

**WYG Engineering**

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# **Great Oak Surface Mine Scheme**

## **Flood Risk Assessment**

**November 2013**



# Document Control

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The conclusions reached are those which can reasonably be determined from the sources of information referred to in the report and from our knowledge of current professional practice and standards. Any limitations resulting from the data are identified where possible but both these and our conclusions may require amendment should additional information become available. The report is only intended for use in the stated context and should not be used otherwise.

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# 1 Executive Summary

Existing Site	<p>The Site is located to the east of Junction 16 of the M6, close to villages of Audley and Bignall End. The Site covers a total area of approximately 80 ha centred on grid reference 381722mE, 351450mN.</p> <p>The Site currently comprises arable farmland, access roads and various pockets of woodlands. The Site contains a property, Diglake Farm, near southwest boundary and a monument near to the south east boundary.</p> <p>The proposed surface mining works will include excavation for opencast coal mining, dewatering of the excavation, temporary spoil storage and restoration.</p>
Flood Risk Assessment	<p>The Environment Agency (EA) website flood risk zone map shows the Site to lie entirely within Flood Risk Zone 1 (low risk – likelihood of flooding less than 0.1% - 1 in 1000 year return period).</p> <p>Following the review of flood risk to the Site it is considered that the proposed development is at low risk of flooding from sources including rivers and watercourses, overland flow and sewers. With groundwater monitoring and appropriate management the flood risk to Site due to groundwater will be insignificant.</p>
Site Drainage	<p>Topographic Site data shows that surface water runoff from the existing Site is collected via a network of open channels, ditches and piped culverts before out falling to a number of off-Site discharge points.</p> <p>To comply with EA requirements, existing runoff rates from each catchment have been calculated and it is proposed to use the same method and rate of surface water discharge from each mining phase to mimic existing Site conditions.</p>
Flood Risk Management	<p>The Site lies in flood risk zone 1 and in accordance with NPPF is considered suitable for the proposed development.</p>
Conclusions	<p>It is concluded that the Site is appropriate for the proposed development and a practical means of surface water management for the Site can be provided.</p>

## 2 Introduction

### 2.1 Background

This Flood Risk Assessment report has been commissioned by UK Coal Mining Limited to support the planning application for the Great Oak Surface Mining Scheme at Great Oak Road, Audley, Staffordshire. This Flood Risk Assessment is undertaken in accordance with NPPF (March 2012) and the accompanying Technical Guide. In addition, it has also been reviewed against the previous Planning Policy Statement 25 (March 2010) and the accompanying guidance issued by the Department for Communities and Local Government – Development and Flood Risk: A Practice Guide Companion to PPS25 (December 2009).

### 2.2 Site Location

The Site for the Great Oak Surface Mining Scheme is located to the east of Junction 16 of the M6, close to villages of Audley and Bignall End. Newcastle-Under-Lyme town centre is located approximately 4 miles to the south of the Site which covers an approximate area of 80 ha, centred on grid reference 381722mE, 351450mN.

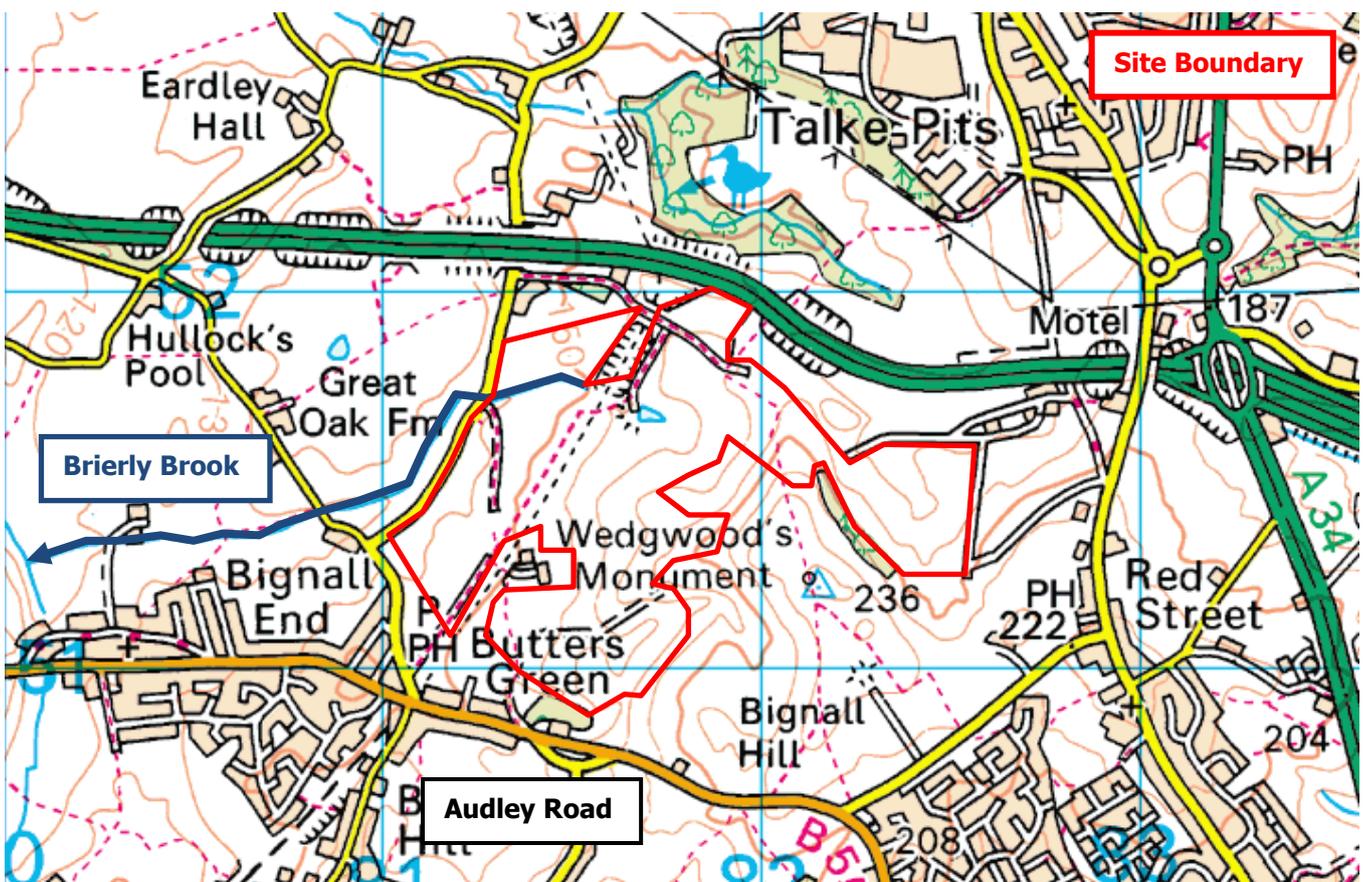


Figure 1: Site Location Plan

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The Site is bounded by the A500 trunk road to the north, the B5500 Audley Road to the south and the Bignall End Road to the west running adjacent to the Brierly Brook. The Site currently comprises a mixture of agricultural grazing farmland, access roads and pockets of woodlands. The Site lies adjacent to a number of isolated farmstead properties, namely Diglake Farm located upon the southwest boundary, Woodlands Farm immediately to the north and Jamage Farm to the north east.

A number of existing open channels, land drains and storage ponds are present within the boundary of the Site. In addition, the Brierly Brook runs alongside the Bignall End Road outside the Site's western boundary. A description of the Site's water bodies is included within Section 3.1.1.

## 2.3 Data Collection

Data sources that have been used for this flood risk assessment are:

- Topographical Survey;
- Environment Agency;
- Newcastle-Under-Lyme Borough Council Strategic Flood Risk Assessment
- Envirocheck Site Investigation Report
- UK Coal Mining Ltd Geological Data

## 2.4 Proposed Development and Restoration

The proposals for the Great Oak surface mining operation involve the surface mining of coal undertaken within predefined areas. Coal extraction will take place upon an area measuring 29 hectares.

Phased proposal plans have been included within Appendix B and include details regarding the operation of the surface mining procedure. The remainder of the Site will accommodate top soil and subsoil storage mounds, overburden storage, water treatment areas and the Site offices, plant areas and coal processing areas, including Site access and haulage roads. Phased coal extraction and restoration is to be carried out over a 2 and a half year timescale with initial soil stripping proposed to commence in the Spring of 2015.

To prevent the off-Site discharge of contaminants, pollutants and sediment from the mining operation to localised water bodies, 4 water treatment areas are to be implemented within the Site of the mining operation. The water treatment areas consist of holding lagoons to attenuate runoff and promote the settlement of pollutants and sediment before discharging off Site. Water treatment areas are shown to the south and south east, in the north and immediately opposite the coal processing plant.

### Restoration Plan

The final restoration of the Site would return much of the land to its current land use, with additional landscape benefits, nature conservation benefits and enhanced public access. The restoration concepts are indicated upon the Scoping Restoration Plan (A075840-007, Appendix B) and the proposals that relate to water bodies are summarised as follows;



- The existing Site has a relatively open landscape with many of the historic field boundaries lost due to historic mining activities and agricultural intensification. As part of this restoration the historic field pattern would be referenced to the lower-lying land to the west to recreate locally characteristic medium-sized fields bound by locally native hedgerows with hedgerow trees.
- To the west, the existing woodland within the retained sections of the Bignall End Coal Yards Site of Biological Importance (SBI - along the disused railway line) would be managed to improve its ecological value.
- The existing angling pond would be recreated with improved access for angling and shallows to the southern side to provide a habitat for wading birds.
- An open, meandering stream would be created from the pond area running in a westerly direction towards the Bignall End Road Biodiversity Alert Site (BAS). All these habitats would be supplemented by low fertility grassland with seasonal wetlands to link the pond, the stream and the restored sections of the Bignall End Coal Yards SBI.
- Drier south or south-west facing low fertility grassland is proposed to the southern boundary, linking the existing semi-improved acid grasslands to the east with the southern end of the Bignall End Coal Yards SBI.
- To the east, the retained sections of the mixed plantation woodland would be supplemented by locally native oak woodland to recreate the original extents of Old Hill Wood (as observed from 1st edition OS mapping).
- The stream to the east of Old Hill Wood would also be enhanced with low, shallow areas and scrapes to its eastern margins, and there is the potential here to replant this stream with wet woodland in accordance with the Supplementary Planning Guidance. Hedgerows to the higher ground around the Monument and to the east would be limited to those which would replace those that currently exist or to link woodland habitats, to maintain a more open habitat, promoting this area's current use by ground nesting birds.

## **3 Data**

### **3.1 Topographical Survey – Existing Site**

A Topographic Survey of the Site has been undertaken in January 2012 and is included within Appendix A.

Topographic Survey data shows that the Site has varied topography. The highest ground levels are situated within the east of the Site towards the Wedgwood's Monument where levels rise up to 200m AOD. From the east, levels within the Site predominantly fall to the west towards Bignall End Road along the Sites western boundary where ground levels are significantly lower between 140m AOD and 145m AOD.

Topographic data shows that the land under proposal is currently divided into 4 sub catchment areas defined by the Sites existing topography and a network of open watercourses, ditches and piped culverts. Drawing A075840-003 (Appendix A) shows the catchment areas and existing drainage features within the Site boundary.

The land within the north of the Site (Catchment A) lying to the east and west of the disused railway line slopes gradually toward the A500 that runs along the Sites northern boundary extent.

To the south of Catchment A, the land lying centrally within catchment B slopes toward an un-named open channel / ditch flowing from east to west across the mine Site towards the western boundary of the Site area along Bignall End Road. The southern land within Catchment B slopes from the high ground around Diglake Farm toward the Sites western boundary running along Bignall End Road.

Within the Sites southern catchment (Catchment D), levels slope from the high ground located to the east surrounding Wedgwood's Monument towards an open watercourse flowing from east to west towards the northern end of small track located of Audley Road at the Sites southern boundary.

Ground levels within Catchment C, situated within the eastern portion of the mining Site slope towards Jamage Farm located to the north east where the land is drained by a small network open channels and ditches flowing north towards the A500.

The existing survey data shows a number of open ditches, drains and piped culverts along the natural valleys within the Site that convey surface water runoff to off-Site watercourses and discharge points.

#### **3.1.1 Site Watercourses**

Ordnance Survey Mapping and the Site Topographic Survey show the Site is drained by a network of open ditches and piped culverts. The locations of the Sites existing water bodies are indicated upon Figure 2 and upon the Sites existing catchment drawing (A075840-003, Appendix A).

The land in the north of the Site drains to a small pond to the east of the disused railway line which in turn discharges to a sequence of open drains and piped culverts which convey flows to the Sites western boundary. Here, the drains flow beneath the Bignall End Road and off-Site before discharging to an upper section of the Brierly Brook which flows south adjacent to the Bignall End Road.



In the south of the Site, an un-named open channel watercourse that rises near to the Wedgwood monument around Bignall Hill enters the Site at the south eastern boundary and continues to flow within the south of the Site toward the northern end of small track located off Audley Road. The surface hydrology drawings (Figure 11, Drawing no 15359/R2/011, August 1992) within the Simon Hydrotechnica report show an existing brick lined culvert that conveys surface waters from the south of the Site toward the Sites western boundary before discharging to the Brierly Brook beneath the Bignall End Road. The location of this culvert is highlighted within Figure 2.

In the east of the Site, a small un-named watercourse flows within a wooded area lying along the boundary line of the proposed processing facilities. The watercourse flows north towards a series of drainage ditches and piped culverts located to the south of Jamage Farm.

The excavation areas shown on the phasing plans will potentially impact upon the existing drainage system and watercourses within the Site. It is therefore recommended that during the detailed design phase Staffordshire County Council be contacted to apply for relevant land drainage consents granting permission for works to be undertaken in or around the ordinary watercourses located within the Site.

The assessment of flood risk from the Sites Ordinary Watercourses is discussed further in Section 4.1.

## **3.2 Environment Agency**

The Environment Agency's website flood risk map was consulted and the Site is shown to lie entirely within flood risk zone 1 (low risk – likelihood of flooding less than 0.1% - 1 in 1000 year return period). The EA website flood risk map is shown in Figure 2.

The Environment Agency's website ground water source protection zone map shows that the Site lies outside any protection zones.

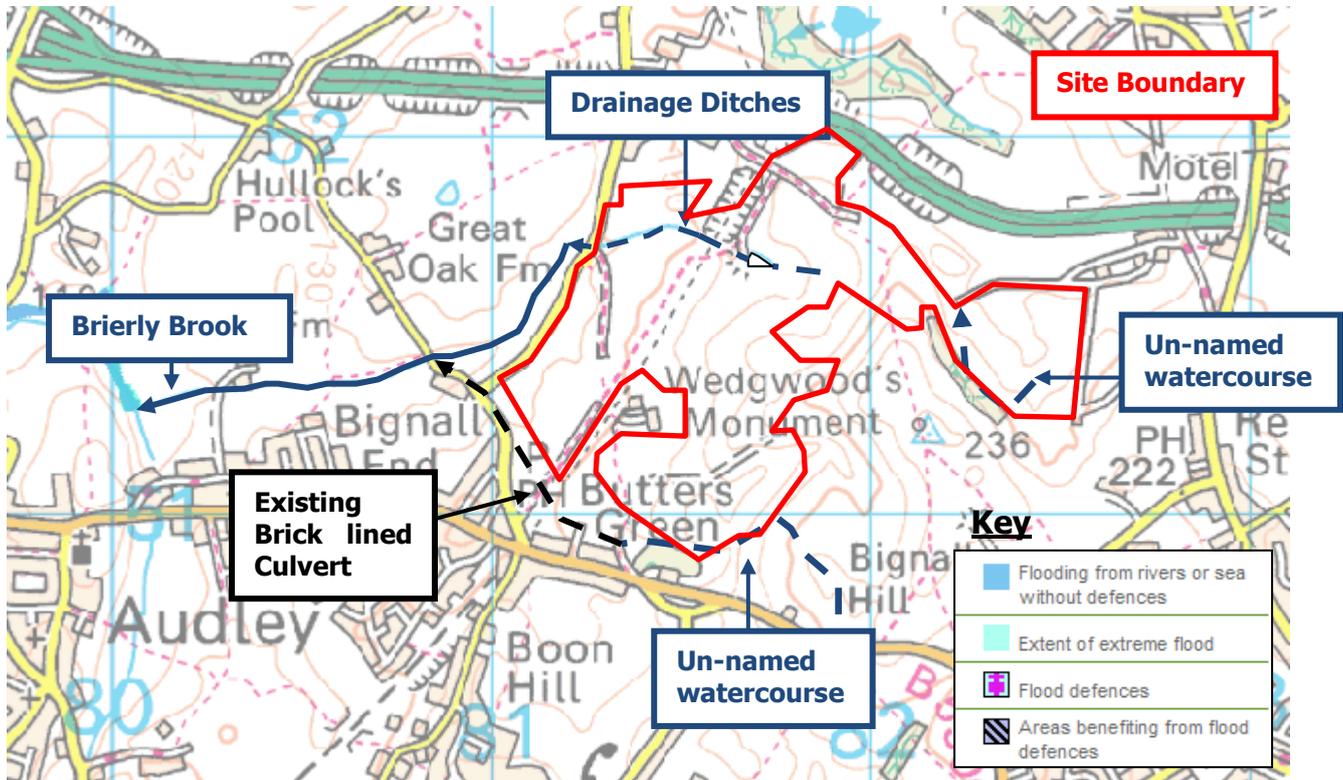


Figure 2: Environment Agency website flood risk map

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### 3.2.1 EA Pre-application Enquiry

A pre-application enquiry has been sent to the Environment Agency (EA) for their advice on flood risk and drainage. In its response (see EA letter dated 27 April 2012, Appendix C), the Environment Agency's requirements for flood risk assessment in terms of surface water management and discharge rates are established and have been summarised as follows;

- *The Site is shown on the Environment Agency's Flood Maps as lying within Flood Zone 1. There could however, be localised flooding problems not shown on the EA flood map and should be assessed as part of any Flood Risk Assessment.*
- *Environment Agency records have identified a number of 'ordinary watercourses' that flow through the Site. The proposals for the Site should ensure that watercourses remain in open channel, for both flood risk and ecological reasons. Should the proposal affect any watercourse, the Lead Local Flood Authority (LLFA) i.e. Staffordshire County Council should be contacted as their consent may be required under the Land Drainage Act 1991.*
- *The FRA should also determine how the discharge of surface water from any proposed development is to be managed. The discharge of surface water from any proposed development should mimic that which discharges from the existing Site. If a single rate of discharge is proposed, this is to be the mean annual run off (Qbar) from the existing undeveloped Greenfield Site. For discharges above the allowable rate, attenuation will be required up to the 1% annual probability event, including allowances for climate change*



- *During a severe rainfall event overland flow of surface water could cause a flooding problem. The FRA is to demonstrate how this risk is to be contained within the Site, and does not affect new buildings and how safe access and egress is provided.*

### **3.3 Newcastle-Under-Lyme Borough Council Strategic Flood Risk Assessment**

A Strategic Flood Risk Assessment (SFRA) has been undertaken for Newcastle-Under-Lyme Borough Council by Land Use Consultants, dated July 2008. A copy of the SFRA has been acquired during the preparation of this report.

It has been reported within the SFRA (Section 4, p27) that there are very few historical records of flooding within the Borough of Newcastle-Under-Lyme; however, the settlement of Kidsgrove located to the north of the Site has reported incidences of surface water flooding due to the surcharging of the sewer system during periods of intense rainfall. However, this instance of flooding is not within the immediate vicinity of the land under proposal and is not considered to effect on the proposed Site.

Given low instances of historical flooding, the SFRA also reports that there is comparatively low fluvial flood risk within the Borough of Newcastle-Under-Lyme. The flood risk map presented within the SFRA is very similar to the Environment Agency's flood risk map showing the entire Site lies within Flood Risk Zone 1.

In addition, the SFRA considers flooding due to sources other than fluvial sources including artificial drainage systems and surface water runoff, flooding from impounded water bodies and flooding from groundwater. A map showing areas of Newcastle-Under-Lyme at Risk of Flooding (Northern Sheet) is included in Appendix A and shows that there have been no recorded instances of ground water or sewer flooding within the Site boundary or within the immediate vicinity of the Site.

### **3.4 Geological Plan**

The UK Coal Geological plan dated March 2008 shows that the Site comprises of made ground of thickness from up to 5.8m underlain by Gravel. The solid geology of the Site comprises Carboniferous Middle Coal Measures. A drift channel runs parallel to Bignall End Road from north to south. The drift deposits largely comprise glacial till consisting of a gravelly clay with occasional sand and gravel lenses in accordance with ground investigation carried out by Simon Hydrotechnica in 1992.

The ground investigation carried out by Simon Hydrotechnica revealed that the groundwater level in the drift is near ground level in the vicinity of the buried channel and Brierly Brook along the Sites western boundary. The report highlights that the drift to the east of the Sites disused railway is largely unsaturated whilst the groundwater level in the drift to the west of the excavation Site lies at 1m to 2m below ground level.

In the area of the buried channel, the ground is marshy and the Brierly Brook has been observed to gain baseflow fed by groundwater discharge. To the west of the Site, there are numerous ponds and water levels in these features are believed to be consistent with the drift groundwater levels.

### **3.5 Envirocheck Report**

Envirocheck reports for the Site have been acquired and extracts are included within Appendix D.



The reports show that the Site and the surrounding area have historically been used as landfill for the deposition of household and highway waste. Locations of historical landfill Sites are shown within the Site Sensitivity Maps included in Appendix D.

The Ground Vulnerability Maps within the Envirocheck report show that the Site comprises minor aquifer with variable permeability and does not lie within a source protection zone. The central and southern areas of the Site are shown to lie within a minor Aquifer, with a low permeability. The eastern extent of the Site also lies within a minor Aquifer although classified as 'high' in terms of permeability.

## 4 Flood Risk Assessment

### 4.1 Fluvial Flood Risk

The Brierly Brook watercourse flows along the Sites western boundary adjacent to Bignall End Road toward the settlement of Bignall End. At the settlements western extent, the Brierly Brook discharges to the Dean Brook. The Environment Agency's website flood risk map indicates that no floodplain is associated with the Brierly Brook along the Bignall End Road and that the entire Site lies within Flood Risk Zone 1.

At the confluence of the Brierly Brook with Dean Brook, small areas of Flood Risk Zone 2 and Zone 3 are present although these lie approximately 0.7km to the south west of the Site boundary. These areas of Flood Risk Zone 2 and 3 are remote from the Site and appear to have a maximum level of approximately 120m AOD on the contours shown on OS mapping. The lowest Site ground level is approximately 15m higher, so fluvial flooding is not considered to pose a risk to the Site.

The open drainage ditches in the north and south of the Site (which discharge to the Brierly Brook) follow natural drainage paths within the Site's valleys and therefore any flooding associated with these drains is likely to be conveyed to discharge points off the Site; fluvial flooding is not considered to pose a risk to the Site and the proposed surface mining operation.

### 4.2 Tidal Flood Risk

The Site is remote from the coast and lies at levels in excess of 135m AOD; as such the Site is not considered to be at risk of tidal flooding.

### 4.3 Overland Flow

The topographical survey drawing shows that the Site ground levels are higher than the surrounding roads and lands, therefore overland flows from outside the Site are not considered to pose a significant risk to the Site. However during the extreme storm event overland flow of surface water within the Site will require management via a proposed network of drainage ditches. It is anticipated that with the use of an appropriate drainage strategy for the proposed development the risk from overland flow will be insignificant.

### 4.4 Groundwater

Ground investigation carried out previously in 1992 by Simon Hydrotechnica found that the ground water levels are at or near the ground surface in the vicinity of the Brierly Brook. As such it is likely that the proposed excavations to be undertaken toward the Sites western boundary will be affected by the inflow of groundwater. This water will be pumped to the water treatment areas and discharged to the local watercourses via a controlled discharge so will not increase flood risk to off-Site areas.

A suitable strategy for the monitoring and management of groundwater should therefore be implemented during the excavation works. It is anticipated that with the use of suitable mitigation measures during the excavation the flood risk to the Site and elsewhere will be insignificant.



## **4.5 Sewer Flooding**

There are no known sewers within the Site and the risk of the Scheme being affected by sewer flooding is considered low.

## **4.6 Artificial Sources**

The existing pond in the north of the Site lies within an excavation area so will be removed during the operation of the phase, but it will be replaced with a new angler's pond following restoration of the Site. Other ponds in the vicinity of the Site are at lower levels so are not considered to pose a flood risk to the Site. As such, the flood risk from artificial sources is considered low.

## **4.7 Climate Change**

In accordance with NPPF Technical Guidance, the effects of future climate change have been considered. The duration of the Scheme is approximately 2 years 6 months so the effects of climate change during the Scheme are considered minimal.

The restoration proposals are to put the Site broadly back to an agricultural land use along with ecological enhancement that will include open watercourses and a new pond. The Site will discharge runoff at calculated Greenfield rates so flood risk to off-Site areas is not anticipated to increase.

## 5 Site Drainage

### 5.1 Existing Site Drainage

The topographical survey of the Site shows that existing drainage within the Site is provided by a series of open channel watercourses, drainage ditches and piped culverts that discharge to the Brierly Brook within the Site or off Site via culverts under the A500 in the north. The Site has an approximate area of 80 ha and is split into 4 sub catchment areas based upon current topography as shown by the Sites existing catchment Drawing A075840-003 (Appendix A).

The Environment Agency have stated that the discharge of surface water from any proposed development should mimic that which discharges from the existing Site; therefore an estimation of the existing Greenfield runoff rate from existing catchments has been undertaken using the ICP SUDS mean annual flood method for catchments A, C and D (See Appendix E.1, E.3 respectively). An estimation of the existing Greenfield runoff rate from catchment B (more than 50 ha) has been undertaken using the IH 124 mean annual flood method (See Appendix E.2).

Existing Greenfield runoff rates for the Sites catchments are contained within Table 2. A summary of the existing drainage mechanisms for each of the Sites catchments follows;

#### **Catchment A**

Catchment A, consisting of land lying to the east and west of the disused railway, is situated within the north of the Site and has an area of 5.0 ha. Topographic survey data shows that the land slopes from south to north towards the A500. In terms of land drainage, surface water runoff from fields is channelled via the existing topography and drain through several culverts beneath the A500 and into Parrot's Drumble to the north.

#### **Catchment B**

Catchment B has a total area of 52 ha. Topographic survey data shows that the land lying within the north east of Catchment B drains to an unnamed ditch before discharging to a small pond lying centrally within the catchment. From the pond, an open ditch land drain conveys surface waters from the pond to the Sites western boundary where the drain discharges to the Brierly Brook via a culvert located beneath the Bignall End Road.

#### **Catchment C**

Catchment C has an area of 10.3 ha. Currently, the land within the catchment is drained by a series of small open ditches that convey surface waters to a number of culverts surrounding the marshy ground around Jamage Farm. Outfalls from the culverts are not apparent on the topographic survey, but it is presumed that surface waters discharge from the Site via a culvert beneath the A500 to land known as the to the Parrots Drumble to the north.

#### **Catchment D**

Catchment D, located in the south of the Site, has an area of 12 ha. it is observed that a series of open ditches convey surface water from the high ground within the catchment toward an outfall within the south of the Site at the northern end of a small track located off Audley Road. Existing drainage drawings show that an existing brick



line culvert conveys surface waters from the south of the Site past Diglake Farm to an outfall located along the Sites western boundary running alongside Great Oak Road before discharging to the Brierly Brook.

**Table 2 Existing Runoff Rates**

Return Period	Existing catchment run off rate (l/s)			
	Catchment A (5.0 ha)	Catchment B (52 ha)	Catchment C (10.3 ha)	Catchment D (12 ha)
QBar l/s	25.7	265.9	52.9	61.6
Q <sub>1yr</sub> (1 in 1 year)	21.3	220.7	43.9	51.2
Q <sub>30yr</sub> (1 in 30 year)	50.3	521	103.7	120.8
Q <sub>100yr</sub> (1 in 100 year)	66	683.4	136	158.4

## 5.2 Phased Drainage Proposals

In accordance with the recommendations in NPPF (March 2012), the design of the new development will adopt measures to reduce the impact of surface water runoff through the use of sustainable drainage techniques.

The observed drainage paths of the existing Site have been described in Section 4.1. It proposed, where possible, to maintain the natural drainage regime during the Scheme and for the restored Site; Where this is not possible, mitigation measures are to be undertaken to provide on and off-Site drainage mimicking that of the existing Site.

### 5.2.1 Surface Water Attenuation and Discharge

The surface mining Scheme comprises the excavation of voids within the Site. Rainfall conveyed toward, or falling within, the excavated voids will be collected at the lowest point and pumped to water treatment areas located on the perimeter of the Site.

The outlets from the water treatment areas will be to either Brierly Brook or other existing watercourses along the Sites northern and western boundaries. The proposed surface water management strategy for each phase during the scheme is shown on drawings A075840-004 through to A075840-006 in Appendix B.

The discharge rate at the outfall from each water treatment area to the receiving watercourses will be restricted to the existing run off rate for each catchment area (See Table 1). This will ensure that the overall flow from the Site does not exceed the current situation and does not increase flood risk to downstream areas. In addition, the collection and discharge of runoff will be such that runoff from catchment B will discharge to the Brierly Brook, whilst the runoff from the Sites southern catchment (catchment D) will continue to discharge to the outfall located at the Sites western boundary before discharging to the Brierly Brook alongside Bignall End Road. Runoff from catchments A and C will continue to collect and discharge via culverted outfalls located beneath the A500 to the north and north east of the mine Site, thus mimicking the existing Site drainage.



During the Scheme, runoff from areas of the Site yet to be worked will continue to discharge as per the existing Site arrangements. This arrangement will maintain the existing drainage regime for these areas.

To ensure that the discharge of surface water from the Site during the operation phase matches that of the existing scenario, some on-Site storage will be required to attenuate run off from storm events up to and including the 1 in 100 year event. The attenuation is required to temporarily accommodate flood water during storm events and the required volume will be provided in the drainage system or within excavated Site areas.

To provide an estimation of the required on-Site attenuation, a rational method calculation has been undertaken. Areas that have received topsoil strip will exhibit an increased runoff rate over the existing scenario. FEH parameters show the Site has a SPRHOST soil value of 0.37. A runoff co-efficient of 0.44 has been used to simulate a 20% increase in the rate of runoff. A Greenfield run off rate of 4.5 l/s/ha has been used, restricting discharge to 341 l/s over the 80 ha Site area. No climate change has been considered as the operation is to be undertaken over a period of 2.5 years.

For the 100 year event, the increased runoff rate estimates that approximately 14000m<sup>3</sup> of storage would be required during the mining phases of the Site operation. The working void within the worst case mining phase (6 month) approximates 15000m<sup>2</sup>; therefore, given that the working voids are significantly more than 1m in depth, it is considered that adequate storage can be provided within the Sites excavation voids in the event of a 1 in 100 year event before being pumped to one of the Sites discharge points at the allowable Greenfield runoff rates as outlined in Table 2.

### **5.2.2 Surface Water Treatment**

Treatment of surface runoff during the operation phase will be provided in 4 water treatment areas located throughout the Scheme. These treatment areas will promote settlement in the water before it is discharging to existing local watercourses or off-Site discharge points. This process will be carefully monitored in order to avoid pollution entering neighbouring watercourses; discharge rates would be managed in such a way as to comply with existing catchment runoff rates in order to maintain a flow regime similar to that of the existing Site.



## **6 Flood Risk Management**

NPPF recommends that a risk-based approach and sequential test are used in order to determine whether a Site is suitable for a particular development. The assessment of risk and sequential test are considered as follows:

The proposed development Site is shown to be located within Flood Zone 1, therefore, in accordance with NPPF, the Site is considered suitable for the proposed development.

Surface water runoff during the operational phase and following restoration will be restricted to Greenfield runoff rates. As a result flood risk to downstream areas will not be increased.



## 7 Conclusions

This Flood Risk Assessment report has been commissioned by UK Coal Mining Limited to support the planning application for the Great Oak Surface Mining Scheme located to the north of Bignall End settlement, Staffordshire.

It is concluded that the Site is at low risk of fluvial flooding and in accordance with the requirements of the sequential test in NPPF, Table 3, the Site is considered suitable for the proposed development in terms of vulnerability to flood risk. Furthermore it is considered that the proposed development is at low risk of flooding from other sources including overland flow, sewers and groundwater.

In accordance with Environment Agency pre-development advice, the surface water runoff from the Site will be attenuated and discharged in a controlled manner to maintain the Greenfield runoff rate of surface waters to receiving watercourses, thereby mimicking the drainage of the existing Site.

This report concludes the Site is at low risk of flooding and will not increase flood risk elsewhere in the catchment. Furthermore it is concluded that there is a practical means of surface water management for the Site.



## **Appendix A – Drawings**

Strategic Flood Risk Map - North of the Borough

A075840-002 – Topographic Survey

A075840-003 – Existing Drainage Catchments



## **Appendix B – Proposed Operational Phases**

A075840-004 - 6 Month Phasing Plan

A075840-005 - 12 Month Phasing Plan

A075840-006 - 18 Month Phasing Plan

A075840-007 - Restoration Plan



## **Appendix C – Environment Agency Correspondence**

EA letters dated 27 April 2012



## **Appendix D – Extracts from Envirocheck Report**

Site Sensitivity Map – Slice A

Site Sensitivity Map - Slice B

Site Sensitivity Map – Slice C

Site Sensitivity Map – Slice D



## **Appendix E – Preliminary Surface Water Runoff Calculation**

WinDES MicroDrainage Results for Annual Greenfield Flow Rate (Qbar)

Site Surface Runoff & Catchment A

Site Surface Runoff & Catchment B

Site Surface Runoff & Catchment C

Site Surface Runoff & Catchment D