following equation:

$$q_d = P.k_0.sd \qquad [Eqn\ 1]$$

Where q_d is fuel consumption (kg/h), P is the rated engine power (kW), k_0 is the engine load factor, and sd is the specific fuel consumption (kg/kWh).

[6] Confirmation of S190 Triple deck [CAT C4.4TA Engine] via email from Suzanne Dynes from McCloskey International (McCloskey International, 2017)

This is multiplied by the estimated hours of operation to provide total fuel consumption in kg and multiplied by the density of non-forecourt diesel (1.194 litres/kg from BEIS Emission Factors) to provide an estimate of fuel consumption in litres.

BEIS Emission Factors for non-forecourt diesel are then applied to calculate GHG emissions associated with these activities.

Table 6: Scope 1 Emissions – Mining Activities

Activity	**Total Operating Hours**	**Fuel Consumption [litres]**	**GHG Emissions [t CO_2e]**
Excavation	26,900	870,538	2,326
Loading	10,760	124,816	333
Grading	400	2,680	7
Screening	2,682	34,978	93
Water Pumping	18,816	77,146	206
TOTAL	**59,558**	**1,110,158**	**2,965**

4.5.4 Data Limitations & Uncertainty

The nature of the works makes running hours of individual pieces of machinery difficult to predict; the estimates included within this assessment are considered to be conservative.

As described in Section 4.5.2, fuel consumption is dependent on many factors, and the precise levels of engine power, and therefore fuel consumed, are difficult to accurately predict.

There are inherent uncertainties in the emission factors used for diesel, which are based an averages for the fuel type and do not take into account the precise fuel mix that may be procured.

4.6 Internal haulage of materials

4.6.1 Description of Process

Soils and overburden will be transported from their original destinations to bunds located around the site whilst coaling is in operation. They will then be relocated around the site as part of the restoration process.

Coal will be moved from where it is mined to the processing area in the centre of the site. From here it will be transported to various destinations as described in Section 6.5.

Temporary Works: As outlined in Section 3.14, prior to the commencement of coaling activities, soils/spoil will be stripped and moved to storage bunds located at the western side of the site, and at the proposed temporary stockpiling area at the centre of the site. Where longer distances are required to be travelled for the placement of soil in storage bunds, it will be transported by dump truck.

Extraction of Coal: Mineral will be extracted with an excavator and then loaded into dump trucks to transport to the coal processing area.

4.6.2 Data Sources

An assessment of vehicle movements within the site has been made using Site Preparation and Phasing Plans (drawings 17929-SK-101 to 17929-SK-119) and a corresponding assessment of earthworks operations provided by Provectus (Provectus Remediation Ltd, 2017) outlining individual movements of materials and an approximation of hours for each movement.

It is assumed that all dump trucks and the loading shovel are in operation 100% of the time for the number of operational hours for each movement identified by Provectus.

Average fuel consumption rates have been obtained from Matris data as described in Section 4.5.2 and are reported in Table 7.

Table 7: Operational & Manufacturer Data for Proposed Vehicles

Plant & Equipment	Qty	Operating Hours	Average Fuel Consumption Rate (litres/ hour)
VEHICLE MOVEMENTS			
A40F Volvo 40 tonne dump truck	7	1,702	25.3
A25T Volvo 25 Tonne dump truck	2	1,702	20[7]
L150F Volvo 22 tonne loading shovel	1	1,702	17.8

An emission factor for diesel of 2.67193 kgCO_2e per litre and is assumed based on non-forecourt diesel figures from BEIS Emission Factors.

4.6.3 Calculation Procedure & Estimated Emissions

The activity data (hours of vehicle operation) is multiplied by the emission factor for non-forecourt diesel.

[7] We have been unable to obtain any data relating to the fuel consumption of this vehicle; an estimate of fuel consumption has been made based on the 40 tonne vehicle.

Table 8: Scope 1 – Internal Haulage of Materials

Plant & Equipment	Total Operating Hours	Fuel Consumption [litres]	GHG Emissions [tCO_2e]
VEHICLE MOVEMENTS			
A40F Volvo 40 tonne dump truck	11,914	301,424	805
A25T Volvo 25 Tonne dump truck	3,404	68,080	182
L150F Volvo 22 tonne loading shovel	1,702	30,295	81
TOTAL	**17,020**	**399,800**	**1,068**

4.6.4 Data Limitations & Uncertainty

The nature of the works makes running hours of individual pieces of machinery difficult to predict; the estimates included within this assessment are considered to be conservative.

As described in Section 4.5.2, fuel consumption is dependent on many factors, and the precise levels of engine power, and therefore fuel consumed, are difficult to accurately predict.

There are inherent uncertainties in the emission factors used for diesel, which are based on averages for the fuel type and do not take into account the precise fuel mix that may be procured.

Fugitive Emissions

4.7 CH_4 from Coal Mines & Coal Piles

4.7.1 Description of Process

According to the University of Oxford, Environmental Change Institute (University of Oxford) coal mine methane (CMM) is the term given to the gas trapped in coal seams, which has an approximate composition of 70% methane, 15% carbon dioxide and 15% nitrogen. The gas is released once the seams are mined and can then escape into the atmosphere.

The *Intercontinental Panel on Climate Change (IPCC)* has produced a series of research papers titled *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (IPCC, 2000), which includes guidance titled *CH_4 Emissions: Coal Mining and Handling.* The paper states that the amount of methane released during coal mining depends on a number of factors, the most important of which are coal rank, coal seam depth, and the method of mining.

At surface mines, methane escapes from newly exposed coal faces and surfaces, as well as from areas of coal rubble created by blasting operations.

Additional CH_4 may come from the overburden, which is broken up during the mining process, and the underlying strata, which may be fractured and distressed due to the removal of the overburden. Emissions per ton of coal are generally much lower from surface mining than from underground mining.

Methane emissions also occur during post-mining handling, processing, and transportation. Some CH_4 is released from coal waste piles and abandoned mines. Emissions from these sources are believed to be low because much of the CH_4 would likely be emitted within the mine.

4.7.2 *Data Sources*

The IPCC Guidance provides two general approaches to estimating CH_4 emissions from coal mining. The first approach is based on coal production and an emission factor, and the second approach is based on more mine-specific measurement data from ventilation and degasification systems. Given the stage at which this assessment is taking place, only the first approach is applicable and has been adopted here.

A Tier 1 Global Average Method and a Tier 2 Country Basin Specific Method for emissions factors are provided within the report; Tier 1 default emission factors are stated in Table 4.7.1 below along with a conversion into tonnes of CO_2e, consistent with other emissions reported in this assessment:

Table 9: Tier 1 Default IPCC Emission Factors per Tonne of Coal Produced

Category	**m^3 CH_4/tonne**		**t CO_2e_4/tonne**	
	Low	**High**	**Low**	**High**
Surface Mining	0.3	2.0	0.0054	0.036
Post Mining (surface)	0	0.2	0	0.0036

An assessment of country-specific emission factors has been made based on data published by the National Atmospheric Emissions Inventory (NAEI, 2017). The NAEI publishes annual emissions for all greenhouse gases for the UK and overseas territories; consistent with reporting to the United Nations Framework Convention on Climate Change (UNFCCC), GHG data includes the United Kingdom, Guernsey, Jersey, the Isle of Man, Gibraltar, Bermuda, Cayman Islands and the Falklands Islands. Emissions are reported in accordance with the IPCC Guideline emissions categories; in this instance category *1B1aii,* which relates to fugitive emissions from surface coal mining activity. Data is currently available up to 2015 and a summary of total emissions over recent years and is provided in Table 4.7.2 below.

Table 10: National Atmospheric Emissions Inventory Data for Fugitive Coal Emissions

NFR/ CRF Group	Units	2013	2014	2015
1B1aii	Kilotonnes CH_4	3.6	3.4	2.4
Fugitive emissions from open-cast coal	Kilotonnes CO_2e	91	85	62

This data is an estimate of absolute emissions and is not provided with reference to the quantity of coal produced from surface mines in each given year. Coal production data is separately obtained from the Department for Business, Energy & Industrial Strategy in the document *Historical Coal Data: Coal Production, availability and consumption 1853 to 2016* (BEIS[3], 2017). UK coal production figures for 2013 to 2015 are stated in Table 4.7.3 below:

Table 11: UK Coal Production 2013 to 2015

Location	Units	2013	2014	2015
UK	Million tonnes	9	8	6

Based on the NAEI and BEIS coal production data, emissions factors specific to the atmospheric fugitive emissions associated with surface mining activity in the UK have been calculated and are provided in Table 12.

Table 12: Approximate UK Emissions Factor for Fugitive Emissions 2013 to 2015

Units	2013	2014	2015
tCO_2e/ tonne	0.0101	0.0106	0.0103

Whilst this only takes into account mining in the UK and not across UK territories, mining activity across UK overseas territories is considered to be insignificant.

The emission factors calculated in Table12 above for the three different years consistently provide an emissions factor in the region of 0.01 tCO_2e/tonne of coal produced. This lies between the low and high estimates of emissions provided by the IPCC, closer to the low end of the scale.

It is assumed that this figure includes fugitive emissions from post mining, and, that the emissions at this stage are negligible.

An alternate emissions factor of 0.34kg CH_4 per tonne of coal production is assumed for methane emissions from open-case coal in the *UK Greenhouse Gas* Inventory, 1990 to 2014 (Department of Energy and Climate Change, 2016); this equates to approximately 0.0085 tCO_2e per tonne of coal.

On detailed review, this figure is derived from industry research published in 1993 by the Watt Committee on Energy. This report is no longer available and the methodology applied has therefore not been determined, however it is understood to be based on the total methane content of freshly sampled coal cores from open-cast sites from the three main producing regions in the UK. As this data has not been recently updated and the methodology for obtaining the emissions factor cannot be examined, the emissions factor calculated in Table 12 is applied to the quantum of coal generated. A comparison of results is presented in Section 4.7.5.

4.7.4 *Calculation Procedure*

Following the Tier 1 approach identified in the IPCC guidance, the following equation is used to calculate methane emissions associated with surface coal production:

Emissions = In-situ Gas Content x Surface Coal Production

$$[m^3CH_{4}] = [m^3CH_4/ t] \times [t] \qquad [Eqn\ 2]$$

For the purposes of consistency with other emissions assessed in this assessment, the emissions factor in Section 4.7.3 is converted to tonnes CO_2e. It is assumed that the density of methane is 0.72 kg/m^3, and that methane is 25 times as potent as CO_2, as reported in the BEIS Emission Factors.

Table 13: Scope 1 Emissions – Fugitive Emissions

Activity	**Coal Produced [t]**	**GHG Emissions [tCO_2e]**
Surface mining	175,000	1,802
Post mining	Negligible	Negligible
TOTAL	**175,000**	**1,802**

4.7.5 *Data Limitations & Uncertainty*

Due to the rounding of coal production to the nearest million tonnes, estimates of methane emissions from surface coal mining to the nearest kilotonnes, and rounding of the resultant emission factor to two decimal places, there is an approximate -5% / +14% uncertainty in the estimate of tonnes of CO_2e generated.

There is a 17.5% variation in the estimated emissions using the calculated emission factor when compared with the emission factor published by the Watt Committee (which result in 1,488 tCO_2e).

Provectus (Hunt, 2017) indicate that there is the potential for +/- 5% in coal production from the seams, which would introduce further variance.

There is a variation in the gas content of different coal types at different seam depths. Limited data regarding the gas content of the clay types expected at Hilltop Farm is available and an average gas content based on the method described in Section 4.7.3 is applied instead.

5. Scope 2 Emissions

General Description

5.1 Scope 2 emissions are indirect GHG emissions that occur from the generation of purchased electricity, heat or steam consumed by the company; the emissions physically occur at the location where the electricity, heat, or steam are generated, but are within the operational boundary of the company.

5.2 In the context of the Hilltop Farm coal mine, these emissions relate to the mining of coal and all associated works to facilitate this at the Proposed Development.

5.3 As summarised in Section 2.3, the GHG Protocol identifies the following Scope 2 emissions sources associated with mining activity:

- Stationary combustion (consumption of purchased electricity, heat or steam)

These are explored further in the following sections.

Emissions from Stationary Combustion

5.4 **Purchase of electricity**

5.4.1 Description of Process

Electricity will be consumed on site in the site cabins for the duration of the project. One cabin will provide office facilities and an additional cabin will be utilised as a staff canteen.

5.4.2 Data Sources

Provectus (Hunt, 2017) have confirmed that two site cabins will be purchased from TF Jackson who provides an Energy Performance Certificate (EPC) for the units on their website (T F Jackson Portable Offices, 2017). This reports a building emission rate of 91.16 $kgCO_2/m^2$ and a total useful floor area for each cabin (in energy terms) of $54m^2$.

The EPC includes ‘regulated’ uses only; to take into account the energy required by for unregulated uses, such as IT equipment, cooking equipment and other welfare facilities (such as drying), an additional 20% of electricity consumption is assumed.

The assessment of emissions for the purpose of EPCs includes standard occupancy assumptions which may under-estimate the level of usage in this scenario, however there is no transparency on the assumptions applied to generate the figures provided in the EPC. It is assumed that an 8-hour per day, five-day working week has been applied (40 hours) and an increase of 27 hours to take into account the operating hours of the scheme identified in Section 3.6 is added to the building emission rate, in addition to the 20% applied above. This results in an operational hour adjustment factor of 1.675.

The building emission rate estimated in the EPC is calculated using the National Calculation Methodology (NCM) produced by BRE. The NCM consists of the Standard Assessment Procedure (SAP) for domestic dwellings and the Standard Building Energy Model (SBEM) for non-domestic buildings; the current iteration of the models was produced in 2012. The *Proposed Carbon Emission Factors and Primary Energy Factors for SAP 2012* (BRE, 2011) confirms that the methodology for emission factors applies to both SAP and SBEM assessments. The methodology also confirms that:

- although reported as CO_2, the emission factor additionally takes into account the impacts of CH_4 and NO_2;
- the emissions factor used also takes into account upstream emissions associated with generation, transport, transmission and distribution;
- the figure used is the projected average value for UK grid supply electricity over the stated period, where the projected electricity generation mix is based on DECCS Central Prices, Central Policy, Central Growth scenario.

The resulting emission factor for grid electricity is 0.519 $kgCO_2$. This compares with the BEIS Emissions Factors conversion factor of 0.35156 $kgCO_2e$.

5.4.3 *Calculation* Procedure *& Estimated Emissions*

For consistency with other emissions reported in this document, the total annual energy use is calculated based on the emission factor applied in the calculation of the EPC, and the grid electricity emission factor reported in the BEIS Emission Factors is used to estimate annual emissions.

This is then multiplied by 3.5 years to cover the entire period the site cabins will be in operation at the site.

Table 14 Scope 2 Emissions – Purchase of Electricity

Activity	**Regulated Emissions [$kgCO_2$/year]**	**Regulated Energy Use [kWh/year]**	**Unregulated Energy Use [kWh/year]**	**Total Energy adjusted for operational hours**	**GHG Emissions [tCO_2e]**
Site Cabin Electricity	9,845	18,969	3,794	133,448	46.9

5.4.4 *Data Limitations & Uncertainty*

Although adjustments have been made to the building emission rate to improve the accuracy of the activity data, this is an estimate of consumption and is likely to vary in operation.

The grid electricity emission factor applied is based on the current annual UK average grid supply across all suppliers. The carbon content of electricity varies significantly between suppliers; for the year ending 31st March 2016, based on data reported under the requirements of the *Fuel Mix Disclosure Regulations*, the most carbon intensive of the big six electricity suppliers had a carbon intensity 1.75 times greater than the least carbon intensive of the group.

Table 15: CO_2 Emissions of the Big Six Suppliers 2015/16

Supplier	**CO_2 Emissions [gCO_2/kWh]**
British Gas[8]	252
EDF Energy[9]	167
Npower[10]	408
E.ON UK[11]	328
Scottish Power[12]	460
SSE[13]	380

Additionally. the emission factor for electricity is based on the current annual average mix of grid electricity; the duration of the project is expected to be 3.5 years, commencing from 2018. The supply of electricity is decarbonising, and it is expected that over the three year period of operation that emission factors will reduce.

Whilst the use of the current annual average emission factor is likely to over-estimate emissions associated with this activity, as a proportion of total emissions associated with the project, the impact of the above estimates are considered to be insignificant.

[8] https://www.britishgas.co.uk/business/about-us
[9] https://www.edfenergy.com/fuel-mix
[10] http://www.npower.com/Home/About-npower/Our-responsibility/How-we-source-our-fuels/index.htm
[11] https://www.eonenergy.com/About-eon/Fuel-Mix
[12] https://www.scottishpower.co.uk/about-us/performance/fuel-mix
[13] https://www.sse.co.uk/help/energy/energy-regulations#item1

6. Scope 3 Emissions

General Description

6.1 Scope 3 emissions are other indirect GHG emissions that occur as a result of the activities of the company; these can be upstream or downstream of the mining activity.

6.2 In the context of the Hilltop Farm coal mine, these emissions relate to activities outside the boundary of the mining of coal and associated works to facilitate the mining of coal at the Proposed Development, and in most cases are outside the control of the Applicant.

6.3 As summarised in Section 2.4, the GHG Protocol identifies the following Scope 3 emissions sources associated with mining activity:

- Stationary combustion (product use as fuel)
- Mobile combustion (transportation of coal/ waste, employee business travel, employee commuting)
- Process emissions (gasification)

These are explored further in the following sections.

Emissions from Stationary Combustion

6.4 **Product use as Fuel**

6.4.1 Description of Process

Two types of end use have been identified by Provectus (Hunt, 2017) for the coal mined at Hilltop Farm; of the estimated 175,000 tonnes of coal that will be extracted:

a) **Electricity Generation:** Approximately 85,000 Tonnes of coal are proposed to be distributed to Ratcliffe Power Station, operated by E.On for the generation of electricity.

b) **Domestic use:** Approximately 90,000 Tonnes of coal will be sold to wholesalers and distributed for direct consumption in the domestic market.

In addition to the emissions associated with the generation of electricity from coal, there are additional emissions associated with the transmission and distribution of electricity across the network before it reaches the final consumer.

6.4.2 Data Sources

BEIS Emission Factors provide an estimate of the emissions associated with the use of solid fuels, including coal for domestic purposes and coal for use in electricity generation in power stations; they also provide an estimate for the emissions associated with losses during the transport and distribution of electricity. Figures for 2017 are highlighted in Table 16:

Table 16: UK GHG Conversion Factors for Coal

Activity	Emission Factor [kgCO_2e/ tonne]	Emission Factor [kgCO_2e/kWh]
Coal (domestic)	2,861.96	-
Coal (electricity generation)	2,244.63	0.05292 (Net CV)
Transmission & Distribution Losses (grid electricity)	-	0.03287

6.4.3 *Calculation Procedure & Estimated Emissions*

The quantity of coal that is estimated to be generated for each source is multiplied by the emission factors provided in Table 16 for each of the proposed end uses.

Transmission and distribution losses from grid electricity are calculated per kWh of electricity consumed. Based on the CO_2e emission factors provided per tonne of coal and per kWh (Net CV), the electricity generated per tonne of coal = 42,415.5kWh.

Emissions from the use of coal as a fuel are estimated in Table 17.

Table 17: Scope 3 Emissions - Product use as Fuel

Activity	Coal [tonnes]	Electricity Generated [kWh]	Emissions [t CO_2e]
Coal (domestic)	90,000	-	257,103
Coal (electricity generation)	85,000	3,605,317,500	191,972
Transmission & Distribution	85,000	3,605,317,500	118,507
TOTAL	**175,000**	**-**	**567,582**

6.4.4 *Data Limitations and Uncertainty*

The quantity of coal generated is an estimate and Provectus (Hunt, 2017) anticipates that the final totals will be in the region of 5% +/- tonnes of the figures reported above.

Actual emissions associated with the burning of coal depend on the individual properties of the coal being burned; figures provided by BEIS in the UK conversion factors are national averages and may not accurately reflect the gas content of the specific coal types at the seam depths expected at Hilltop Farm.

Emissions from Mobile Combustion

6.5 Transportation of Coal

6.5.1 *Description of Process*

The two proposed routes for the coal following on-site processing have different profiles in terms of transportation.

Coal for domestic use will be transported in bulk to a central distribution point located in either Wakefield or Wolverhampton (Hunt, 2017), and then either delivered to, or picked up by, retail customers.

Coal for use in the power station will be transported in bulk to Ratcliffe power station (Hunt, 2017), located approximately 56km away[14].

6.5.2 *Data Sources*

Distances to the distribution point for domestic coal and to Ratcliffe power station have been calculated using Google Maps and a route via the M1 as identified in Appendix E of the Transport Assessment.

For domestic coal, a conservative estimate of emissions has been made based on distribution to Wolverhampton, the farther of the two potential locations.

The number of lorry vehicle movements has been estimated based on the capacity of typical vehicles used in the distribution of the coal and cross-referenced with the estimated number of trips generated from the Transport Statement, assuming a 20 tonne payload per vehicle.

Vehicle emissions have been estimated based on BEIS Emissions Factors. It is assumed that for distribution to Ratcliffe and to the domestic coal distribution point, large articulated lorries are used (>33t) and that vehicles are fully laden. A return vehicle movement that is 0% laden is also calculated.

For the domestic coal, there will be onward distribution via a number of different routes after it is transported to the distribution centre; this is likely to involve a combination of deliveries to local distributors (e.g. supermarkets), deliveries to individual customers, and collections by customers. Given the significant uncertainty regarding these trips and the lack of control that Provectus have over this activity, they are considered outside the scope of, and have therefore been excluded from, this assessment.

Table 18: Distances, Trips and Emission Factors for the Transportation of Coal

Journey Description	**Vehicle**	**Distance [km]**	**Total No. Trips**	**Emission Factor [kgCO_2e/km]**
N/A	100% laden articulated (>3.5t - 33t)	-	-	1.02676
Clay Cross to Ratcliffe Power Station	61% laden articulated (>3.5t - 33t)	56	4,250	0.89472
Ratciffe Power Station to Clay Cross	0% laden articulated (>3.5t - 33t)	56	4,250	0.6882
Clay Cross to Domestic	61% laden	75	4,500	0.89472

14 As measured using Google Maps using the route outlined in the Transport Assessment that accompanies the Planning Application

Distribution Point (Wolverhampton)	articulated (>3.5t - 33t)			
Domestic Distribution Point (Wolverhampton) to Clay Cross	0% laden articulated (>3.5t - 33t)	75	4,500	0.6882

6.5.3 *Calculation Procedure & Estimated Emissions*

The number of trips generated over the three year coaling period is multiplied by the emission factor for those vehicles.

Table 19: Scope 3 Emissions – Transportation of Coal

Activity	**Total Distance [km]**	**GHG Emissions [t CO_2e]**
Transport to Ratcliffe Power Station		
Out: 61% laden	238,000	213
Return: 0% laden	238,000	164
Transport to Distribution point (Wolverhampton)		
Out: 61% laden	337,500	302
Return: 0% laden	337,500	232
TOTAL	**1,151,000**	**911**

6.5.4 *Data Limitations and Uncertainty*

As described in Section 6.5.3, the final distribution of the coal between distribution point and end user has been excluded from this assessment due to limitations in data.

6.6 Transportation of Materials & Waste

6.6.1 *Description of Process*

The majority of materials generated by the construction and operation of the mine will be soils and hardcore; these will be stockpiled for use in the remediation of the site. The movement of this material is accounted for under Scope 1 and is reported in Section 4.6.

Circa 100 tonnes of shredded green waste is anticipated by Provectus (Hunt, 2017); again, it is intended that this is reused in soil preparation and augmentation on site and so no additional movements are expected.

Any fines collected as a result of washing the coal will be collected and placed at depth within the worked coal seams.

Whilst a small quantity of office and canteen waste will be generated, this is considered insignificant in terms of the scale of the assessment and has been excluded on the basis of reasonableness and proportionality.

Provectus (Hunt, 2017) expect that the only materials that will need to be transported to the site are a quantity of circa 500m^3 of crushed aggregate for the construction of the haul road.

6.6.2 *Data Sources*

The number of HGV vehicle movements has been estimated based on the capacity of typical vehicles used in the transport of, assuming a 20 tonne payload per vehicle as per the Transport Assessment.

A search of the area identifies a number of aggregate suppliers within a 10km radius of the site.

Articulated lorries with a payload of between 3.5 tonne and 33 tonne have been assumed to be used, laden with 61% of load on the supply journey and 0% of load on the return trip back to the supplier.

The BEIS Emission Factors for this type of vehicle laden with 0% load and 100% load have been used to interpolate the emission factor for 61% of load.

Table 20: Distances, Trips and Emission Factors for the Transportation of Materials

Journey Description	**Vehicle**	**Distance [km]**	**Total No. Trips**	**Emission Factor [kgCO_2e/km]**
N/A	100% laden articulated (>3.5t - 33t)	-	-	1.02676
Aggregate Supplier to Clay Cross	100% laden articulated (>3.5t - 33t)	10	25	0.89472
Clay Cross to Aggregate Supplier	0% laden articulated (>3.5t - 33t)	10	25	0.6882

6.6.3 *Calculation Procedure & Estimated Emissions*

The number of trips generated in the movement of material is multiplied by the emission factor for those vehicles.

Table 21: Scope 3 Emissions – Transportation of Materials & Waste

Activity	**Total Distance [km]**	**Emissions [t CO_2e]**
Transport from Aggregate Supplier		
Out: 61% laden	250	0.22
Return: 0% laden	250	0.17
Total	**500**	**0.39**

6.6.4 *Data Limitations and Uncertainty*

The anticipated number of trips is an estimate and may vary.

6.7 Employee Commuting & Business Travel

6.7.1 Description of Process

According to the Transport Assessment, during operation it is expected that the site will employ an average 10 to 15 staff per day. On this basis and assuming an element of car sharing, a total of 20 car movements (10 in and 10 out) per day have been assumed, across 6 days per week, 48 weeks of the year, for three years.

The Socio-Economic section of the ES states that given the coal mining history of the Clay Cross area, it is reasonable to assume that there are likely to be people with appropriate experience and skills in the locality.

On this basis, an average commuting distance of 30km has been assumed.

Provectus (Hunt, 2017) anticipate that business travel will be limited to a single monthly return trip from their Headquarters in Essex.

6.7.2 Data Sources

For employee commuting, an ‘average car’, as determined by BEIS Emission Factors has been assumed, with petrol as the fuel.

For business travel, it is assumed that a larger vehicle will be used.

Table 22: Distances Trips and Emission Factors for Employee Commuting and Business Travel

Journey Description	Vehicle	Trip Distance [km]	Total Trips	Emission Factor [$kgCO_2e/km$]
Commuting to and from site	Average Car	30	17,280	0.19184
Business travel	Large Car	260	84	0.28539

6.7.3 *Calculation Procedure & Estimated Emissions*

Table 23: Scope 3 Emissions – Employee Commuting & Business Travel

Activity	Total Distance [km]	Emissions [tCO_2e]
Employee Commuting	518,400	99
Business Travel	21,840	6
Total	**540,240**	**105**

6.7.4 Data Limitations and Uncertainty

Accurate data on employee commuting and business travel can only be obtained by recording the number of actual movements, distance travelled and fuel consumption.

An assumption on the likely types of vehicle used has been made, but there is likely to be a mix of different vehicle types and fuels used in actual vehicles owned by employees.

Process Emissions

6.8 **Gasification**

6.8.1 Description of Process

Process emissions associated with gasification of coal for the generation of electricity would occur at the power station and be accounted for in the emission factor associated with product use as fuel in Section 6.4; Ratcliffe-on-Soar Power station does not include gasification plant.

It is assumed that there will be no gasification process associated with the coal exported from the site for domestic purposes.

No further assessment of process emissions has taken place.

7. Summary

Total Emissions

7.1 The total Scope 1 and 2 emissions from the proposed Hilltop Farm coal mine and within the direct control of Provectus equate to 5,882 tonnes CO_2e over the 3.5 year period.

7.2 Scope 3 emissions associated with the upstream and downstream impacts relating to Provectus's activities equate to a further 568,599 tonnes CO_2e over the 3.5 year period.

7.3 Table 24 summarises the emissions calculated in earlier sections, with the most significant impact related to the downstream use of coal as a fuel, equating to 567,582 tonnes of CO_2e, or 98.8% of the total calculated emissions.

Table 24: Estimate of Scope 1, 2 and 3 Emissions as a Result of Mining Activities at Hilltop Farm Coal Mine

	GHG Emissions [t CO_2e]	**% of Total GHG Emissions**	**GHG Emissions per tonne of Coa [tCO_2e/tonne]**
TOTAL EMISSIONS	**574,481**	**100%**	**3.28**
TOTAL SCOPE 1 EMISSIONS	**5,835**	**1.0%**	**0.03**
Scope 1: Stationary Combustion	**0**	**0.0%**	**0.00**
Methane Flaring/ Explosives	0	0.0%	**0.00**
Scope 1: Mobile Combustion	**4,033**	**0.7%**	**0.02**
Mining Activities	2,965	0.5%	**0.02**
Vehicle Movements on Site	1,068	0.2%	**0.01**
Scope 1: Fugitive Emissions	**1,802**	**0.3%**	**0.01**
CH_4 from Coal Seams & Piles	1,802	0.3%	**0.01**
TOTALSCOPE 2 EMISSIONS	**47**	**0.0%**	**0.00**
Scope 2: Stationary Combustion	**47**	**0.0%**	**0.00**
Site Operations	47	0.0%	**0.00**
TOTAL SCOPE 3 EMISSIONS	**568,599**	**99.0%**	**3.25**
Scope 3: Stationary Combustion	**567,582**	**98.8%**	**3.24**
Use of Coal as Fuel - domestic	257,103	44.8%	**1.47**
Use of Coal as Fuel – electricity	310,479	54.0%	**1.77**
Scope 3: Mobile Combustion	**1,017**	**0.2%**	**0.01**
Transportation of Coal (distribution)	911	0.2%	**0.01**
Transportation of Waste & Materials	1	0.0%	**0.00**

Business Travel	6	0.0%	0.00
Employee Commuting	99	0.0%	0.00

The Changing Role of Coal

7.4 UK coal production is declining significantly and will continue to decline in line with government policy to meet emissions standards and decarbonise the supply of fuel.

7.5 The Digest of UK Energy Statistics (BEIS[(1)], 2017) states that in 2016, the UK produced 4,156 thousand tonnes of coal and imported a further 8,494 tonnes; 5,655 thousand tonnes were used from stocks and 443 thousand tonnes were exported.

Table 25: Demand for Coal between 2012 and 2016

	Quantity of Coal (thousand tonnes)				
	2012	**2013**	**2014**	**2015**	**2016**
Total Demand	64,042	60,206	48,295	37,612	17,889
Electricity Generation	54,901	49,873,	38,234	29,330	12,058
Domestic	674	640	547	552	550

Source: DUKES 2017 Table 2.4 supply and consumption of coal

7.6 The demand for coal is reducing rapidly, mainly as a result of aging coal-fired power plant that does not conform to various emissions requirements and so are being decommissioned.

7.7 The EU Large Combustion Plant Directive (LCPD), which aims to control emissions of sulphur dioxide, nitrogen oxides and dust imposes emissions limits on new plants (those licensed after 1st July 1987) and older plants could either meet new emission limits, opt out with a restriction of 20,000 operating hours impose between 2008 and 2015, or close before the beginning of 2008.

7.8 Of the 17 coal-fired power stations that were operation at the beginning of 2012, only eight remained operational by the end of 2016. This is reflected in the demand for coal for electricity generation, which as can be seen from Table 25, has decreased by 72% over this period.

7.9 The Government is currently reviewing responses to the proposals set out by BEIS in the consultation *Coal Generation in Great Britain* (BEIS, 2016), issued in November 2016. Broadly, the proposals would put in place a backstop after which it will not be possible for existing stations to operate unless they significantly reduce emissions to levels that are consistent with decarbonisation commitments by 2025. It is also proposed that there is a constraint placed on coal production in the years leading up to 2025.

7.10 The EU Industrial Emissions Directive (IED) came into force on 6 January 2011 and into effect on 1 January 2016; it sets new emission limits for key air pollutants. There are three compliance options available to plants:

- To meet the emissions requirements form 1 January 2016.

- To participate in the Transitional National Plan (TNP), allowing older plants until July 2020 to meet the emission limit requirements. If they fail to do so, they will either need to close or continue with operation limited to 1,500 hours per year (17 % of annual load factor).
- To utilise the Limited Lifetime Derogation (LLD) which limits plants to 17,500 hours of operation between 1 January 2016 and 31 December 2023, after which they must close.

7.11 Ratcliffe-on-Soar already meets the IED requirements, but as a result of the IED, Eggborough power station will close before 2023, and the remaining six power stations will either transition to meet the emissions requirements or close after 2023, further reducing the demand for coal.

7.12 Despite the potential closures identified above, there will still be demand in the short term for coal (over the period of coaling at Hilltop Farm), which is unlikely to be met by UK supplies alone.

7.13 The demand for coal for domestic use has also declined, but to a much lesser degree (18% since 2012); over the last three years demand has remained stable and due to a lack of policy in relation to its use, this trend is likely to continue in the short term.

Scale of Emissions from Coal at Hilltop Farm

7.14 In making a comparison with the local emissions profile, it is only appropriate to include the emissions associated with activities that occur on site or in the direct locality. These include:

Scope 1 Emissions

- Methane
- Mining Activities
- Vehicle Movements on Site
- CH_4 from Coal Seams & Piles

Scope 2 Emissions

- Site Operations

Scope 3 Emissions

- Transportation of Materials & Waste
- Employee Commuting
- Transportation of Coal (32% of total distance to Ratcliffe Power Station and 59% of the distance to Wolverhampton are within the Derbyshire boundary.

7.15 Transportation emissions are recorded in the locality in which they occur and so longer journeys are recorded across multiple areas. Only the proportion of the journey recorded in Derbyshire is assessed here.

- Clay Cross to Ratcliffe-on Soar: The journey on the M1 between J28 and J24a is outside the Derbyshire boundary. The journey within the boundary is 18km or 32% of the total.

- Clay Cross to Wolverhampton: the length of the journey along the A38 is within the Derbyshire boundary until Stretton; this is 44km or 59% of the total.

7.16 BEIS produces a breakdown of CO_2 emissions across the country using nationally available data sets. The most recently published version of the *UK Local Authority and Regional Carbon Dioxide Emissions National Statistics: 2005 - 2015* (National Statistics, 2017) provides a breakdown up to 2015.

Table 26: Scope 1 & 2 Emissions compared with Regional Historic Emissions

	Total GHG Emissions [t CO_2e]	**2013 CO_2 Emissions [t CO_2]**
Methane	0	-
Mining Activities	2,965	-
Vehicle Movements on Site	1,068	-
CH_4 from Coal Seams & Piles	1,802	-
Site Operations	47	-
Transportation of Materials & Waste	1	-
Employee Commuting	99	-
Transportation of Coal	434	-
Total Emissions within Derbyshire	**6,416**	**5,377,900**

7.17 The emissions that are expected to be generated over the 3.5 year period in the locality of the site are equivalent to 0.12% of 2013 annual CO_2 emissions for the county of Derbyshire.

7.18 As the greatest emissions associated with the mining at Hilltop Farm are the indirect emissions associated with the use of coal as a fuel, these are more appropriately compared with the total emissions for England.

Table 27: Scope 1, 2 & 3 Emissions compared with National Historic Emissions

	Total GHG Emissions [t CO_2e]	**2013 CO_2 Emissions [t CO_2]**
Total Scope 1 Emissions	5,835	-
Total Scope 2 Emissions	47	-
Total Scope 3 Emissions	568,599	-
Total Emissions within England	**574,481**	**3,075,754,000**

7.19 The emissions expected to be generated over the 3.5 year period at Hilltop Farm across all operations are equivalent to 0.18% of 2013 annual CO_2 emissions for the whole of England.

7.20 The Committee for Climate Change, the statutory body established under the Climate Change Act 2008 to advise Government on emissions targets, sets out five-yearly carbon budgets that restrict the quantity of greenhouse gas that the UK can legally emit over each period. Assuming a start on site of summer/ autumn 2018, the 3rd Carbon

Budget (2018 to 2022) is relevant to the Hilltop Farm coal mine, allowing the release of 508.8 $MtCO_2e$ per year, or 1780.8 $MtCO_2e$ over the duration of the project.

7.21 Total Scope 1, 2 and 3 emissions associated with the mining activity at Hilltop Farm will result in approximately 0.03% of the UK's allowable emissions over that period.

Conclusions

7.22 Emissions within the control of the applicant (Scope 1 and Scope 2) are expected to total approximately 0.0058 $MtCO_2e$ over the 3.5 year period of proposed activity.

7.23 Total emissions associated with project, including Scope 3 emissions upstream and downstream of the activities of the applicant total 0.574 $MtCO_2e$ over the 3.5 year period of proposed activity, equating to 0.03% of the total carbon budget over that period.

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Turley Office
The Charlotte Building
17 Gresse Street
London
W1T 1QL

T 020 7851 4010

Turley