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Date: 28 July 2022
Our ref: 50303/04/HS/JCx/25608822v1
Your ref: NYM/2017/0505/MEIA

Dear Rob

North York Moors: Ladycross Plantation - Application to Partially Discharge Conditions 4, 18, 34, 42, 52, 57, 59, 60, 65, 68, 70, 71, 76, 80, 88, 89, 90, 91, 92, 93, 94 and 95 of Planning Permission NYM/2017/0505/MEIA

On behalf of our client, Anglo American Woodsmith Limited, we are pleased to submit this application for limited and partial approval of Planning Conditions 4, 18, 34, 42, 52, 55, 57, 59, 60, 65, 68, 70, 71, 76, 80, 88, 89, 90, 91, 92, 93, 94 and 95 of Planning Permission NYM/2017/0505/MEIA.

The Project will be delivered in a series of Phases within each discrete part of the overall consented area. This application relates solely to Phase 5 works at Ladycross Plantation.

Background

On 19 October 2015, the NYMNPA granted planning permission for the "Winning and working of polyhalite by underground methods including the construction of a minehead at Dove's Nest Farm involving access, maintenance and ventilation shafts, the landforming of associated spoil, the construction of buildings, access roads, car parking and helicopter landing site, attenuation ponds, landscaping, restoration and aftercare and associated works. In addition, the construction of an underground tunnel between Doves Nest Farm and land at Wilton that links to the mine below ground, comprising 1 no. shaft at Doves Nest Farm, 3 no. intermediate access shaft sites, each with associated landforming of associated spoil, the construction of buildings, access roads and car parking, landscaping, restoration and aftercare, and the construction of a tunnel portal at Wilton comprising buildings, landforming of spoil and associated works" (Council Reference NYM/2014/0676/MEIA).

NYM/2014/0676/MEIA was approved subject to 95 planning conditions and a Section 106 Agreement.

On 6 February 2017, the NYMNPA granted planning permission for the *"Variation of Condition 5 of planning permission NYM/2014/0676/MEIA to allow minor*

material amendments relating to that part of the development at the Woodsmith Mine site (formerly known as Doves Nest Farm and Haxby Plantation), including; re-design of foreshafts and shaft construction methodology, changes to building layout and shaft access arrangements, revisions to construction and operational shaft platform levels, revisions to location and layout of surface water attenuation ponds, revisions to groundwater management arrangements and amendments to internal access arrangements" (Council Reference NYM/2017/0505/MEIA).

The amended scheme (NYM/2017/0505/MEIA) was approved subject to 98 planning conditions and a deed of variation to the originally approved Section 106 Agreement.

Phase 5 Works

Phase 5 comprises the following works:

- Mobilisation of shaft sinking contractors, including installation of shaft sinking equipment and shaft platform civils and infrastructure;
- Construction of foreshaft, including secant piling;
- Drilling of pilot borehole;
- Sinking of proposed MTS shaft via blind bore drilling method;
- Installation of shaft lining;
- Grouting of shaft anulus and dewatering;
- Revised design to security cabin and;
- Addition of showers to existing welfare.

Partial Discharge

Anglo American acknowledges that limited and partial approval of Planning Conditions 4, 18, 34, 42, 52, 57, 59, 60, 65, 68, 70, 71, 76, 80, 88, 89, 90, 91, 92, 93, 94 and 95 when given, does not constitute permission to undertake works other than those described, and that such works remain subject to the approval of other conditions.

This approach has been discussed and agreed with your Planning Team and is consistent with the approach taken at the Woodsmith Mine site.

Application Submission

The application was submitted via the planning portal on 28 July 2022 (reference PP-11412024) and comprises the following documentation:

- Completed application form;
- Application drawings – Please see Appendix 1;
- Supporting Documents – Please see Appendix 1.

The requisite planning application fee of £116 has been paid online by credit card.

Conclusion

We trust that this application provides you with the necessary information to be able to partially discharge the above conditions to cover Phase 5 site works at Ladycross Plantation. However, should you require any further information, please do not hesitate to contact me.

Yours sincerely

James Cox
Associate Director

Appendix 1 : Supporting Documents

Table 1: List of Supporting Documents

Condition No	Description	Document Name / Number	Further Details
N/A	N/A	Listed Plans	40-STS-LC-2100-PA-22-20116 – Ladycross Plantation Phase 5 General Arrangement 40-STS-LC-2100-PA-22-20114 – Ladycross Plantation Phase 5 Phasing Plan *N.B The General Arrangement drawing shows how the workshop to the immediate east of the welfare facility has been positioned / orientated in a slightly different way to that shown on the Phase 4 General Arrangement drawing, albeit it remains in the same general location.*
4	Phasing Plan	40-STS-LC-2100-PA-22-20114 – Ladycross Plantation Phase 5 Phasing Plan	N/A
18	Noise & Vibration	Phase 5 Ladycross Plantation Noise and Vibration Management Plan - 40-STS-LC-2100-EN-PL-00027	N/A
34	Construction Traffic Management Plan	Phase 3 Ladycross Plantation Construction Traffic Management Plan - 40-STS-LC-2100-LG-PL-00001	To manage the potential impacts of construction traffic associated with the Phase 3 works at Ladycross Plantation, a Construction Traffic Management Plan (CTMP; Reference 40-STC-LC-2100-LG-PL-00001) was submitted to North York Moors National Park Authority and North Yorkshire County Council (local highway authority).

			The Contractors have confirmed that the total numbers of employees working out of Ladycross Plantation during the proposed Phase 5 works would not exceed those peak levels currently permitted by the Phase 3 CTMP. Whilst the Phase 5 works will require HGV deliveries, the Contractors have confirmed that the demand for deliveries can be accommodated within the daily targets set out in the Phase 3 CTMP. The Phase 5 works are expected to require approximately 50 abnormal indivisible load (AIL) deliveries over four weeks, i.e. two to three AILs per day. These AILs would primarily comprise of casings, measuring 3.2 – 3.5m in width and 9.0m in length. The casings would first be delivered to Lockwood Beck for grouting, before then being transferred onwards to Ladycross Plantation. The routing and timing of these AIL deliveries will be subject to separate agreement with the local highway authorities and police through the established Electronic Service Delivery for Abnormal Loads system (ESDAL) process. It is considered that the targets, measures and monitoring processes contained within the Phase 3 CTMP would be appropriate to manage the additional construction activities proposed as part of Phase 5.
42	Access	Refer to CEMP (Condition 93)	Access arrangements will remain as per earlier phases. Further details regarding the proposed parking, manoeuvring and turning areas that will be utilised in this phase are also set out in the Construction Method Statement and Listed Plans.

52	Protected Species Management Plan	Ladycross Plantation Phase 3 Protected Species Management Plan – Bats – 40-STS-LC-2100-EN-PL-00001 Ladycross Plantation Phase 3 Protected Species Management Plan – Breeding Birds – 40-STS-LC-2100-EN-PL-00002 Ladycross Plantation Phase 3 Protected Species Management Plan – Reptiles – 40-STS-LC-2100-EN-PL-00003 Ladycross Plantation Phase 3 Protected Species Management Plan – Badgers – 40-STS-LC-2100-EN-PL-00004 Ladycross Plantation Phase 3 Protected Species Management Plan – Water Voles – 40-STS-LC-2100-EN-PL-00005	Please also refer to the Phase 5 CEMP (Condition 93).
57	Landscape & Ecological Management Plan	Ladycross Plantation – Phase 3 Works – NYMNPA 57 Landscape &	The Phase 3 LEMP will remain applicable for the Phase 5 works.

		Ecological Management Plan– 40-STS-LC-2100-EN-PL-00014	
59	External Lighting	Refer to CEMP (Condition 93)	N/A
60	Surface Water Drainage	Ladycross Plantation – Phase 3 Works – NYMNPA 60 and 80 Surface Water Drainage Scheme – 40-STS-LC-2100-PA-PL-20102	The Phase 3 Surface Water Drainage Scheme will remain applicable for the Phase 5 works.
65	Temporary Fencing	Refer to Construction Method Statement (Condition 94)	Please also refer to CEMP (Condition 93).
68	Temporary Structures	Refer to Construction Method Statement (Condition 94)	Please also refer to CEMP (Condition 93).
70	Arboricultural Method Statement	Ladycross Plantation Phase 3 Arboricultural Method Statement – 40-STS-LC-2100-CN-MS-00003	Please also refer to CEMP (Condition 93).
71	Hard & Soft Landscaping	40-STS-LC-2100-20115 – Ladycross Plantation Phase 5 Hard and Soft Landscaping Plan	N/A
76	Soil Management Plan	Ladycross Plantation – Phase 3 Works – NYMNPA 76 Soil Management Plan – 40-STS-LC-2100-EN-PL-00007	The Phase 3 Soil Management Plan will remain applicable for the Phase 5 works.
80	Surface Water Drainage	Ladycross Plantation – Phase 3 Works – NYMNPA 60 and	See Condition 60 above

		80 Surface Water Drainage Scheme – 40-STS-LC-2100-PA-PL-20102	
88	Hydrogeological Risk Assessment	Ladycross Plantation – Phase 5 Works – NYMNPA Condition 88 & 90 Hydrogeological Risk Assessment – 40-STS-LC-2100-EN-RA-00004	N/A
88	Ground Water & Surface Water Monitoring Scheme	Ladycross Plantation – Phase 5 Works – NYMNPA Condition 88 & 90 Hydrogeological Risk Assessment – 40-STS-LC-2100-EN-RA-00004	The Phase 4 Construction & Operation Groundwater & Surface Water Monitoring Scheme will remain applicable to the Phase 5 works.
89	Remedial Action Plan	Ladycross Plantation – Phase 5 Works – NYMNPA Condition 88 & 90 Hydrogeological Risk Assessment – 40-STS-LC-2100-EN-RA-00004	The Phase 4 Remedial Action Plan will remain applicable to the Phase 5 works.
90	Groundwater Management Scheme	Ladycross Plantation – Phase 5 Works – NYMNPA Condition 88 & 90 Hydrogeological Risk Assessment – 40-STS-LC-2100-EN-RA-00004	The Phase 4 Construction & Operation Groundwater & Surface Water Monitoring Scheme and Phase 4 Remedial Action Plan will remain applicable to the Phase 5 works.
91	Emissions	Phase 4 Ladycross Plantation Emissions to Atmosphere - 40-	Condition NYMNPA-91 states that emissions associated with construction works at Ladycross Plantation must lead to nutrient

		STS-LC-2100-EN-PL-00019	nitrogen and acid deposition no greater than that reported in the Environmental Statement and Supplementary Environmental Information (SEI) Report on which the planning permission was based (reference NYM/2017/0505/MEIA). The levels of deposition detailed in the SEI were based upon emissions from 9,030 kVA of diesel power generation fitted with Selective Catalytic Reduction (SCR) technology, the blasting of the shaft, emissions from onsite mobile plant and road traffic. An assessment was undertaken for Phase 4 at Ladycross Plantation (document reference 40-STS-LC-2100-EN-PL-00019) which demonstrated that the total generator capacity on site was significantly below that considered in the ES and SEI (1,662 kVA). In addition, other emission sources (i.e. blasting) would not be in operation. Most generators used during Phase 4 were of a relatively small capacity other than the generator required to power the drill rig (1,250 kVA), which was to be used for only 11 weeks. The assessment also considered the distance from the Works to designated ecological sites. The closest point of the North York Moors SAC and SSSI is 3.5 km from the Ladycross Plantation site, and therefore it was concluded that there would be sufficient dilution and dispersion of emissions from onsite plant and generators to ensure that impacts on the designated site would be no greater than those presented in the ES and SEI.

			For Phase 5, the required generator capacity is not materially different to that considered in the Phase 4 assessment. The total power requirements would be up to 1,800 kVA, and the larger rig generator would be used only for 52% of the duration of Phase 5. Furthermore, it is expected that during Phase 5 an electrical supply will be installed on site which would remove the requirement of a number of smaller generators, and would take the total diesel power requirement below the capacity considered in the Phase 4 assessment. Given the above, it is concluded that emissions associated with generators and onsite plant used during Phase 5 would result in nutrient nitrogen and acid deposition of a lower magnitude than reported in the ES and SEI.
92	CVPMP	Phase 5 Ladycross Plantation Construction Vehicle & Plant Management Plan - 40-STS-LC-2100-LG-PL-00005	N/A
93	CEMP	Phase 5 Ladycross Plantation Construction Environmental Management Plan – 40-STS-LC-2100-EN-PL-00025	N/A
94	Construction Method Statement	Phase 5 Ladycoss Plantation Construction Method Statement	Listed plans.

		– 40-STS-LC-2100-CN-MS-00006	
95	Written Scheme of Investigation	Refer to CEMP (Condition 93)	40-COT-LC-8324-EN-PL-00002 – Ladycross Plantation - Written Scheme of Investigation for an Archaeological Watching Brief – Phase 2

Project Title / Facility Name:

Woodsmith Project

Document Title:

CONSTRUCTION METHOD STATEMENT - PHASE 5 - LADYCROSS

NYMNPA

28/07/2022

Document Review Status	
☑ 1. Reviewed – Accepted – Work May Proceed	By: Robert Staniland
☐ 2. Reviewed – Accepted As Noted, Work May Proceed, Revise & Resubmit	On: 26 Jul 2022 10:21
☐ 3. Reviewed – Work May Not Proceed, Revise & Resubmit	
☐ 4. For information only	
☐ 5. On Hold – Pending Project Restart & Ramp Up	

Rev.	Revision Date (dd mmm yyyy)	Reason For Issue	Prepared by	Verified by	Approved by
E	22-Jul-2022	Planning	PLA			
D	20-Jul-2022	Planning	PLA			
C	14-Jul-2022	Planning	PLA			
B	01-Jul-2022	Planning	PLA			

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40-STS-LC-2100-CN-MS-00006

WOODSMITH PROJECT

(788.5030)

CONSTRUCTION METHOD STATEMENT – PHASE 5 – LADYCROSS PLANTATION / 40-STS-LC-2100-CN-MS-00006

Revision	Date of issue	Prepared by	Checked by	Approved by	Changes
A (PLA)	31/05/2022	W Hodgson	C Thomas	C Fryer	First issue
B (PLA)	01/07/2022	W Hodgson	C Thomas	C Fryer	Changes in accordance with Rev A comments
C (PLA)	14/07/2022	W Hodgson	C Thomas	C Fryer	Changes in accordance with Rev B comments
D (PLA)	20/07/2022	W Hodgson	C Thomas	C Fryer	Final Issue
E (PLA)	22/07/2022	W Hodgson	C Thomas	C Fryer	Final Issue. Amendment to shower unit orientation

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1. INTRODUCTION

1.1. OVERVIEW

This document has been prepared on behalf of Anglo American and details the Construction Method Statement for the Phase 5 construction activity at Ladycross Intermediate Shaft Site (Ladycross).

Anglo American are constructing a Mineral Transport System (MTS) tunnel, as part of the wider Woodsmith Project. The tunnel will be used to transport polyhalite from the Woodsmith Mine site to the Material Handling Facility (MHF) at Wilton, Teesside. Safe and efficient construction and operation of the tunnel requires the construction of an immediate shaft at Ladycross to provide access to the tunnel.

This document builds on the previous Construction Method Statements (CMS) for the previous phases of works.

This report only details the construction works required for the Phase 5 works at Ladycross.

The CMS provides an overview of the resource requirements, the plant and materials that are anticipated to be used during the Phase 5 construction works at Ladycross. It includes the measures to be taken to ensure that the works are carried out in accordance with the requirements of both the planning permission and of Anglo American and, above all, are carried out safely and in compliance with all statutory obligations.

In addition, while not submitted to the Planning Authority, all site works are controlled by a Risk Assessment and Method Statement (RAMS) process, which identify the resources, plant, materials and specific controls required for all scopes of work.

The Phase 5 scope of works, comprises:

- Mobilisation of shaft sinking contractors, including installation of shaft sinking equipment and shaft platform civils and infrastructure;
- Construction of foreshaft, including secant piling;
- Drilling of pilot borehole;
- Sinking of proposed MTS shaft via blind bore drilling method;
- Installation of the shaft lining;
- Grouting of shaft anulus and dewatering;
- Revised design to security cabin; and
- Addition of showers to existing welfare.

A site plan is provided separately.

Table 1 - 1 Condition NYMNPA-94: Construction Method Statement

NYMNPA 94 Compliance	Compliance
Prior to the commencement of each phase of the development at Dove's Nest Farm or Lady Cross Plantation in accordance with the approved Phasing Plan, a Construction Method Statement shall be submitted for that phase, and approved in writing by the MPA, in consultation with the appropriate Highway Authority. Each approved Statement shall be adhered to throughout the construction period. The Statements shall provide for:	This Phase 5 Construction Method Statement
(i) The parking of vehicles of site operatives and visitors clear of the highway;	**Section 2.3** **Phase 3 Construction Traffic Management Plan**
(ii) Loading and unloading of plant and materials;	**Section 2.5** **Phase 3 Construction Traffic Management Plan**
(iii) Storage of plant and materials used in constructing the development;	**Section 2.6**
(iv) Erection and maintenance of security fencing;	**Section 2.2**
(v) Wheel washing facilities;	**Section 2.9**
(vi) An outline construction method for sub-surface works including adherence to the 'rack and pillar' method of mining described in the SEI (14th February 2015) and the SRK Subsidence Memorandum (15th May 2013);	This type of work is not required in Phase 5
(vii) Buildings and structures associated with the mine and tunnel shafts;	**Section 3**
(viii) Welfare/office building and security gatehouse;	**Section 2.2**

NYMNPA 94 Compliance	Compliance
(ix) Screening bunds;	**Phase 5 Noise Vibration Management Plan**
(x) Hardstandings;	**Section 3.8**
(xi) Shuttle Bus terminal;	**Phase 3 Construction Traffic Management Plan**
(xii) Park-and-Ride layby;	This type of work is not required in Phase 5
(xiii) Emergency helipad;	This type of work is not required in Phase 5
(xiv) Lighting columns;	**Section 2.8** **Phase 5 Construction Environment Management Plan**
(xv) Internal access and haul roads;	**Section 2.7**
(xvi) Domestic wastewater (foul sewage) treatment plant;	**Section 2.10**
(xvii) Non-domestic wastewater treatment plant and settlement tanks;	**Section 2.10**
(xviii) Surface water attenuation ponds, settlement ponds, swales and wetland areas;	**Phase 3 Surface Water Management Plan** and **Phase 3 Surface Water Drainage Scheme**
(xix) Temporary spoil and Polyhalite storage areas;	This type of work is not required in Phase 5
(xx) Removal of any temporary structures; and	No removal of temporary structures required in Phase 5
(xxi) Formation of spoil mounds and the establishment of vegetation on them.	**Phase 3 Soil Management Plan**

NYMNPA 94 Compliance	Compliance
The CMS shall contain a construction timetable and order of works noting any construction dependencies, refer to any inherent mitigation measures required to address adverse impacts identified in the EIA and cross refer to the CEMP in relation to any additional avoidance or mitigation measures	**Phase 5 Construction Environment Management Plan**

The CMS is a live document and updates to this CMS plan will be prepared for subsequent construction phases and following any design or method change. The NYMNPA has confirmed that it supports this approach.

2. DESCRIPTION OF WORKS

2.1. PHASE 5 WORKS

Phase 5 works will provide a 3.2m internal diameter shaft. The shaft will provide access to tunnel personnel as well as essential services including ventilation, water, compressed air, grout and power for the MTS construction phase. The shaft will be constructed using a blind boring methodology as detailed in this report.

The proposed works will provide:

- A secant pile wall 5m diameter and 25m deep will be constructed by cutting reinforced “male” piles through installed unreinforced “female” piles. The secant pile wall will provide a watertight interlock. A capping beam to reinforce the piled wall structure will be completed with concrete at ground level.
- Prior to foreshaft excavation a pilot hole will be constructed using the RD20 rig. The pilot hole will be drilled to the depth of the final shaft approximately 362mbgl. The primary objective is to serve as a guide for the reaming head thereby ensuring verticality of the shaft.
- The foreshaft will be excavated down to a depth of 12m. The purpose of the larger diameter surface shaft is twofold: first, to provide an initial pit to set up the drilling equipment and secondly, to prevent loss of water into the shallow subsurface.
- Shaft reaming. The proposed methodology for shaft sinking uses a dedicated drilling rig, with reaming head, with no requirement for shaft headframe or winding gear until the shaft is complete.
- The shaft will be lined with steel casings installed in 9m sections. These will be fabricated offsite and welded together as the installation progresses.
- Annular grouting of shaft between the drilled shaft and exterior wall of the casings using upstage (bottom up) grouting techniques.
- The final stage of shaft development will be dewatering of the shaft casing. The remaining water used during shaft casing install will be over pumped to the cuttings lagoon.

2.2. WELFARE OFFICES AND COMPOUNDS

2.2.1. WELFARE SHOWER UNITS

Changes will be made to the existing welfare and offices established in Phase 3. Welfare shower units will be installed to the north-western side of the existing office block, the cabins will be founded on levelled paving slabs situated on existing hardstanding, **Figure 1**.

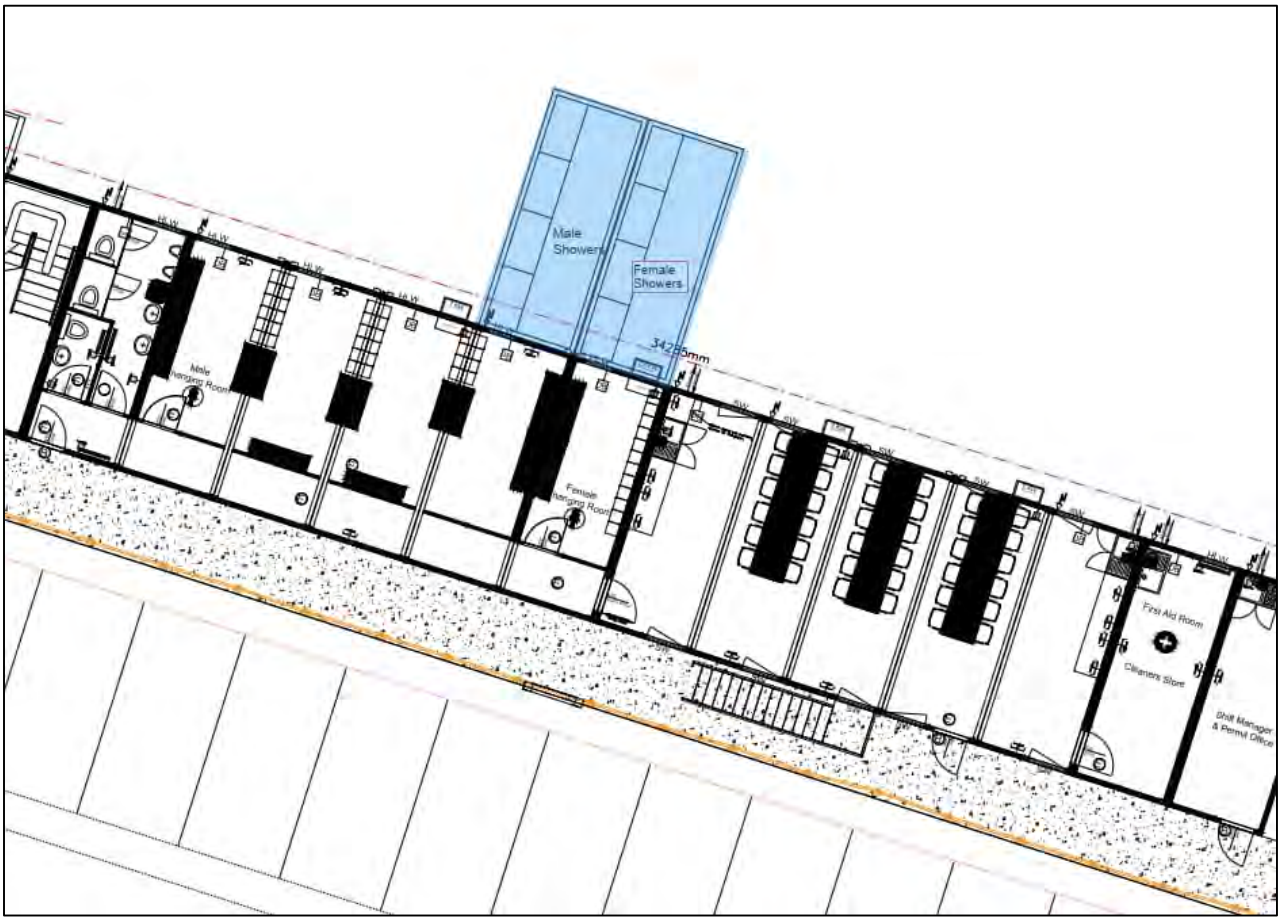


Figure 1: Proposed location of shower units in relation to the existing welfare unit

The shower area will consist of two units similar to the modular containers installed as part of the welfare facility set-up for Phase 3. Each shower unit will have dimensions of 2.5m width and 6m length. The two units will be single storey with a maximum height of approximately 2.5m. Access to the shower room will be via an internal entrance located within the male and female changing rooms respectively. The units will be painted brown/green (RAL6008) or juniper green (RAL 160 20 10) prior to arrival on site.

The wastewater from the showers will drain to the welfare cesspit installed during Phase 3. The existing cesspit capacity is considered to be suitable for the increased volumes of waste water.

2.2.2. SITE SECURITY CABIN REVISION

A revised site security set-up will be installed in the location of the existing site security cabins established in Phase 2. The four cabins will replace the current setup and is required to facilitate the following:

- Provide a professionally configured area within the office for the conducting of site inductions/visitor processing/waiting area,
- A private area for the monitoring of CCTV, briefing, holding of confidential notices etc (to prevent the risk of inadvertent access), and
- Adequate safe and secure storage facilities for security equipment.

The security cabins with dimensions of 6m length by 2.5m width will be installed on a stoned platform (orange), the cabins will be single storey with a maximum height of 2.5m.

The units will be painted RAL6008 (brown/green) or juniper green (RAL 160 20 10) prior to arrival on site. The stone platform will be approximately 11.5m by 9.5m with a tarmacked area for parking of up to three vehicles (blue). The stone hardstanding will be installed to create a level platform for the site security cabins. An indicative site layout is shown in **Figure 2**.

To facilitate the installation of the cesspit the excavated area will be blinded with concrete to form an impermeable barrier with the ground and appropriate anchoring of the tank. This will be installed in accordance with manufacturers specification.

A small 3m x 3m concrete pad with blockwork bund will we constructed along the side of the cabins to provide a level impermeable base for an emergency generator and fuel cube (with internal secondary bunding) in the event it is required.

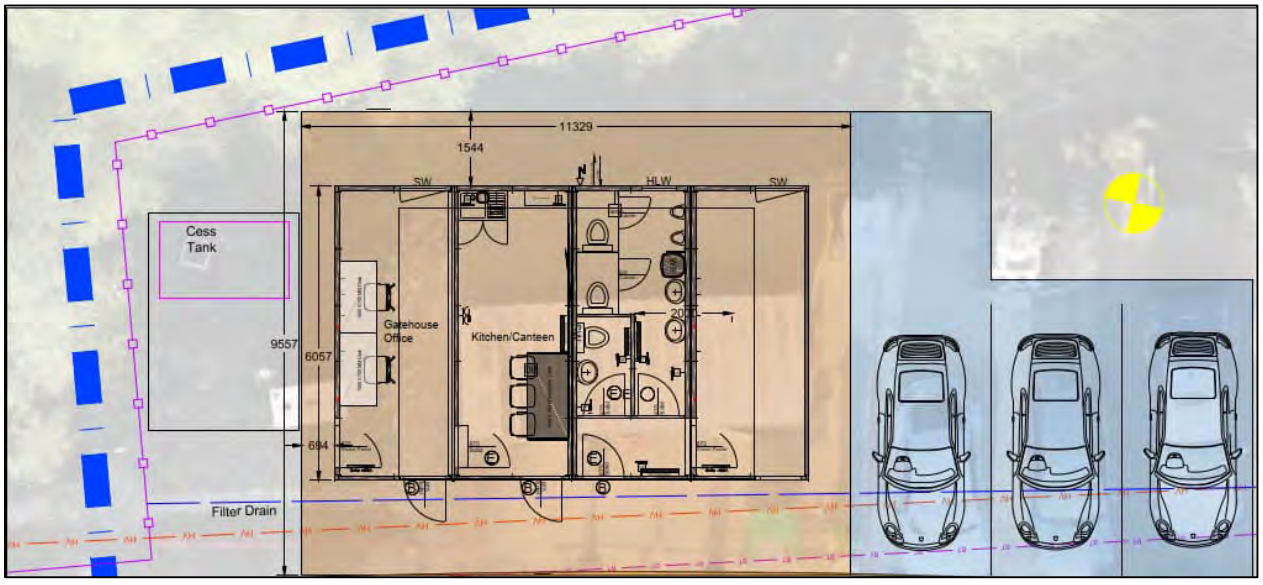


Figure 2: Proposed site security cabin install arrangements

2.2.3. *LAYDOWN AREAS*

The laydown area and workshops constructed during Phase 3 works will be utilised for general laydown of materials and day to day small mechanical tasks. The immediate area surrounding the blind bore drilling operations and ancillaries will be demarcated using pedestrian barriers and classified as a 'restricted access area' where only authorised personnel involved in the operation can gain unescorted access.

An area on the laydown platform will be utilised for temporary storage of the 9m lengths of steel shaft casings.

Shaft casings will be initially stored at Lockwood Beck Site, staggered with Abnormal Indivisible Loads (AIL) delivering casings to Ladycross as required. A small temporary stock will be kept on site.

2.3. CAR PARKING

All site personnel will continue to use the car parking facilities established during the Phase 3 works. Parking will only be permitted within designated car parking areas. No access to the site by foot is permitted. A peak of up to 50 employees are expected on site during the Phase 5 works. As stated in Section 2.5.5, mass transport such as car sharing, and mini-bus services will be utilised to ensure parking is limited to the 43 spaces set out in the Phase 3 Construction Traffic Management Plan (CTMP).

2.4. MOBILISATION

All equipment, plant and materials will be delivered to site using the approved traffic routes as per the Phase 3 CTMP.

All HGV's and abnormal loads will drive directly to site and will not stop / wait on the public highway.

Approximately 50 AIL are expected during the Phase 5 works. Deliveries will be staggered throughout the duration of the Phase 5 works to reduce the number of AIL operating on the A171 and Egton Road between Lockwood Beck Site and Ladycross.

2.5. TRAFFIC AND PEOPLE

2.5.1. TRAFFIC MANAGEMENT

Condition 34 requires that a Construction Traffic Management Plan (CTMP) is to be prepared and submitted to NYMNPA prior to each phase of construction, for detailed traffic information please see the Phase 3 CTMP (ref. 40-STS-LC-2100-LG-PL-00001).

Additional information for Traffic Management is also detailed in the Phase 5 CEMP.

2.5.2. PUBLIC PEDESTRIAN MANAGEMENT

Pedestrian management is to be controlled via both site security fencing and site access gate security; this is to be situated at the entrance to the main site haul road. Perimeter fencing along the site boundary has been installed as part of Phase 2 works.

2.5.3. ACCESS

All construction traffic will use the existing main internal road to access the site. The access road is appropriately sized to allow for three HGVs to queue. In addition to the physical measures proposed, to prevent traffic having to wait on the highway or the potential for multiple to meet at the site access, the contractor will be required to provide a banksman and schedule deliveries and shift times.

Security will be stationed at the site access gates and all drivers will be required to have completed the appropriate driver induction before entering site. Access will only be authorised for deliveries / vehicles booked in for the day and with the appropriate access documentation. All deliveries will follow the onsite one-way traffic controls. Where required a banksman will be provided by the contractor if reversing or manoeuvring of vehicles is required.

In addition to assisting the contractor to manage the total numbers of daily HGV movements, the requirement for planning and scheduling deliveries will also assist the contractor in ensuring that deliveries can be spread throughout the working day.

The contractor will also be required to schedule shift times to try and avoid employees arriving and departing at the same time and to schedule deliveries outside of these hours.

2.5.4. LOADING AND UNLOADING

Loading and unloading of deliveries and materials on site will take place in designated areas dependent on works.

2.5.5. *Transport Hub and Mass Transport*

Lockwood Beck site will be utilised as a transport hub for shift workers travelling to Ladycross. Car sharing and minibuses will be promoted by subcontractors to limit the numbers of people driving / parking at Ladycross to remain within the committed numbers stated in the Phase 3 CTMP (ref. 40-STS-LC-2100-LG-PL-00001).

2.6. Storage of Plant and Materials

Materials will be stored in demarcated zones dependant on material use. The laydown area established during Phase 3 will be utilised for storage of bulk materials and material deliveries will be managed to reduce overall site storage requirements. Materials will also be stored in designated area as close to the works as possible.

All storage areas will be located on hardstanding appropriate to the plant and materials away from sensitive receptors. All COSHH and fuel will be stored in line with requirements and practices outlined in the Phase 5 CEMP.

2.7. Internal Access Routes

Haul roads and internal access routes within the Phase 5 works scope will be demarcated and separated from pedestrian areas as per previous phases. All HGV and delivery vehicles will follow the internal one-way system route. Speed limits will be enforced as per the site limits.

2.8. Lighting Columns

No permanent lighting columns will be installed during the Phase 5 works. Where additional temporary lighting is required to provide a safe working area and access and egress, it will be installed in line with the procedures detailed in the Phase 5 CEMP, where possible aiming to limit upward light spill, and utilising warm spectrum LED's.

2.9. Wheel Wash

Vehicles entering site will stay on hardstanding already installed during Phase 3 works. No plant will travel off site other than specialised plant moving transport. All HGV's and plant exiting site will use the approved wheel washing facilities described in the approved Phase 3 CMS.

2.10. WATER MANAGEMENT

2.10.1. SURFACE WATER MANAGEMENT

No further surface water drainage works will be required during Phase 5. The Phase 3 works will see the completion of the site drainage layout that that will be retained for all construction phases. The Water Treatment Plant (WTP) along with finalised attenuation pond and drainage network set up as part of the Phase 3 works will be utilised to manage site surface water.

2.10.2. PROCESS WATER MANAGEMENT

Drill circulation process water will be primarily stored within the cuttings lagoon. The water will be discharged via an Environment Agency discharge permit via the onsite Water Treatment Plant (WTP) or stored and disposed by a licensed waste contractor.

All controls and mitigation for process water will be carried out in accordance with the controls outlined in the Phase 5 CEMP.

2.10.3. FOUL WATER MANAGEMENT

The foul sewerage from the welfare and offices will be stored in appropriate cesspit installed during the Phase 3 works and removed by a licensed contractor to permitted waste facility. The cesspit will be fitted with a high-level alarm and regular collections will be carried out to ensure levels are managed.

The site security cabins will require a cesspit to receive the foul sewerage generated. The cesspit will be installed to supplier requirements and using the appropriate British Standards for install. The cesspit will be fitted with a high-level alarm and regular collections will be carried out by a licensed waste contractor to ensure levels are managed with all waste disposal at an appropriately licensed facility.

2.11. HOURS OF OPERATION

The piling and concrete works for foreshaft construction will be limited to dayshift operations. All other works associated with Phase 5 will be carried out utilising 24/7 operations, this will be limited wherever practical.

3. CONSTRUCTION METHOD STATEMENTS

3.1. WORKING PLATFORM

The working platform constructed during Phase 3 works was designed to withstand the loadings of all plant and equipment associated with the Phase 5 works.

3.2. POWER REQUIREMENTS

All electrical installations to required areas will be installed by STRABAG electrical team in accordance with the Phase 5 Construction Environmental Management Plan (CEMP) (ref. 40-STS-LC-2100-EN-PL-00025).

The main drilling rig for the blind boring works will require a 60Hz (US standard) supply and will therefore be run off 1250KVA containerised gensets, as mains supply in UK is 50Hz. Two generators will be stored on site, one for operation and the other will be utilised as an emergency back-up. Generators selected will be modern, efficient equipment that minimises emissions and fuel consumption.

3.3. DRILLING OPERATION SETUP

3.3.1. FORESHAFT CONSTRUCTION

The first stage of the blind boring construction is to construct a foreshaft secant pile wall structure and excavate through the superficial deposits, providing a stable conduit from the surface to the top of competent rock. This has the following benefits:

- Prevents cave in and/or hydraulic fracture of the superficial deposits,
- Prevents loss of drilling flush into any permeable layers within the superficial deposits,
- Allows passage of reamer head as the shaft is oversized, i.e., 5 m for a 3.2 m shaft,
- Allows a drilling platform to be built to support weight of drilling rig, and
- Integrates the necessary pipe works to maintain a closed loop materials handling system during drilling.

3.3.2. *Rathole, Caisson and Anchor Installation*

Also required within setup works is the construction of:

- A 1m diameter x 12m deep kelly storage cylinder known as the “Rathole”. This Rathole is drilled on a 78° incline and allows the kelly bar to be placed temporarily out of the way during drill string connections. The Rathole location is critical in order to allow the kelly to be easily swung into and extracted out of the rathole utilising the drill rig hoisting system,
- 3 or 4 caisson bored piles to help distribute the drill pad loading while hoisting. The load bearing concrete piles will be approximately 750mm diameter, and
- 1 or 2 anchor pipe installations to negate uplift while standing and lowering the rig. The anchors are approximately 300mm diameter, drilled a minimum of 3m into competent rock and therefore approximately 9m deep.

3.3.3. *Secant Piled Shaft*

A secant piled shaft is constructed with a series of interlocking concrete piles which are embedded into bedrock to permit excavation within. Piles will be drilled beyond the required excavation in order to toe into rock. The toe depth will be assessed as part of the temporary works design. The centre of the piled shaft would be excavated, and base slab poured.

Firstly, a concrete guide wall will be constructed. An excavator will dig through the stone platform and concrete placed within a bespoke formwork to provide a guide for the pile installation. If permitted tolerances without the use of a guide wall are acceptable as per the design, this step will be avoided. A rotary piling rig will then be set up on an approved platform, over the required installation location. The height of the piling mast will be approximately 28.4m. The auger is drilled into the ground, with spoil being lifted to the surface by the auger flights. If required, casing will be inserted to retain the sides of bored hole. If the design requires reinforced concrete piles, once the pile has been excavated to depth, a steel reinforcement cage will be lowered into position by a mobile crane. Ready mixed concrete will then be directly tremied into the auger hole. If no reinforcement is necessary, concrete can be pumped through the hollow stem of the auger as it is extracted from the pile. Before concrete cures, steel casings to be retracted. A simple schematic shown in **Figure 3**.

The excavated material will be temporarily stored within the cutting pit muck away area. The materials will be removed from site by a licensed waste contractor and disposed at an appropriate licensed facility.

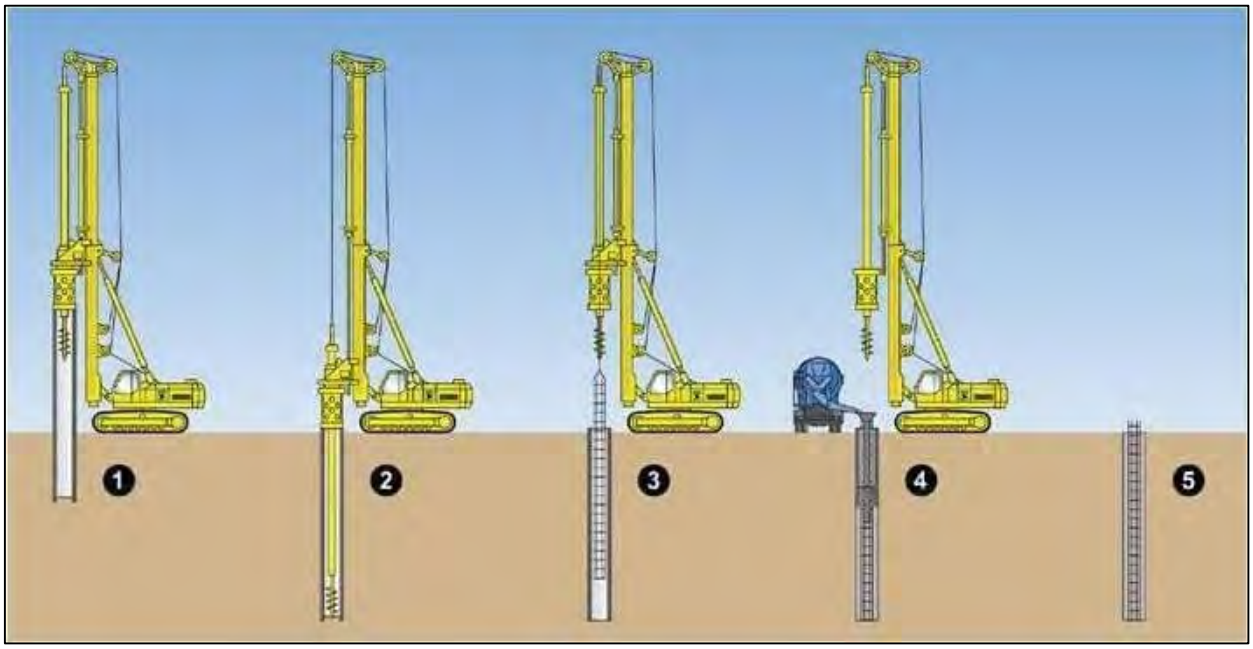


Figure 3: Piling Schematic

The interlock, shown in **Figure 4**, is constructed by cutting reinforced “male” piles through previously installed unreinforced “female” piles. A plan view of a typical secant piled wall is shown in **Figure 4**. A secant shaft will provide a watertight interlock. A capping beam to reinforce the piled wall structure will be completed with concrete at ground level.

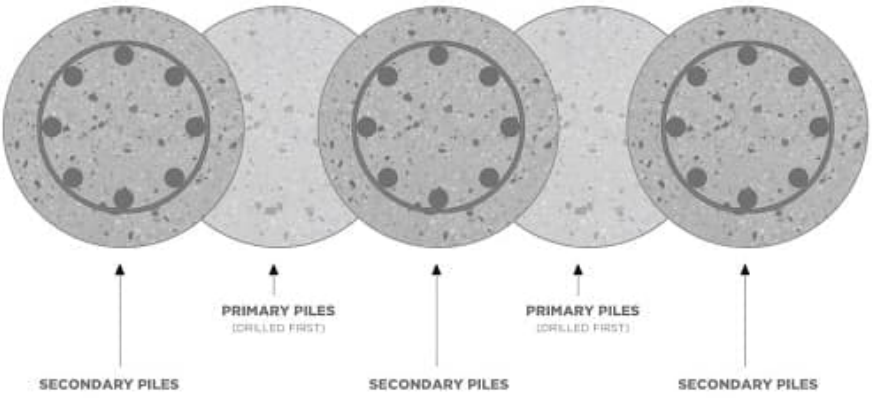


Figure 4: Secant Pile Arrangement

To excavate the foreshaft to the required depth (approx. 12m) an excavator will dig and cast the material outside of the shaft footprint. Once this becomes impractical, a muck skip will be lowered to the base of the shaft and will be filled by a smaller Brokk and / or excavator located within the shaft. A crawler crane at surface will raise and tip the skip at surface. The proposed piling rig technical specification summary is shown in **Attachment A**.

3.3.4. *Other Installations*

As per the secant pile methodology described in **Section 3.3.2.**, a rotary piling rig will be used to install the Rathole, caissons and anchors. The rathole will be backfilled with concrete or other suitable material and the steel lining will not be removed following the completion of shaft works.

3.3.5. *Concrete Pad Construction*

Upon completion of the surface casing, Rathole, anchor and caisson bored pile installations, a concrete drill pad will be constructed. The drill pad supports the drilling rig itself as well as integrating the necessary pipe works to maintain a closed loop spoils handling system is to be installed.

The reinforced concrete slab will be approximately 600 mm thick and will incorporate the 3-4 caissons located under each leg of the derrick and front hoist, the subsurface plumbing including the 500 mm steel overflow and the 300 mm poly return lines and the Rathole. The drill rig slab will be approximately 23m x 18m. An example concrete pad is shown in **Figure 5**.

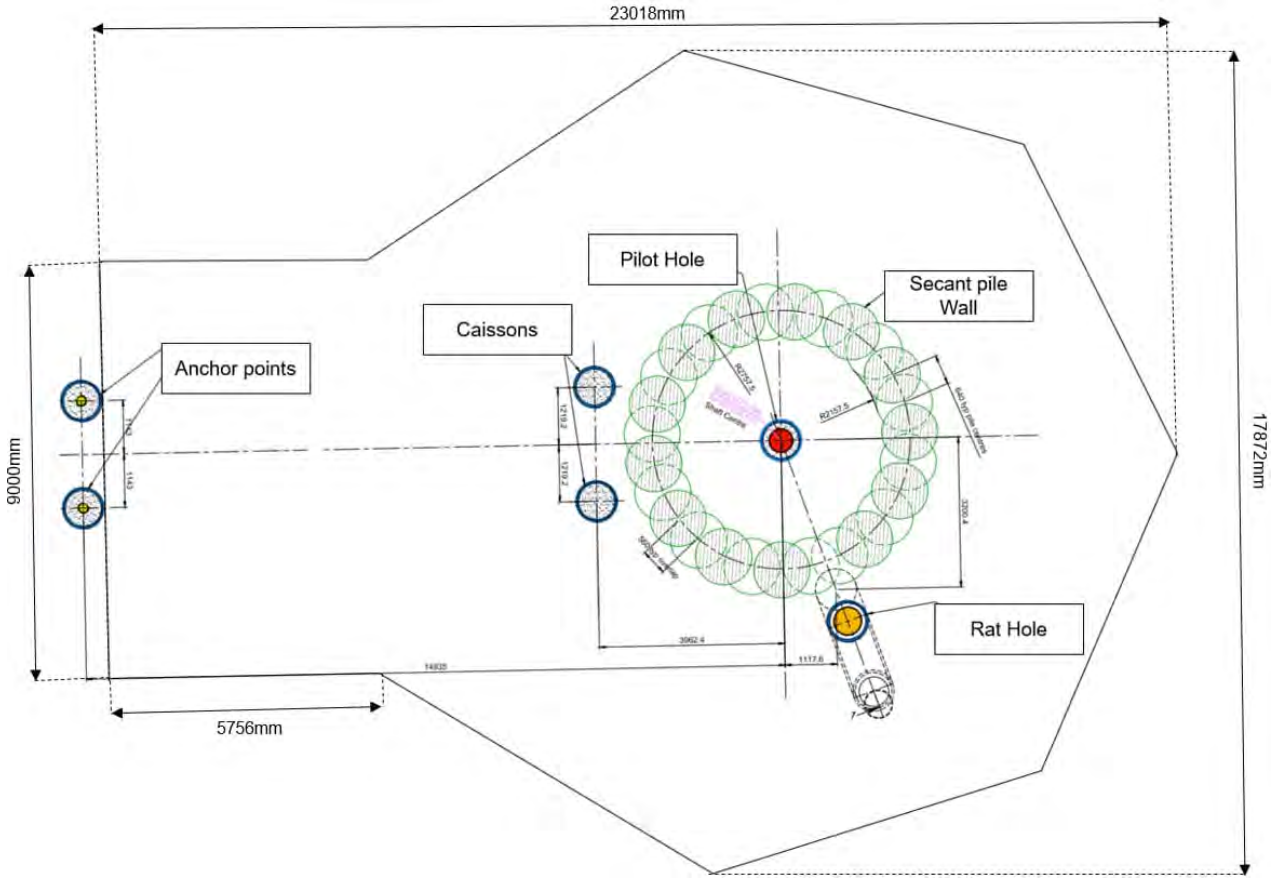


Figure 5: Proposed drill pad dimensions

During project construction, the working slab provides a stable working platform on which to set the drill rig and to facilitate all shaft drilling activities. Upon completion of the shaft, if feasible, the concrete pad will be integrated into the head house foundation.

An excavator will be used to clear and level the working area. Blinding will be poured to provide a level, clean platform on which to build a steel reinforcement cage. Timber formwork or a proprietary shutter will be erected. Spacer blocks will be installed to ensure adequate concrete cover to the reinforcement. Due to the volume and reach required, a mobile concrete pump will be utilised to place concrete. Once cured, the shutter will be removed, and the slab surround will be backfilled with as dug material.

3.4. BLIND BORING WORKS TO FULL DEPTH

3.4.1. PILOT HOLE

The first stage of the drilling process is to drill a pilot hole to full depth. The pilot hole has the primary objective to serve as guide for reaming thereby ensuring verticality.

This will be drilled with the RD20 Rig used within the Phase 4 grouting works, with a mast height of approximately 19m. The pilot hole will be drilled to the full depth of the shaft 362mbgl with a diameter of 451mm. The pilot hole will be installed following pile wall installation and will precede foreshaft excavation works.

It also provides hole centre geological verification of the pre-grout program. The pilot hole will be developed using direct circulation and drilling fluid. The drilling fluid will be water which may be enhanced with bentonite to provide hole stability.

The drilling fluid is pumped under pressure directly down the drill string and out into the development face and then circulated up the annular space between the outside of the drill string and the bored hole.

A closed loop fluid system will be utilised with cleaning capacity supplemented with clean makeup water. Drilling fluid from the direct circulation will be fed into the lagoon in order to remove solids and treat water. The drilling fluid will be treated by cascading through a series of weir walls, or similar, to remove solids and ensure quality of the water before being recirculated back into the direct circulation system.

In addition to the lagoon installations, supplementary (solids reduction) treatment of water may be required to ensure the circulated drill fluids are within specification. A separation unit, desander or similar may be used to remove fines from the water column. The desander unit will sit within the footprint of the muck away area.

3.4.2. Large Diameter Reaming

Reaming the shaft to the final drilled diameter will be performed with a blind bore drilling technique and will utilise a full diameter, hemispherical dome drill bit dressed out with individual disc cutters. Once the rig is assembled, the bottom hole tools are lowered into the surface casing and the rotary table is moved into place. The rotary table provides the torque required to turn the hemispherical bit. The weight stack which is part of the bottom hole assembly provides the downward pressure necessary to engage the disc cutters into the development face to facilitate the cutting action. The large diameter reaming mast will be approximately 27.4m in height.

Blind shaft drilling occurs under a static head of water. During development, the shaft remains full of fluid. The fluid will be maintained just slightly below the level of the drilling pad. Maintaining the elevated water level in the shaft is the primary purpose of the Phase 4 pre-grouting programme. An additive may be used to consolidate the shaft excavation, if required. Cuttings that are generated as the hemispherical dome is rotated are flushed up through openings in the bit by means of the differential pressure generated between the water column in the shaft and the water column in the drill string.

Lift is achieved by injecting air into the centre column (drill string) creating a less dense fluid and thus pressure differential between the water column in the shaft (heavy) and the water in the drill string (light). Cuttings are discharged into the cuttings lagoon and the drill fluid is then recirculated back to the shaft to complete the closed loop system.

Figure 6: Full diameter, hemispherical reaming drill

A closed loop system is developed that allows the cuttings to be discharged into the cuttings lagoon. The cuttings lagoon is sized as approved in Phase 3A to allow the drilling fluid adequate time to both deposit the large cuttings and slow the flow such that smaller suspended materials settle out, playing a primary role in drill water quality and overall drill efficiency. The drill fluid (water) is then recirculated back to the shaft to complete the closed loop system. The basic arrangement of this process is shown in **Figure 7**. The recirculation pump locations will be confirmed during final stages of site setup.

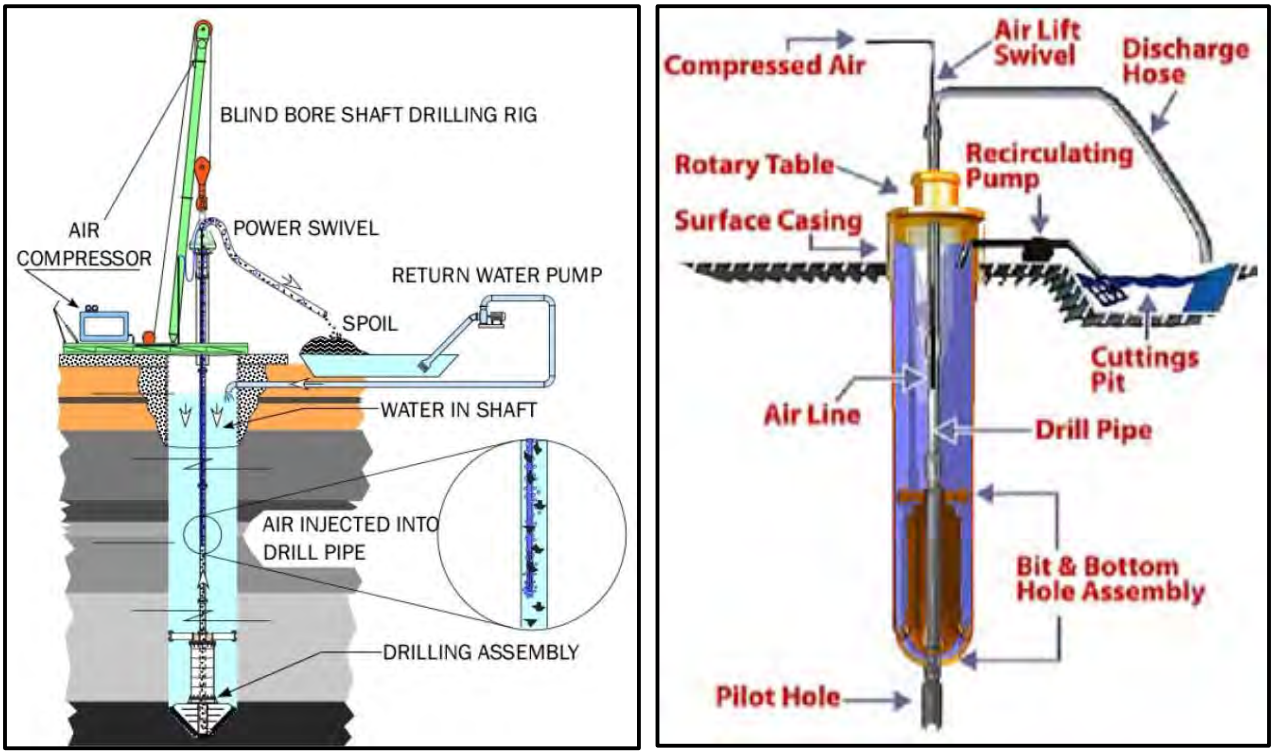


Figure 7: Drilling arrangement and flooded reverse circulation schematic

When assessing lagoon capacity, a key consideration will be the allowance of an adequate freeboard as to ensure no site flood risk. The storage of drilling water and cuttings will be approximately three times the volume of the shaft. The capacity of the existing shaft will be deducted from this to reduce the size of the cuttings lagoon required. This allows adequate retention times during the drilling sequence and adequate storage for the spoils and drilling water.

It is estimated for the 3.81m cut diameter, to a depth of 363 m, using a bulk factor of 1.5, approximately 6,500 m^3 of extractive material will be generated during the shaft construction. An attendant excavator will be used to clear cuttings from the cuttings pit and place within muckbin storage area. The mudstone will be temporarily stored in this location to dry out to an acceptable moisture content.

The cuttings will be loaded into 8-wheeler wagons and removed to an off-site tip location in accordance with the Phase 5 CEMP (ref. 40-STS-LC-2100-EN-PL-00025). The water from the mudstone will drain from the pad back to the cuttings lagoon.

3.5. STEEL CASING INSTALLATION

Upon completion of the shaft reaming, the steel casing installation will be undertaken. A principal advantage of the blind boring technique is that the permanent, watertight, shaft lining can be installed immediately following shaft excavation in a single phase, without requiring access within the shaft. It is proposed that approx. 40no. 9m long, 3.2m internal diameter steel casings will be installed, as well as a shorter bulkhead (dome) section at the base.

The bottom of the initial casing section will be equipped with an engineered and fabricated sealed bulkhead. The bulkhead allows the completed section of casing to become buoyant in the flooded shaft. Linear sections are ballasted with clean water for easy disposal at the dewatering phase.

The installation and grouting of the steel liner also includes handling of water. The casing is floated into the reamed shaft in sections, this float program provides the ability to control hook load through buoyance by adding water to the inside of the casing as annular space remains flooded. This allows for a controlled floating of the liner string. Fresh water will be pumped into the casings that are lowered into the shaft as buoyancy control. Water from around the casing annulus (process drill water) will be displaced by the activity, the annular water will then be discharged into the lagoon.

A temporary habitat will be utilised to carry out the welding operations on the shaft casings. The welding habitat will be a retractable unit approximately 2m in height and 8m in length covered on three sides. The welding habitat is a health and safety requirement when welding / hot works are carried out on the casing to create an exclusion zone.

Figure 8: Welding habitat

Figure 9: Steel Casing Installation

3.6. CEMENTING AROUND CASING

When the full depth of the shaft has been fully lined with the steel casing, the annular space between the drilled shaft and the exterior wall of the casing is upstage (bottom up) grouted through tremie techniques in stages. Water displaced from both casing installation and annular grouting is directed to the cuttings lagoon. The water will be discharged in accordance with an Environment Agency discharge permit via the onsite Water Treatment Plant (WTP) or stored and disposed by a licensed waste contractor. Inspection holes will be used within the steel casing once the shaft has been dewatered to confirm a successful grouting programme. If needed secondary grouting measures can be arranged through the inspection holes.

3.7. SHAFT DEWATERING

3.7.1. DEWATER

The final stage shaft development includes dewatering of the shaft to within a few meters of total depth. Once the grout has achieved required strength, a submersible pump and cable system will be used to pump out the volume of the shaft. Dewatering from within the sunken casings is clean water. It is anticipated that this will be tankered away from site, although it may be treated, tested and pumped off site into the water course strictly in accordance with an Environment Agency discharge permit.

4. PLANT & EQUIPMENT

4.1. SITE ESTABLISHMENT

- General setup and attendance
    - Telehandler
    - Fuel storage bowser
    - COSHH storage containment and bunded storage area for IBCs and spill kits
    - Waste compound setup and hazardous waste area
    - Mobile crane and lifting accessories
    - Siltbuster

4.2. DRILLING OPERATION SETUP

- Surface casing installation
    - Rotary piling rig
    - 20t excavator
    - Mobile crane and lifting equipment
    - Caisson equipment
- Rathole - 1m diameter x 12m deep storage cylinder drilled on a 78° incline.
    - Rotary piling rig
    - 360 degree tracked attendant excavator 8t-13t
    - Dump trucks 6t-25t
- Drill pad piles - 3 or 4 caisson bored piles at approx. 750mm diameter.
    - Rotary piling rig
    - 360 degree tracked attendant excavator 8t-13t
    - Dump trucks 6t-25t
- Anchor piles - 1 or 2 anchor pipe approx. 300mm diameter and 9m deep.
    - Rotary piling rig
    - 360 degree tracked attendant excavator 8t-13t
    - Dump trucks 6t-25t

- Concrete pad construction
    - 360 degree tracked excavator 8t-40t
    - Concrete pump
    - Dump trucks 6t-25t
    - 2” vibrating pokers
    - Compressor
    - Small tool generator
    - Burning gear
    - Formwork
    - Power Floats

4.3. BLIND BORING WORKS TO FULL DEPTH

- Pilot hole
    - RD-20 drill rig
    - Drill rods and drilling accessories
    - Bentonite silos
    - Air compressor
    - Generator
    - Telehandler
- Large diameter reaming
    - Drilling rig including hemispherical reaming drill bit and accessories
    - Air compressor
    - Generator
    - 80t Mobile crane and lifting accessories
- Cuttings lagoon management
    - Water treatment equipment
    - 360 degree tracked attendant excavator 8t-13t with dredging bucket
    - 8-wheel tipper wagon 20t-25t

4.4. STEEL CASING INSTALLATION

- Welding sets and consumables
- Welding screens
- 80t Mobile crane and lifting accessories

4.5. CEMENTING AROUND CASING

- Shear force batch mixer grout plant
- Grout pump and accessories
- Storage units
- Tremie tubing
- Submersible pumps
- Water treatment equipment

4.6. SHAFT DEWATER

- Dewater
  - Submersible pumps
  - Water treatment equipment
  - 80t Crane

5. HAZARDOUS MATERIALS AND SUBSTANCES

The following hazardous materials are foreseen to be used during construction of site works activities listed within this document. This list may not be exhaustive, individual Risk Assessment and Method Statements will identify the hazardous materials and a specific COSHH Assessment will be included within the Safe System of Work (SSOW) documentation.

- Concrete / Cement
- Grout
- Hilti Hit
- Diesel
- Petrol
- Oils and Greases (Plant Maintenance)
- Spray Paint (Setting out)
- Mould oil / release agents
- Bentonite (drilling fluid)

6. RELATED DOCUMENTS AND REFERENCES

GENERAL ARRANGEMENT - PHASE 5 – LADYCROSS - 40-STS-LC-2100-PA-22-20114

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN - PHASE 5 - CONDITION 93 – LADYCROSS - 40-STS-LC-2100-EN-PL-00025

7. DEFINITIONS AND ABBREVIATIONS

CMS – Construction Method Statement

RAMS – Risk Assessment and Method Statement

MPA – Mineral Planning Authority

EIA – Environment Impact Assessment

NYMNPA – North York Moors National Park Authority

AIL – Abnormal Indivisible Load

CTMP – Construction Traffic Management Plan

HGV – Heavy Goods Vehicle

COSHH – Control of Substances Hazardous to Health

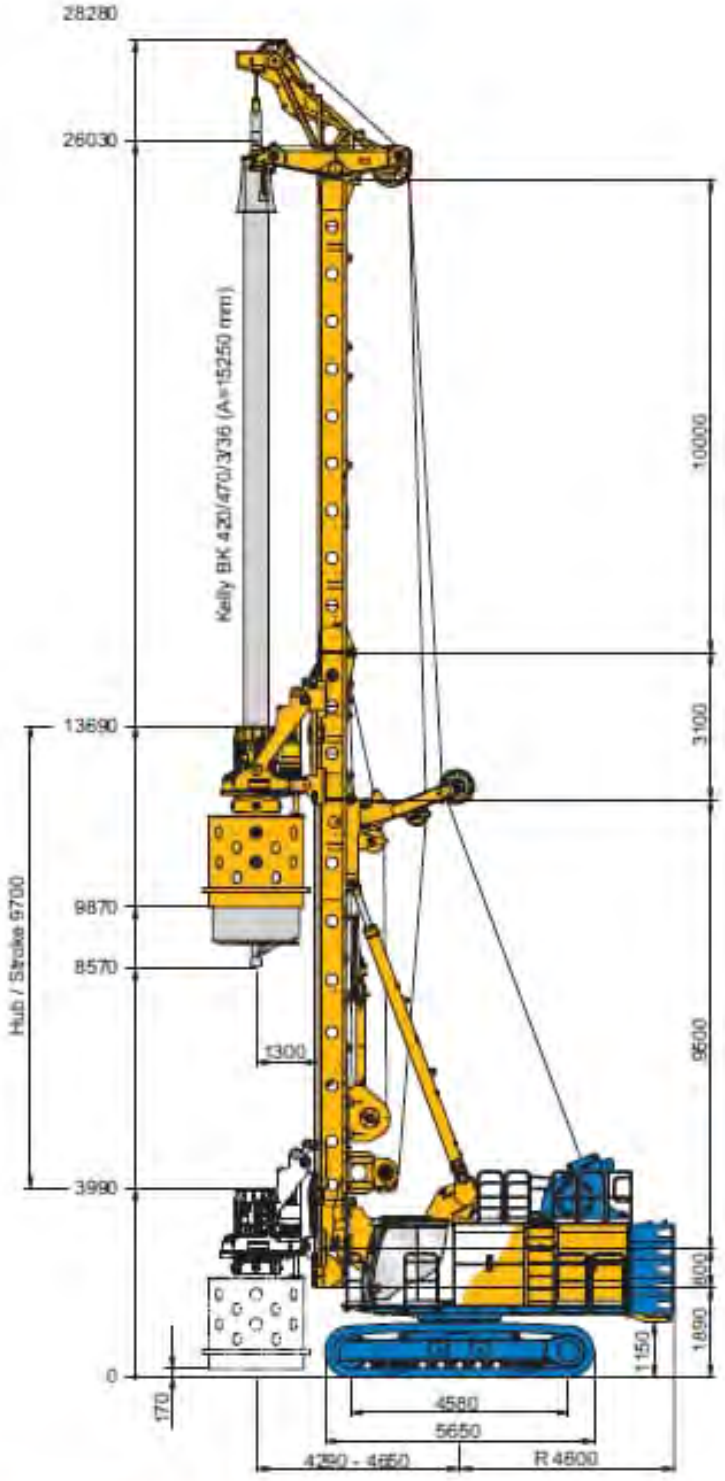
WTP – Water Treatment Plant

CEMP – Construction Environment Management Plan

8. ATTACHMENTS

ATTACHMENT A – Piling Rig Technical Specification

ATTACHMENT A – PILING RIG TECHNICAL SPECIFICATION



Technische Daten — Technical data

Gesamthöhe	**Overall height**	28,3 m
Einsatzgewicht (ca.) (mit Kelly 420/470/3/36)	**Operating weight** (approx.) (with Kelly 420/470/3/36)	133 t
Drehantrieb	Rotary drive	KDK 390 S
Drehmoment (nominal) bei 350 bar	Torque (nominal) at 350 bar	390 kNm
Max. Drehzahl	Max. speed of rotation	46 rpm
Windenvorschub	**Crowd winch**	
Druckkraft / Zugkraft (effektiv)	Crowd force push / pull (effective)	400 / 400 kN
Hub (Kellysystem)	Stroke (kelly system)	9.700 mm
Max. Schlittenhub	Max. stroke of sledge	19.700 mm
Hauptwinde (Windenklasse)	**Main winch** (winch classification)	M6 / L3 / T5
Zugkraft (1. Lage) effektiv / nominal	Line pull (1st layer) effective / nominal	290 / 368 kN
Hilfswinde (Windenklasse)	**Auxiliary winch** (winch classification)	M6 / L3 / T5
Zugkraft (1. Lage) effektiv / nominal	Line pull (1st layer) effective / nominal	100 / 125 kN
Mastneigung (nach hinten / vorne / quer)	**Mast inclination** (backward / forward / lateral)	15° / 5° / 2°

Geräteträger	**Base carrier**	**BS 95**
Motor	**Engine**	**CAT C 15**
Nennleistung ISO 3046-1	Rated output ISO 3046-1	433 kW@1.800 U/min
Motor spezifiziert nach Abgasnorm	Engine conforms to exhaust emission standard	EEC 97/68 Stage III A EPA Tier 3 oder EEC 97/68 Stage III B EPA Tier 4 interim
Dieseltank	Diesel tank capacity	1.000 l

Hydrauliksystem	**Hydraulic system**	
Hydraulische Leistung (gemessen am Verteilerblock KDK)	Hydraulic power output (measured at inlet to rotary drive)	290 kW
Hydraulikdruck	Hydraulic pressure	350 bar
Tankinhalt	Hydraulic oil tank capacity	1.000 l

Unterwagen	**Undercarriage**	**UW 110**
Laufwerksklasse	Crawler type	B7
3-Steg Bodenplatten	Width of triple grouser track shoes	900 mm
Fahrwerkslänge	Overall length of crawler	5.650 mm
Fahrwerksbreite (eingefahren / ausgefahren)	Overall width of crawlers (retracted / extracted)	3.500 / 4.680 mm

Bohrdaten	**Drilling data**	
Bohrdurchmesser bei Bohrachse 1.300 mm unverrohrt / verrohrt	Drilling diameter for drill axis 1.300 mm uncased / cased	2.300 / 2.000 mm
Bohrdurchmesser bei Bohrachse 1.550 mm unverrohrt / verrohrt	Drilling diameter for drill axis 1.550 mm uncased / cased	2.800 / 2.500 mm

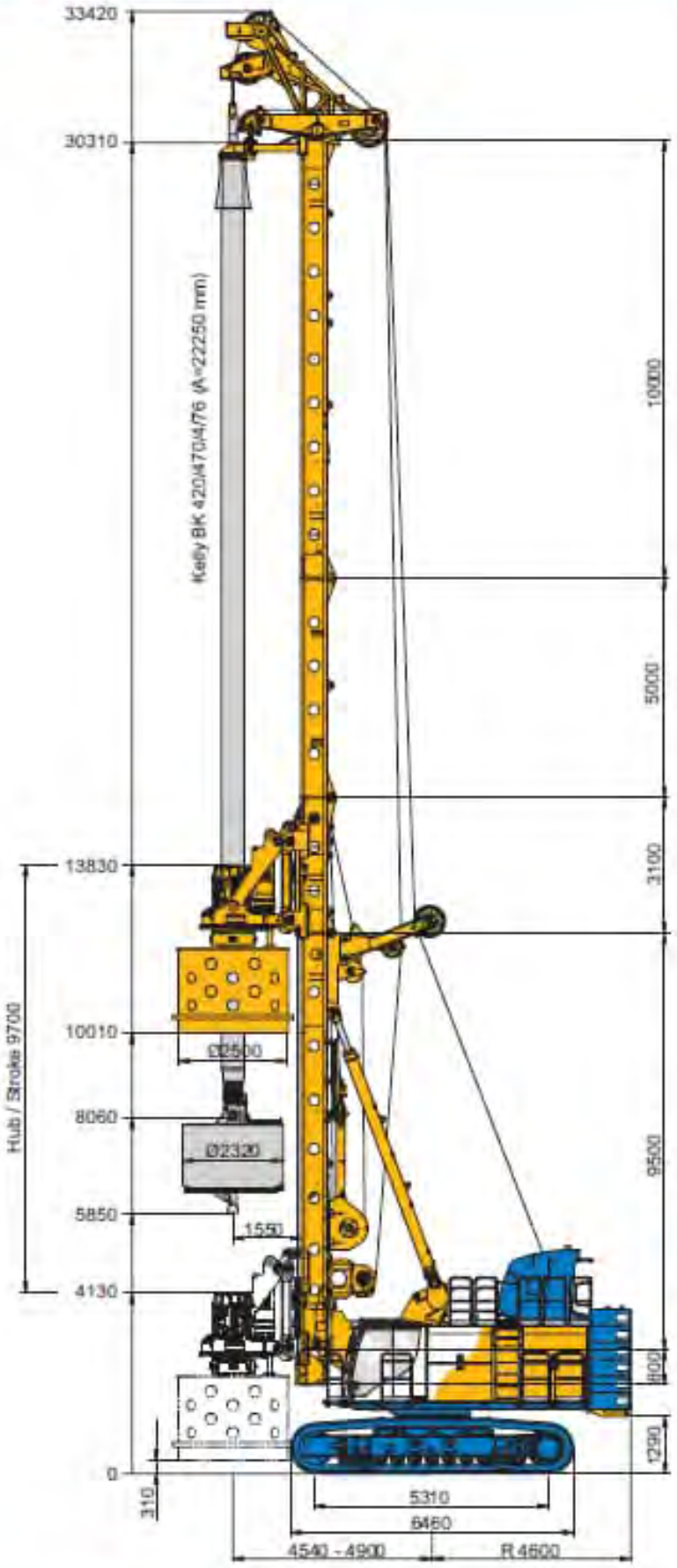
Bohrtiefen	**Drilling depths**	
BK 420/470/3/36	BK 420/470/3/36	36,10 m
BK 420/470/4/72	BK 420/470/4/72	71,70 m

Bohrtiefenangaben gültig für minimale Ausladung des Mastes. Bei maximaler Ausladung erhöht sich die Bohrtiefe um 0,39 m.

Drilling depth specifications are based on min. operating radius of mast. With max. operating radius the drilling depth increases by 0,39 m.

Ausbaustufe
Abmessungen

Upgrade version
Dimensions



Ausbaustufe Technische Daten

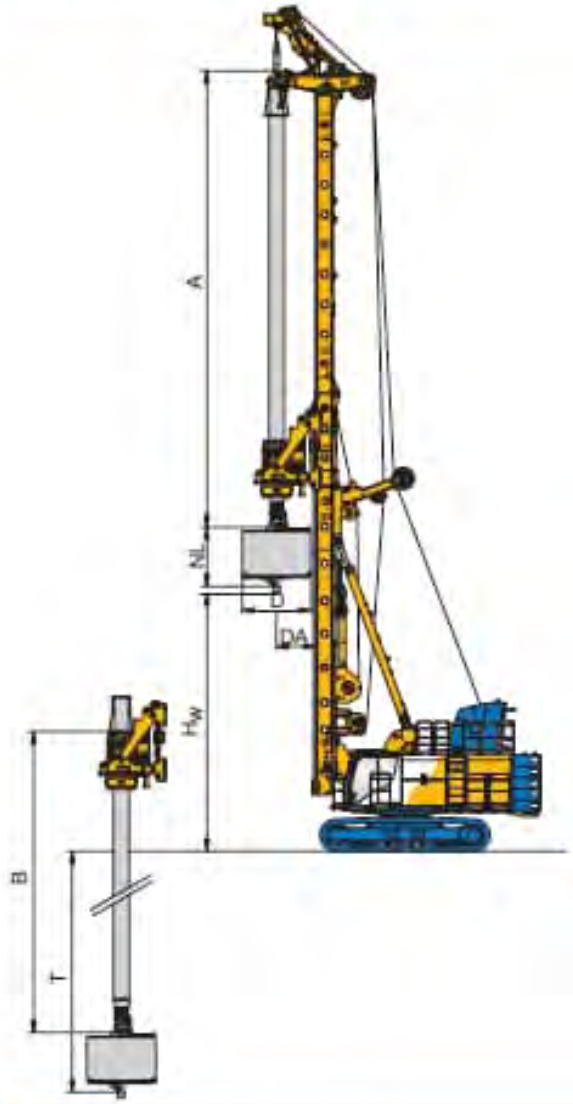
Upgrade version Technical data

Gesamthöhe	**Overall height**	33,4 m
Max. Schlittenhub	Max. stroke of sledge	24.700 mm
Hauptwinde (Windenklasse)	**Main winch** (winch classification)	M6 / L3 / T5
Zugkraft (einlagig) effektiv / nominal	Line pull (single layer) effective / nominal	355 / 450 kN
Hilfswinde (Windenklasse)	**Auxiliary winch** (winch classification)	M6 / L3 / T5
Zugkraft (1. Lage) effektiv / nominal	Line pull (1st layer) effective / nominal	140 / 179 kN
Gegengewicht	**Counterweight**	6 x 4,9 t

Unterwagen	**Undercarriage**	**UW 130**
Laufwerksklasse	Crawler type	BeB
3-Steg Bodenplatten	Width of triple grouser track shoes	1.000 mm
Fahrwerkslänge	Overall length of crawler	6.460 mm
Fahrwerksbreite (eingefahren / ausgefahren)	Overall width of crawlers (retracted / extracted)	3.700 / 5.000 mm

Bohrdaten	**Drilling data**	
Bohrdurchmesser bei Bohrachse 1.550 mm unverrohrt / verrohrt	Drilling diameter for drill axis 1.550 mm uncased / cased	2.800 / 2.500 mm

Bohrtiefen / Drilling depths



3 fach Kelly **3-part Kelly**	A (m)	B (m)	Gewicht Weight (kg)	Hw (m)	T (m)
BK420/470/3/36	15,25	38,20	9.300	8,85	**36,00**
BK420/470/3/42	17,25	44,20	10.350	8,85	**42,00**
BK420/470/3/48	19,25	50,20	11.450	8,85	**48,00**
BK420/470/3/54	21,25	56,20	12.550	8,85	**54,00**
BK420/470/3/60	23,25	62,25	13.700	4,85	**60,00**

4 fach Kelly **4-part Kelly**	A (m)	B (m)	Gewicht Weight (kg)	Hw (m)	T (m)
BK420/470/4/44	14,25	45,80	11.750	8,85	**43,60**
BK420/470/4/56	17,25	57,80	14.100	8,85	**47,60**
BK420/470/4/64	19,25	65,80	15.700	8,85	**63,60**
BK420/470/4/80	23,25	81,80	18.800	4,85	**79,60**
BK420/470/4/92	26,25	93,80	21.150	1,85	**91,60**

Bohrtiefe T mit einem Bohrwerkzeug NL = 1.900 mm ermittelt
Drilling depth T with drilling tool NL = 1.900 mm calculated

A Länge Kellystange / length of kelly bar
B Länge von komplett ausgefahrener Kellystange - unverriegelt / Length of kelly bar, fully extended - unlocked
T Bohrtiefe / drilling depth
Hw Maximale Höhe unter dem Bohrwerkzeug / Maximum height to drilling tool
DA Bohrachse / Drill axis
NL Nutzlänge / Useful length
D Bohrdurchmesser / Drill diameter

Bohrtiefenangaben gültig für minimale Ausladung des Mastes. Bei maximaler Ausladung erhöht sich die Bohrtiefe um 0,39 m.
Drilling depth specifications are based on min. operating radius of mast. With max. operating radius the drilling depth increases by 0,39 m.

Ausstattung — Equipment

Serienausstattung

- Drehgetriebe KDK 390 S (Schaltgetriebe)
- Hauptwinde mit hydraulischer Freilaufsteuerung
- Haupt- und Hilfswinde mit Spezialrillung
- Hubendschalter für Haupt- und Hilfswinde
- Wirbel für Hauptseil
- Vorschub schnell / langsam
- Schwenkbarer Anschlagpunkt für Haupt- und Hilfsseil
- Absturzsicherung Oberwagen
- Hauptwinde zum Transport abklappbar
- Hydraulische Stützbockverriegelung
- Vario-Mastsegment 3,1 m

Mess- und Steuerungstechnik

- SPS Rechner für alle elektrisch angesteuerten Funktionen
- B-TRONIC 4.1: elektronisches Steuerungs-, Kontroll- und Visualisierungssystem
- Anzeige von Fehlermeldungen in Klartext
- Fernübertragung der Betriebsdaten (DTR Modul, W-LAN)
- Schockiereinrichtung für KDK
- Notsteuerung Bohrgerät (Kernfunktionen)
- Mastneigungsmessung in x/y Richtung (Anzeige digital/ analog)
- Mastautomatik (automatische Vertikalstellung)
- Hauptwinde mit elektronischer Seilkraftmessung
- Hilfswinde mit hydraulischer Seilkraftmessung
- Tiefenmessung Hauptwinde
- Tiefenmessung Vorschub
- Funktion „Wirbel aufstellen" Hauptwinde
- Drehzahlmessung KDK
- Schlappseilabschaltung Hauptwinde
- Anpresskraft-Einstellung
- Tablet-PC

Standard equipment

- Rotary drive KDK 390 S (multi geared)
- Main winch with hydraulically operated freewheeling
- Main and auxiliary winch with special grooving
- Hoist limit switch on main and auxiliary winches
- Swivel for main rope
- Crowd in fast or slow mode
- Pivoted anchor points for main and auxiliary ropes
- Safety rails upper level
- Main winch with swing down mechanism for transport
- Hydraulic support trestle locking device
- Vario mast segment 3,1 m

Measuring and control equipment

- PLC processor for all electrically actuated functions
- B-TRONIC 4.1: Electronic monitoring -, control -, and visualization system
- Display of fault messages as plain text
- Remote transmission of process and operating data (DTR module, W-LAN)
- Uni-directional impact function on KDK (for auger discharge)
- Emergency mode of operation for drilling rig (core functions)
- Mast inclination measurement on x/y axes (digital/analog display)
- Automatic vertical alignment of mast
- Electronic load sensing on main rope
- Hydraulic load sensing on auxiliary rope
- Depth measuring device on main winch
- Depth measuring device (on crowd winch system)
- Swivel alignment function on main winch
- Speed measuring device on KDK
- Rope slack prevention on main winch
- Crowd pressure setting
- Tablet-PC

Zusatzausstattung

- Drehmomentwandler (für Kellybetrieb) 514 kNm
- Motor CAT C 15 (Stage IV) 433 kW@1.800 U/min
- Hauptwinde 355 kN (effektiv)
- Hilfswinde 140 kN (effektiv)
- Verrohrungsmaschinenanbau BV 2000
- Bohrachserweiterung (Kellybetrieb) 1.550 mm
- 3 m Mastverlängerung*
- 5 m Mast-Verlängerung* (nur in Kombination mit UW 130)
- Unterwagen UW 130
- Begehung auf Oberwagenebene mit Geländer
- Mastabstützung

Optional equipment

- Torque multiplier kelly technique 514 kNm
- Engine CAT C 15 (Tier 4 final) 433 kW@1,800 rpm
- Main winch 355 kN (effective)
- Auxiliary winch 140 kN (effective)
- Oscillator attachment BV 2000
- Extension of drill axis (Kelly mode) 1.550 mm
- 3 m Mast-extension*
- 5 m Mast-extension* (only in combination with UW 130)
- Undercarriage UW 130
- Walkway lower level with rails
- Mast support

* Mast aufstellen mit Hilfskran
Raising the mast with auxiliary crane

Basis Version
Transportdaten

Basic version
Transport data

Gewichtsangaben sind ca. Werte, Zusatzausrüstungen (Optionen) können das Gesamtgewicht verändern.

Weights shown are approximate values; optional equipment may change the overall weight.

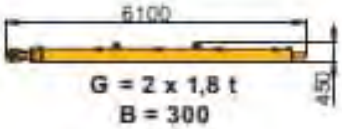
G = Gewicht / Weight, **B** = Breite / Width

G = 8,3 t

G = 3,5 t
B = 2100

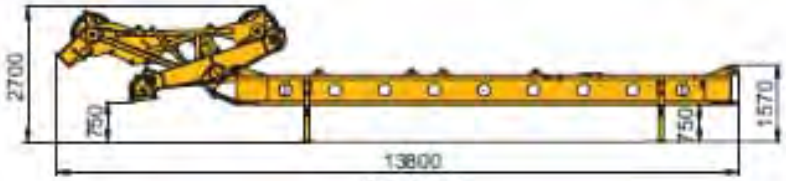
G = 2 x 0,3 t

G = 2,1 t
B = 1750



G = 2 x 1,8 t
B = 300

G = 5 x 4,9 t
B = 3000



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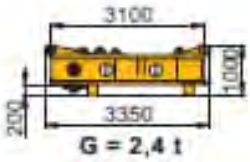
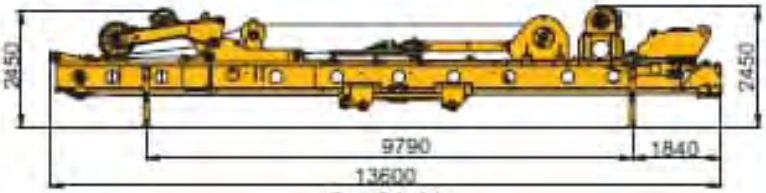
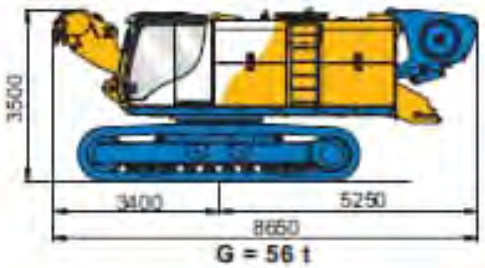
B = 2100



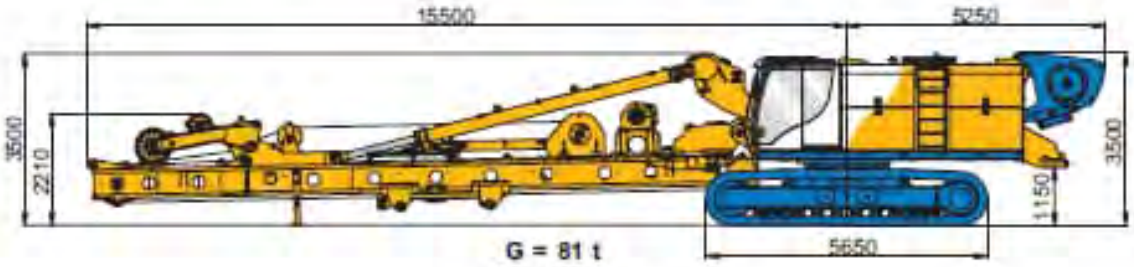
G = 2,4 t
B = 1150



G = 21,4 t
B = 2600



G = 56 t
B = 3500



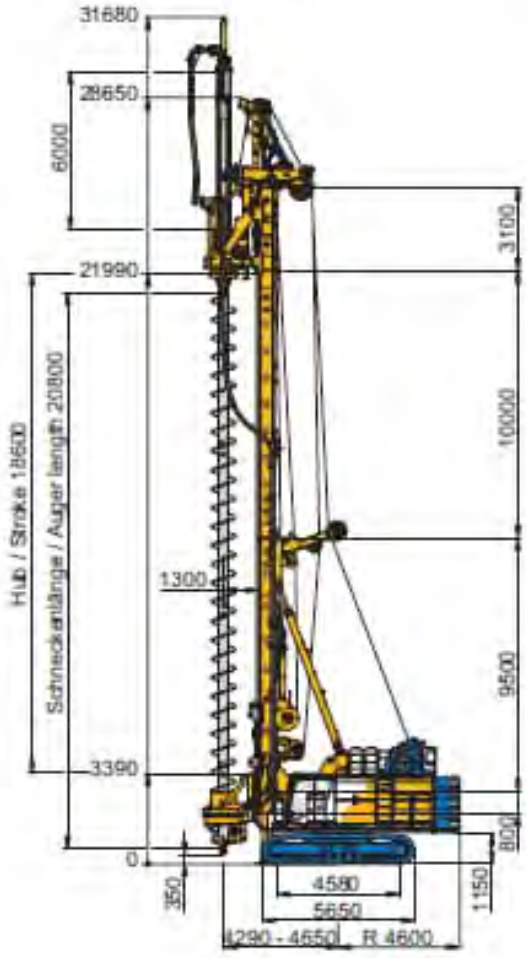
G = 81 t
B = 3500

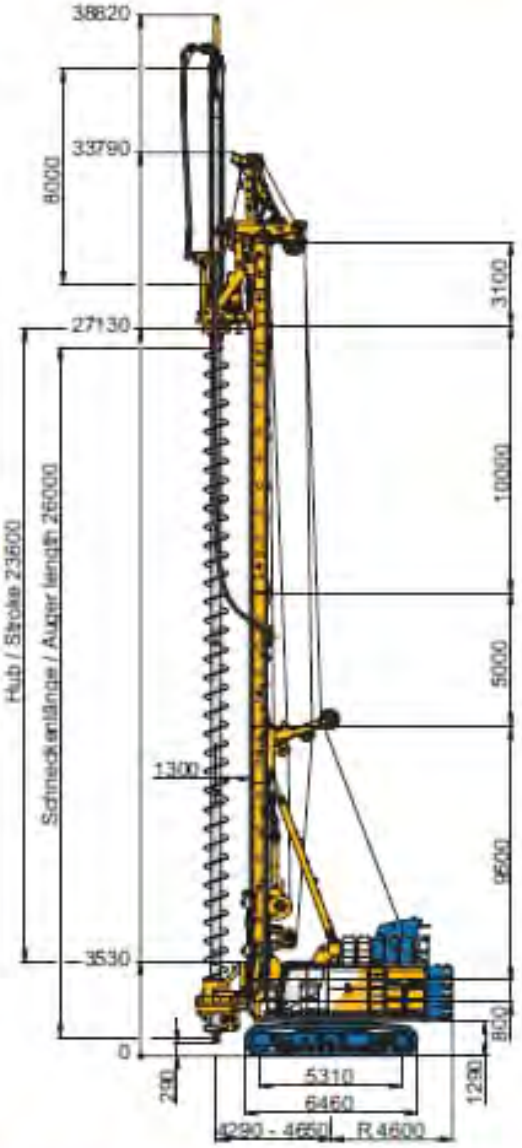
Anwendungen — Applications

SOB – Bohrverfahren — CFA – Drilling system

Hydraulische Mastabstützung erforderlich; zusätzliches Gegengewicht (abhängig von der Ausrüstung) erforderlich
Hydraulic mast support required; additional counterweight (depending on type of equipment) required

Zeichnung: kombinierte Zugkraft mit Vorschubwinde + Hauptwinde mit Aufhängung, Traverse und Seilwirbel
Drawing: Combined extraction force with crowd winch + main winch with connection, spreader beam and swivel





	Basis Version Basic version	Ausbaustufe Upgrade version
Kellyverlängerung Kelly extension	6 m	5 m
Bohrtiefe mit Schneckenputzer Drilling depth with auger cleaner	24,0 m	31,0 m
Max. Bohrdurchmesser Max. drilling diameter	1.200 mm	1.200 mm
Max. Zugkraft mit Haupt- und Vorschubwinde (effektiv) Max. extraction force with main- and crowd winch (effective)	1.000 kN	1.000 kN
Schneckenlänge (ohne Pilot) Continuous flight auger length (without pilot bit)	23,8 m	26,0 m
Unterwagen Undercarriage	UW 110	UW 130
Mastverlängerung Mast extension	—	5,0 m

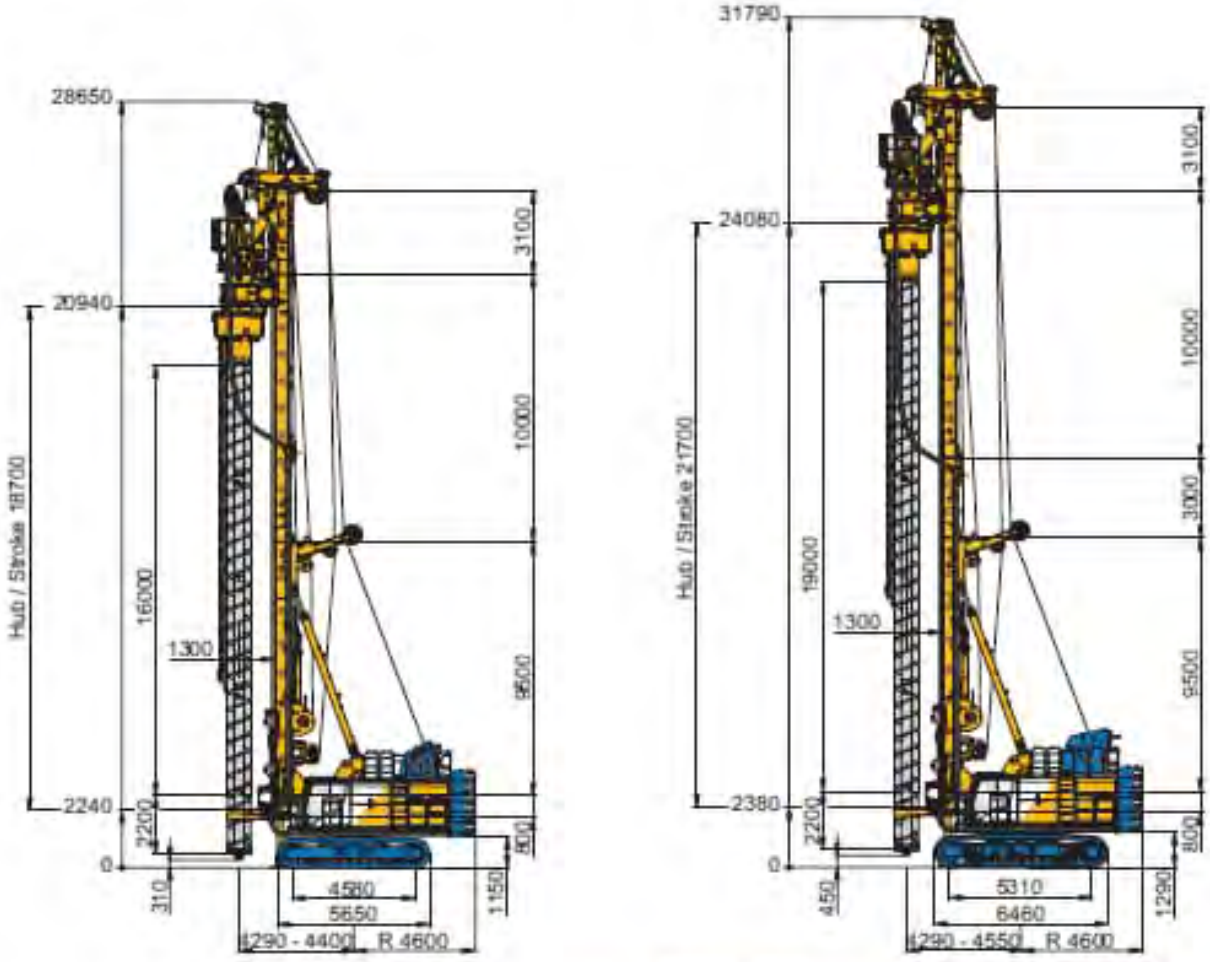
Weitere Bohrtiefen und Bohrdurchmesser auf Anfrage. / Further d and drilling diameter on request.

Anwendungen Applications

CCFA mit BTM CCFA with BTM

Hydraulische Mastabstützung und maximales Gegengewicht (29,4 t) erforderlich
Hydraulic mast support and maximum counterweight (29,4 t) required

Zeichnung: kombinierte Zugkraft mit Vorschubwinde + Hauptwinde mit Aufhängung,Traverse und Seilwirbel
Drawing: Combined extraction force with crowd winch + main winch with connection, spreader beam and swivel



	Basis Version Basic version	Ausbaustufe Upgrade version	
Maximale Bohrtiefe Maximum Drilling depth	18,0 m	21,0 m	18,0 m
Bohrdurchmesser Drilling diameter	750 mm	750 mm	880 mm
Max. Zugkraft mit Haupt- und Vorschubwinde (effektiv) Max. extraction force with main- and crowd winch (effective)	1.000 kN	1.000 kN	1.000 kN
Unterwagen Undercarriage	UW 110	UW 130	UW 130
Mastverlängerung Mast extension	—	3,0 m	—

Weitere Bohrtiefen und Bohrdurchmesser auf Anfrage. / Further d and drilling diameter on request.

Project Title / Facility Name:

Woodsmith Project

Document Title:

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN - PHASE 5 - CONDITION 93 - LADYCROSS

NYMNPA

28/07/2022

Document Review Status

- [x] 1. Reviewed – Accepted – Work May Proceed — By: Robert Staniland
- [ ] 2. Reviewed – Accepted As Noted, Work May Proceed, Revise & Resubmit — On: 26 Jul 2022 10:22
- [ ] 3. Reviewed – Work May Not Proceed, Revise & Resubmit
- [ ] 4. For information only
- [ ] 5. On Hold – Pending Project Restart & Ramp Up

Rev.	Revision Date (dd mmm yyyy)	Reason For Issue	Prepared by	Verified by	Approved by
D	22-Jul-2022	Planning	PLA			
C	20-Jul-2022	Planning	PLA			
B	14-Jul-2022	Planning	PLA			
A	01-Jul-2022	Planning	PLA			

Document ID:

40-STS-LC-2100-EN-PL-00025

WOODSMITH PROJECT

(788.5030)

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN – PHASE 5 – CONDITION 93 – LADYCROSS PLANTATION / 40-STS-LC-2100-EN-PL-00025

Revision	Date of issue	Prepared by	Checked by	Approved by	Changes
A (PLA)	01/07/2022	W Hodgson	C Thomas	C Fryer	First Issue
B (PLA)	14/07/2022	W Hodgson	C Thomas	C Fryer	Changes in accordance with Rev A comments
C (PLA)	20/07/2022	W Hodgson	C Thomas	C Fryer	Final Issue
D (PLA)	22/07/2022	W Hodgson	C Thomas	C Fryer	Final Issue. Amendment to shower unit orientation

TABLE OF CONTENTS

1. INTRODUCTION

1.1. PURPOSE OF THE DOCUMENT

In 2014 a planning application (reference NYM/2014/0676/MEIA) was submitted to the North York Moors National Park Authority (NYMNPA) for permission to develop a polyhalite mine and underground Mineral Transport System (MTS). Planning permission was subsequently granted in 2015 subject to conditions, as varied in February 2018 by NYM/2017/0505/MEIA.

Anglo American are constructing a Mineral Transport System (MTS) tunnel, as part of the wider Woodsmith Project. The tunnel will be used to transport polyhalite from the Woodsmith Mine site to the Material Handling Facility (MHF) at Wilton, Teesside. Safe and efficient construction and operation of the tunnel requires the construction of an immediate shaft at Ladycross Intermediate Shaft Site (Ladycross) to provide access to the tunnel.

This Construction Environmental Management Plan (CEMP) has been prepared on behalf of Anglo American for the Phase 5 Works at Ladycross (as described in **Section 1.2** below).

This CEMP has been prepared to discharge condition 93. Subsequent CEMPs will be prepared for future phases of works. This CEMP covers work carried out in Phase 5.

Table 1 - 1 Condition NYMNPA-93: Construction Environment Management Plan

NYMNPA-93 Description	Compliance with Condition NYMNPA 93
Prior to the commencement of each Phase of Construction in accordance with the approved Phasing plan at either Doves Nest Farm or Lady Cross Plantation, an updated CEMP shall be based on the approved Construction Method Statement (CMS) and should be submitted and approved in writing by the MPA in consultation with the Environment Agency in respect of the area concerned.	This version of the CEMP is for Phase 5 as defined in **Section 1.2** below. Earlier versions of the CEMP were produced for preceding works.
The size, location and design of any site compounds, including how any potentially polluting materials will be stored to minimise the risk of pollution	**Section 3** and **Section 11** Phase 4 Construction Method Statement
An incident Response Plan to deal with any pollution that may occur during the course of construction;	**Section 12**

NYMNPA-93 Description	Compliance with Condition NYMNPA 93
A protocol to deal with contaminated ground, should this be encountered, to ensure protection of water resources;	**Section 10**
Details of how surface water run-off shall be passed through a settlement facility of settlement facilities prior to being discharged into any watercourse or soakaway;	**Section 9.1**
Plant and wheel washing including that it shall only be carried out in a designated area of hard standing at least 10 metres from any watercourse or surface water drain and that washings shall be collected in a sump, with settled solids removed regularly and water recycled and reused where possible;	**Section 3.10**
A scheme for the recycling/disposing of waste resulting from demolition and construction works;	**Section 11**
Storage of waste not covered by the Mine Waste Directive;	**Section 11**
Measures to control glare from in-site lighting;	**Section 3.6**
Measures to manage deliveries by HGV including routing and timing for deliveries and details of the penalty system for breaches of the agreed control;	**Section 4**
Temporary Traffic Management	**Section 4**
The provision of a Dust Management Plan relating to Phase 1 of the construction period (earthworks and bund formation) and Polyhalite handling and stockpiling to include dust generation modelling so as to identify	**Section 6** Phase 4 Emissions to Atmosphere Construction Phase Dust Management Plan

NYMNPA-93 Description	Compliance with Condition NYMNPA 93
sensitive receptors; likely dust generation and its disposition during the construction Phases and operation over time and under different weather conditions; the avoidance and mitigation measures required to ensure dust deposition levels at the sensitive receptors are maintained at the residual levels identified in the approved EIA, and monitoring arrangements. The Dust Management Plan must comply with the criteria set out in the 'Dust and Air Emission Mitigation Measures' best practice guidance for control of dust on construction sites from the Institute of Air Quality Management 2012. The monitoring arrangements will include dust deposition or dust flux or real-time PM_{10} continuous monitoring locations; baseline dust monitoring at least three months before construction commences; daily on-site and off-site inspections at monitoring locations with results recorded in a log to be made available to the MPA on request, and more frequent monitoring during periods of high dust generation;	
In the event that there is insufficient clay with the Lady Cross Plantation site to form 1m deep basal layer beneath the spoil storage area, a contingency plan to address the importation of clay, including the source, quantity and quality of such material, and how adverse effects on the water environmental would be avoided;	**Phase 3 Construction Environment Management Plan**
How the requirements of the approved CEMP will be disseminated to all relevant	**Section 2.2**

NYMNPA-93 Description	Compliance with Condition NYMNPA 93
staff/contractors throughout the construction period;	
The location of the site notice board;	**Section 2**
A scheme for parking, loading, unloading during construction;	**Section 4** **Phase 3 Construction Traffic Management Plan**
A scheme for security and lighting during construction;	**Section 3.1** and **3.6**
A protocol for the replenishment of tanks and containers, including that all refuelling of vehicles, generators, plant and equipment shall be supervised and shall take place within a suitable bunded, impervious hardstanding;	**Section 3.8**
Contingency proposals for if fuel cannot be delivered for the generators, e.g. due to adverse weather;	**Section 3.8**
Proposals / contingency plans for waste not managed as part of the Mine Waste Permit comprising the storage and management of temporary mining waste stored on-site for less than three years (e.g. Pyritic Mudstone); non-inert and non-hazardous materials stored for less than one year, and unexpected hazardous waste stored for less than six months, including measures to prevent the dispersal of dust, leachate and surface water run-off;	**Section 11**
Precautionary Method of Working for Site Clearance (PMWSP) which shall be submitted to and agreed in writing by the MPA prior to commencement of Preparatory Works and	**Section 7** **Attachment C** – Precautionary Method of Working

NYMNPA-93 Description	Compliance with Condition NYMNPA 93
shall be adhered to thereafter. The PMWSP shall set out proposals for tree clearance and the demolition of structures and shall include that between March and September each year surveys of areas to be cleared should occur no less than 48 hours before clearance occurs so that occupied wild bird nests can be identified and prevented from being destroyed;	
Alarms fitted to mobile plant and vehicles for the purposes of warning pedestrians of their movements;	**Section 5**

Additional conditions addressed in this CEMP are detailed in **Table 1 - 2**.

Table 1 – 2 Additional relevant conditions

Condition	Topic	Compliance with Condition
NYMNPA-18	Noise and Vibration Management	**Section 5** Phase 5 Noise and Vibration Management Plan
NYMNPA-34	Construction Traffic Management	**Section 4** Phase 3 Construction Traffic Management Plan
NYMNPA-42	Access Arrangements	**Section 3** Previous Phase 2 Construction Environment Management Plan and Phase 5 Construction Method Statement
NYMNPA-52	Protected Species	**Section 7.1** Phase 3 Protected Species Management Plans
NYMNPA-57	Landscape and Ecological Management	**Section 7.3** Phase 3 Landscape and Ecological Management Plan

Condition	Topic	Compliance with Condition
NYMNPA-59	External Lighting	**Section 3.6**
NYMNPA-65	Temporary boundary treatments	**Section 3**
NYMNPA-68	Temporary Structures	**Section 3** Phase 5 Construction Method Statement
NYMNPA-70	Vegetation retained & clearance	**Section 7.2** Construction Phase Arboricultural Method Statement
NYMNPA-76	Soil Management Plan	**Section 10** Phase 3 Soil Management Plan
NYMNPA-92	Plant and Vehicle Management	**Section 4** Phase 5 Construction Vehicle and Plant Management Plan
NYMNPA-95	Written scheme of Archaeological Investigation	**Section 8** Phase 2 Written Scheme of Investigation for an Archaeological Watching Brief

This document details only the additional activities required for Phase 5 at Ladycross associated with the Anglo American Woodsmith Project. Updates to this plan will be prepared for subsequent phases and following any design or method changes. The NYMNPA, as well as the Environment Agency and Natural England agreed that they support this approach in meetings held in April 2016.

1.2. SCOPE OF WORKS

The Phase 5 scope of works, comprises:

- Mobilisation of shaft sinking contractors, including installation of shaft sinking equipment and shaft platform civils and infrastructure;
- Construction of foreshaft, including secant piling;
- Drilling of pilot borehole;
- Sinking of proposed MTS shaft via blind bore drilling method;
- Installation of the shaft lining;
- Grouting of shaft anulus and dewatering;
- Revised design to security cabin; and
- Addition of showers to existing welfare.

A site plan is provided separately.

1.3. SCOPE OF THIS DOCUMENT

This CEMP details how the Phase 5 works will be planned, monitored and managed in an environmentally responsible manner. The document outlines the management framework for the environmental requirements, commitments, and performance targets associated with the planning and implementation of Phase 5 of the project.

The CEMP refers to several management plans, which have been prepared to discharge a number of planning conditions. Collectively these plans incorporate all mitigation measures relevant to Phase 5.

The Phase 5 CEMP should also be read together with the documentation listed below. Information in these documents is summarised in this CEMP where appropriate:

- Phase 3 Construction Traffic Management Plan (40-STS-LC-2100-LG-PL-00001)
- Phase 5 Noise & Vibration Management Plan (40-STS-LC-2100-EN-PL-00027)
- Phase 3 Landscape and Ecological Management Plan (40-STS-LC-2100-EN-PL-00014)
- Phase 4 Emissions to Atmosphere (40-STS-LC-2100-EN-PL-00019)
- Phase 3 Surface Water Management Plan (40-STS-LC-2100-PA-PL-20102)
- Phase 5 Construction Method Statement (40-STS-LC-2100-CN-MS-00006)

- Phase 2 Archaeological Watching Brief Written Scheme of Investigation (40-COT-LC-8324-EN-PL-00002)
- Phase 3 Soil Management Plan (40-STS-LC-2100-EN-PL-00007)
- Phase 5 Hydrogeological Risk Assessment (40-STS-LC-2100-EN-RA-00004)
- Phase 3 Surface Water Drainage Scheme (40-STS-LC-2100-PA-22-20107)
- Construction Phase Dust Management Plan (40-STS-LC-2100-EN-PL-00015)
- Construction Phase Arboricultural Method Statement (40-STS-LC-21-CN-MS-00003)
- Phase 5 Construction Vehicle & Plant Management Plan (40-STS-LC-2100-LG-PL-00004)

This CEMP will remain a live document, being reviewed and updated in consultation with the appointed contractor(s) or sub-contractor(s) as required. Each of these updated CEMPs will be submitted to NYMNPA for approval prior to the start of each phase of works.

2. ENVIRONMENTAL MANAGEMENT FRAMEWORK

2.1. STRUCTURE OF RESPONSIBILITIES

This CEMP addresses those environmental matters within the responsibility of Anglo American and the Contractors engaged on its behalf to deliver the Phase 5 construction works. While overall responsibility for compliance with environmental requirements will remain with Anglo American, the Contractors working on site are accountable for undertaking the works in line with the requirements of this CEMP as well as all legal and other requirements imposed via permits and licenses.

2.2. TRAINING, AWARENESS AND COMPETENCE

2.2.1. *INTERNAL COMMUNICATION*

All staff and sub-contractors working on site will be required to attend a site induction prior to commencing work. This will cover the key environmental aspects relating to the project and the roles and responsibilities of individuals.

Toolbox talks will be undertaken by the Environmental Manager or other nominated personnel throughout the project. The aim will be to communicate information to all staff and serve to educate, prompt and remind them of their responsibility to protect the environment during works.

Monthly progress meetings will be used to disseminate the results of monitoring and audit reports. At these meetings, a review of the environmental performance throughout the site to date will be undertaken, and any improvements required during the Phase 5 works will be identified. Details of where sustainable approaches to works activities have been implemented or developed as the work proceeds will also be discussed and recorded. Their suitability for implementation at other areas of the site will be considered and applied where appropriate. Decisions about amendments required to the processes and procedures will also be agreed.

2.2.2. *EXTERNAL COMMUNICATIONS*

Anglo American will lead communication with members of the public, including adjacent landowners, local residents and businesses in line with the Community Stakeholder and Engagement Framework (CSEF) see **Attachment A**.

The CSEF includes provision for a quarterly Liaison Group Forum meeting, which are open to members of the public to attend.

2.3. MONITORING OF COMPLIANCE

All Phase 5 construction works will be supervised by the Contractor's managerial staff with the support of members of their teams on a daily basis. The Contractor's managerial staff will receive a briefing from the Contractor's Environmental Manager to ensure that they are aware of the environmental requirements. The briefing will also ensure that they are able to assess whether the environmental requirements are being implemented properly.

Procedures relating to environmental management and monitoring of environmental performance identified within the CEMP will be subject to inspections by the Contractor at least once every week, with oversight and audit by the Anglo American Environmental Team. Records of inspections, audits and overall environmental performance will be submitted to Anglo American.

2.4. COMPLAINTS PROCEDURE

The implementation of the systems and procedures to protect the environment will effectively reduce or remove the risk of an environmental incident and/or exceedance of established thresholds. However, complaints may still be received and in this event the Complaints Procedure will be implemented, as detailed in **Attachment B**.

3. DESCRIPTION OF SITE

The following section seeks to address the requirements of planning conditions 65 and 68, providing details for the sites temporary boundary treatments, temporary compounds and structures that will be used as part of Phase 5 works. Most of the site set-up will have been completed as part of the previous phases of works. Only small changes will be made to the existing site set-up as detailed in the below sections.

3.1. FENCING AND SECURITY OF THE SITE

Perimeter fencing will be installed around the shaft works area as a demarcation zone. Post and Rail fencing will be also installed around the site temporary welfare facility. The Automatic Number Plate Recognition (ANPR) system installed as part of the site access gate during the previous phase will be used to record and track employee access to site.

Site access and controls established in previous phases will be utilised for site access and security during the Phase 5 works. Further controls for site access are detailed in the Phase 5 CMS.

Changes will be made to the existing site security cabins as detailed in **Section 3.2.2**.

3.2. SITE LAYOUT AND COMPOUNDS

The site layout and compounds are detailed in the Phase 5 Ladycross Plantation General Arrangement Plan and the Phase 5 Construction Method Statement (CMS).

The working platform constructed during Phase 3 works was designed and constructed to withstand the loadings of all plant and equipment associated with the Phase 5 works.

3.2.1. *WELFARE SHOWER UNITS*

Changes will be made to the existing welfare facility established in Phase 3. Shower units will be installed to the north-western side of the existing welfare block, the cabins will be founded on levelled paving slabs situated on existing hardstanding, **Figure 1**.

The shower area will consist of two units similar to the modular containers installed as part of the welfare set-up for Phase 3. Each shower unit will have dimensions of 2.5m width and 6m length. The two units will be single storey with a maximum height of approximately 2.5m. Access to the shower room will be via an internal entrance located within the male and female changing rooms respectively. The units will be painted brown/green (RAL6008) or juniper green (RAL 160 20 10) prior to arrival on site.

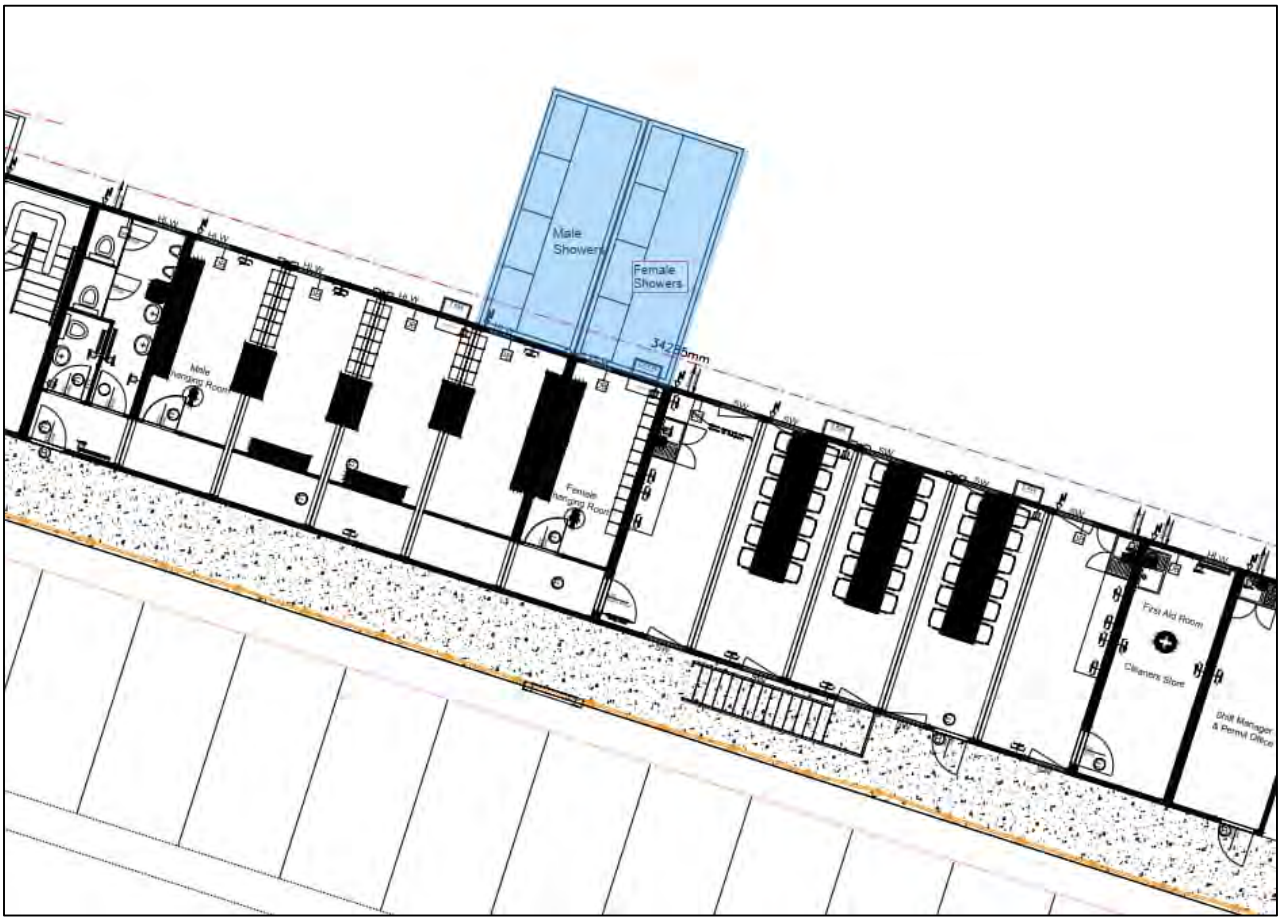


Figure 1: Proposed location of shower units in relation to the existing welfare unit

The wastewater from the showers will drain to the welfare office cesspit installed during Phase 3. The existing cesspit capacity is considered to be suitable for the increased volumes of waste water.

3.2.2. *Site Security Cabin Revision*

A revised site security set-up will be installed in the location of the existing site security cabins established in Phase 2.

The security cabins with dimensions of 6m length by 2.5m width will be installed on a stoned platform (orange), the cabins will be single storey with a maximum height of 2.5m. The units will be painted RAL6008 (brown/green) or or juniper green (RAL 160 20 10) prior to arrival on site. The stone platform will be approximately 11.5m by 9.5m with a tarmacked area for parking of up to three vehicles (blue). The stone hardstanding will be installed to create a level platform for the site security cabins. An indicative site layout is shown in **Figure 2**.

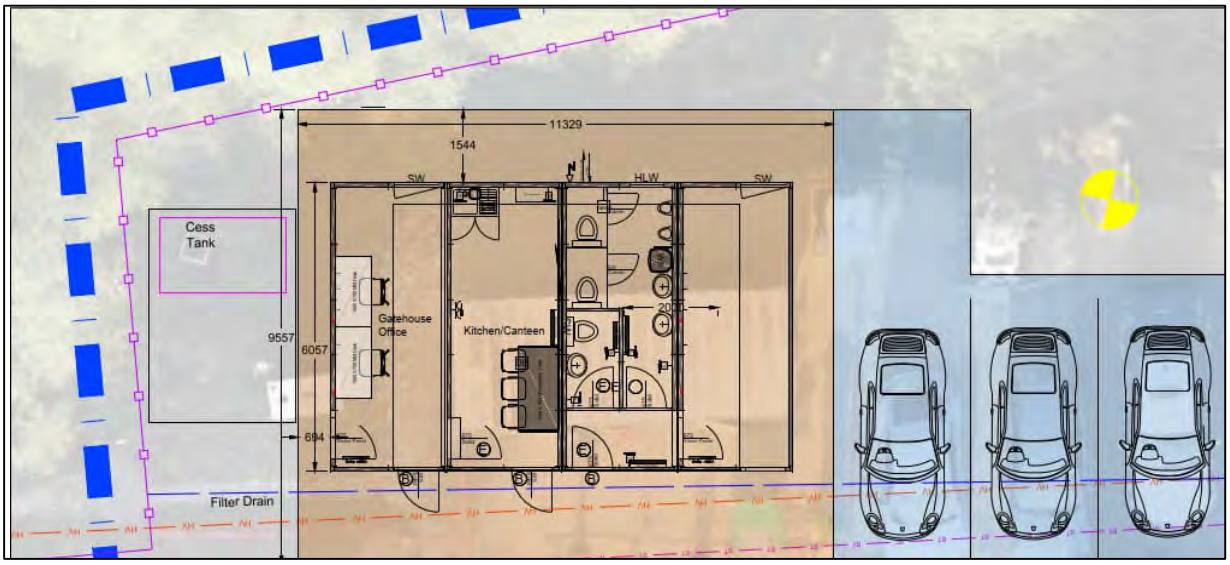


Figure 2: Proposed site security cabin install arrangements

3.3. AREAS OF HARDSTANDING

3.3.1. *CONCRETE/SLABS*

Construction of concrete base pad will be limited on site and only installed where required. The drill pad supports the drilling rig itself as well as integrating the necessary pipe works to maintain a closed loop spoils handling system is to be installed.

A reinforced concrete slab will be installed to support the drill rig and to integrate the necessary pipework to maintain the closed loop spoils handling system.

The concrete pad will be approximately 600 mm thick and will incorporate 3-4 caissons located under each leg of the derrick and front hoist, the subsurface plumbing including the 500 mm steel overflow and the 300 mm poly return lines and the Rathole. Further information is provided in the Phase 5 CMS.

To facilitate the installation of the cesspit the excavated area will be blinded with concrete to form an impermeable barrier with the ground and appropriate anchoring of the tank. This will be installed in accordance with manufacturers specification.

During project construction, the working pad provides a stable working platform on which to set the drill rig and to facilitate all shaft drilling activities. Upon completion of the shaft, if feasible, the concrete pad will be integrated into the head house foundation.

A small 3m x 3m concrete pad will we constructed along the side of the security cabins to provide a level impermeable base for an emergency generator and fuel cube in the event it is required.

3.3.2. *Stone / Aggregate Hardstanding*

No changes will be made to the existing stone / aggregate hardstanding detailed as part of previous submissions.

Additional stone hardstanding will be constructed to create a level platform for the additional site security cabins to be installed. The hardstanding platform will be approximately 11.5m by 9.5m.

3.4. Utilities

3.4.1. *Water Supply*

Raw water to facilitate site operations will be serviced by a 4" Yorkshire Water potable water supply. The potable water will provide services to both welfare facilities and for site process use.

Bottled water dispensers will be provided for site staff. Where required, dust suppression bowsers will also periodically be topped up via the water supply. Temporary tanks may be utilised for storage of water for site specific operations.

3.4.2. *Electrical Supply*

A three-phased 415V electrical supply will be installed during Phase 4 to power site operations.

The main drilling rig for the blind boring works will require a 60Hz (US standard) supply and will therefore be run off 1250KVA containerised gensets, as mains supply in UK is 50Hz.

Two generators will be stored on site, one for operation and the other will be utilised as an emergency back-up. Generators selected will be modern, efficient equipment that minimises emissions and fuel consumption.

Where standalone generators are required, these will be super silent and installed in a manner to reduce noise impacts on local receptors. Further details for generators are supplied in the Phase 4 Emissions to Atmosphere. Practices to reduce noise impacts will include but not be limited to:

- Procurement of super silent generators with reduced noise impact,
- Positioning of generators during installation, and
- Noise attenuation fencing/panels installed around generators, where required.

3.5. Welfare Facilities

The welfare facilities will remain the same as from previous phases, notwithstanding the addition of showers as detailed in para 3.2.1.

3.6. LIGHTING

The Phase 5 works will be illuminated, when necessary, through temporary, task-specific directional lighting. The additional cabins, workshops and grout plant area will be fitted with motion sensor controlled, discreet perimeter lighting for safe access and egress. Shutters on welfare buildings will be shut after nightfall to reduce light spill. Phase 5 works will be 24/7 works for a large proportion of the shaft drilling works.

On-site exterior lighting will apply the following principles which will ensure that impacts on wildlife are minimised in accordance with 'Artificial Lighting and Wildlife' guidance[1]:

- Task lighting will be used where appropriate,
- Lighting will be directed downwards (0 to 20 degrees where possible), with all beam angles below 70°,
- Lighting will be kept as low as is safe and practicable for the works taking place and kept at a maximum height of 4m,
- Lights will be switched off when not in use or will be motion sensor controlled,
- Where safe and practicable, British Standards and guidance from the Institute of Lighting Professionals in the document 'Bats and Artificial Lighting in the UK' (September 2018) (https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/) will be followed where relevant, and
- All lighting will be directed to avoid light spill on to the perimeter woodland.

Where additional temporary lighting is required to provide a safe working area and access and egress, it will be installed in line with the above procedures, where possible aiming to limit upward light spill, and utilising warm spectrum LED's.

3.7. MATERIAL STORAGE

The type of material stored on site will determine the storage methodology adopted. Fuel and chemical storage areas will be located as far from all open drains and watercourses as practicable, with at least 10m from these locations. In addition, the storage areas will not be located near any open excavation of natural ground. Additional storage requirements will be implemented based upon the associated manufacturers Material Safety Data Sheet (MSDS). The areas in which hazardous substances are stored will be clearly demarcated and within appropriate containerised units with integrated secondary containment.

All fuel will be stored within the onsite fuel tank installed during Phase 3 works.Specific areas on site will be designated for materials storage.

All non-polluting materials will be stored in designated areas, with surface water run-off draining to adjacent filter drains, surface swales and surface water drainage as detailed in **Section 10**. Penstocks and hydraulic brakes have been installed within the surface water drainage network, which will be closed in the event of a spill or detection of other contaminants. Details of site drainage and penstock locations are detailed in the Phase 3 Surface Water Management Plan and Phase 3 Surface Water Drainage Scheme.

Table 3 - 1 Material storage for Phase 5 works

Material	How it will be stored
Concrete (Wagon / truck loads)	Bulk concrete will be delivered and used straight from the concrete wagon.
Cement (small bags 25kg)	Small bags of cement will be stored on pallets with appropriate weatherproofing in a designated area away from high trafficked zones.
Grout (60 tonne silo)	Silos approved as part of Phase 3 works will be used to store grout and are installed with appropriate secondary containment.
Diesel / Petrol (Bulk storage)	Bulk storage of diesel/petrol will be stored in a designated refuelling area installed during Phase 3 works. A towable bowser with secondary containment will be utilised for refuelling of large plant. The bowser will be stored in an appropriate demarcated location.
Oils and greases (Plant maintenance and site operations)	Oils and greases will be stored in appropriate containers in segregated areas of site (COSHH container and workshops). COSHH assessment and MSDS will be assessed for further storage requirements.
Bentonite (small bags 25kg)	Small bags of bentonite will be stored on pallets with appropriate weatherproofing in a designated area away from high trafficked zones.
Chemicals	Chemicals will be stored within appropriate container within the on-site COSHH containers.

3.8. FUEL OIL STORAGE AND REFUELLING ON SITE

3.8.1. *STORAGE*

Fuel will be stored within/on the refuelling area provided as part of Phase 3 works, it will be stored in accordance with The Control of Pollution (Oil Storage) (England) Regulations 2001, as follows:

Secondary containment will be provided for all surface oil and diesel tanks:

- For a single tank, the secondary containment will be at least 110% of the maximum storage capacity; and
- For two or more tanks in one secondary containment system, the secondary containment will be at least 110% of the biggest tank's maximum storage capacity or 25% of the total maximum storage capacity of all the tanks, whichever is the greater.

Storage must be more than 10 m away from any watercourse or the surface drainage system. Static fuel tanks (such as those linked to generators) will be sited on sealed, level ground adjacent to the generators. All fuel bowsers will have tanks with integrated secondary containment that holds a minimum of 110% of the volume of the inner tank.

Spill kits will be stored adjacent to the storage areas and relevant staff will be trained in the use of such equipment in the event that spillages occur.

3.8.2. *REFUELLING*

All replenishment of tanks and containers and all re-fuelling of vehicles, plant and equipment shall take place within bunded, impervious hardstanding where practical. The refuelling area will be utilised to refuel all site mobile plant. The refuelling area comprises of an impervious hard standing area with containment French drains and drainage to an oil interceptor. A double bunded tank will be used for the storage of diesel and a further bunded IBC unit will be used to contain AdBlue. Toolbox talks regarding refuelling processes will be briefed to all relevant personnel.

For larger or stationary plant such as drill rigs, cranes and generators refuelling will be carried out in-situ on site. The following control measures will be implemented during refuelling processes:

- Supervision of all fuel deliveries;
- Checks carried out on delivery of fuels to ensure correct fuel is delivered;
- Ensure all valves on a bunded tank or secondary containment is closed when not in use;
- Any static fuel bowsers are fitted with automatic cut-off or trigger nozzles; and
- Never leave vehicle or plant unattended during refuelling.

Heavy plant undergoing in-situ refuelling will be located on the working pad area. As part of the Phase 3 works an impermeable Geosynthetic Clay Liner (GCL) was installed to minimise impact from any pollution incidents.

3.9. SITE HOUSEKEEPING

The implementation of a good site housekeeping policy is key to reducing the likelihood of accidents and environmental pollution incidents. Good housekeeping measures that will be implemented on site include:

- Keeping the site tidy;
- Segregating waste and removing it from site regularly;
- Maintaining all site facilities, including welfare facilities;
- Maintaining site roads, ensuring internal roads and those surrounding the site are kept clean;
- Ensuring plant and vehicles on site are well maintained;
- Ensuring all materials are stored appropriately;
- Undertaking regular inspections of all areas of the site to ensure housekeeping requirements are being fully implemented; and
- Ensuring that detailed records of these inspections, their findings and any mitigation required are kept.

The Site Supervisor will monitor the cleanliness of the road daily to ensure that it is free of dirt and debris. Road sweepers will be deployed to clean the roads as necessary, under instruction of the Site Supervisor.

3.10. WHEEL WASHING FACILITIES

The wheel washing facilities constructed as part of Phase 3 works will be utilised for wheel cleaning of all HGVs and plant exiting site onto the public highways. Traffic will be routed one way to ensure all vehicles required use the wheel washing facilities.

Regular maintenance of the wheel washing facility will be carried out in accordance with the manufacturers servicing specification. The washings shall be collected in a sump, with settled solids removed regularly and water recycled and reused where possible.

4. TRAFFIC

4.1. CONSTRUCTION TRAFFIC MANAGEMENT PLAN

The Phase 3 Construction Traffic Management Plan (CTMP) (40-STS-LC-2100-LG-PL-00001) will remain applicable for the Phase 5 works. This contains a range of general measures for the management of transport including:

- High occupancy travel for employees, including car-sharing, minibus pick up and utilising Lockwood Beck (LWB) as a transport hub, and
- All vehicles travelling to site using the designated routes only.

The CTMP also contains a Highway Communication Plan, which outlines how communication with the public, the planning and local authorities, and any other stakeholders will be undertaken.

The CTMP also specifies prohibited routes for construction vehicles. To support this, Prohibitive and Directional Signage will be shared with all delivery drivers. This signage was installed prior to the commencement of Phase 2 of the project as part of the Phase 1 Highway works and will be maintained throughout the construction period for Phase 5.

4.2. PARKING, LOADING AND UNLOADING

4.2.1. *PARKING AND LOADING*

4.2.1.1 PARKING

Parking will only be permitted within designated car parking areas and drivers will be required to display permits while parking on site. No access to the site by foot is permitted. A peak of up to 50 employees will be on site during Phase 5.

4.2.1.2 LOADING AND UNLOADING

Loading and unloading of deliveries and materials on site will take place in designated areas dependent on works.

Approximately 50 Abnormal Indivisible Loads (AIL) are expected during the Phase 5 works. Deliveries will be staggered throughout the duration of the Phase 5 works to reduce the number of AIL operating on the A171 and Egton Road between Lockwood Beck Site and Ladycross.

4.2.2. *ACCESS*

All construction traffic will use the existing main access road to access site. The access road is appropriately sized to allow for three HGVs to queue. In addition to the physical measures proposed, to prevent traffic having to wait on the highway or the potential for multiple to meet at the site access, the contractor will be required to provide a banksman and schedule deliveries and shift times.

Security will be stationed at the site access gates and all drivers will be required to have completed the appropriate driver induction before entering site. Access will only be authorised for deliveries / vehicles booked in for the day and with the appropriate access documentation. All deliveries will follow the onsite one-way traffic controls. Where required a banksman will be provided by the contractor if reversing or manoeuvring of vehicles is required.

In addition to assisting the contractor to manage the total numbers of daily HGV movements, the requirement for planning and scheduling deliveries will also assist the contractor in ensuring that deliveries can be spread throughout the working day.

The contractor will also be required to schedule shift times to try and avoid employees arriving and departing at the same time and to schedule deliveries outside of these hours.

5. NOISE AND VIBRATION

5.1. NOISE AND VIBRATION MANAGEMENT PLAN

The imposed noise limits for the Ladycross Plantation are 55dB $LAeq^{-1}hr$ during the day and 42dB $LAeq^{-1}hr$ in the evening (07:00-19:00 and 19:00-07:00 respectively). The Phase 5 works will comply with these limits. Noise monitoring will be carried out for the full duration of the Phase 5 works. A Phase 5 Noise and Vibration Management Plan (NVMP) (40-STS-LC-2100-EN-PL-00027) has been produced and provides further details regarding the mitigation, monitoring and controls to be implemented during the Phase 5 works.

6. AIR QUALITY AND DUST MANAGEMENT PLAN

During the Phase 5 works dust suppression measures will include:

- Damping down of road surfaces, additional road sweeping and potentially vehicle wheel washing will be utilised across the works area, as appropriate,
- Site fencing, barriers and other areas of dust accumulation will be kept clean using water spraying where there is the risk of dust accumulation. Any run-off will be filtered via the site surface water drainage system,
- Materials that have the potential to create dust problems will be removed unless they are to be re-used on site. Where possible these will be covered or contained in a fenced area,
- Seeding of all topsoil and subsoil bunds,
- Burning of waste materials will be prohibited, and
- Plant and vehicles used on site will be well maintained to minimise pollutant emissions.

6.1. DUST MANAGEMENT PLAN

Dust emissions can arise during Phase 5. Measures and controls to minimise dust emissions from Phase 5 are provided in the Construction Phase Dust Management Plan (DMP) submitted as part of Phase 3 to partially discharge condition 93. Daily inspections and monitoring will be undertaken by the contractors, in accordance with this procedure. Some of the dust management mitigation identified in the DMP is detailed in **Table 6-1** below. The Phase 4 Emissions to Atmosphere and Phase 3 CTMP provides further detail regarding the air quality and dust mitigation to be adopted during the Phase 5 works.

Table 6 - 1 Dust Mitigation

Source / Activity	Mitigation Measures
Construction Traffic	• Implement speed limit on internal roads • Dust suppression used on roads when dust emissions noted • Provide wheel washes to reduce dust on public highways • Sheeting of vehicles carrying dust generating materials • Regular maintenance of vehicles and plant

Source / Activity	Mitigation Measures
Compound Areas	• Ensure areas used for welfare facilities and vehicle management (loading and unloading) are constructed of hardstanding • Sweeping / dampening down areas of hardstanding when required
Storage Areas	• Grass seeding temporary earth bunds until re-use • Profiling stockpiles of dust generating materials • Covering dust generating materials, if practical • Dampening down facilities for stockpiles
Preparatory Works and utility installation (Earthworks)	• Monitor earth moving works, especially in dry and windy conditions
Foreshaft Piling and excavation works	• Covering dust generating materials, if practical • Regular maintenance of vehicles and plant • Sweeping / dampening down areas of hardstanding when required
Shaft reaming works	• Covering dust generating materials, if practical • Regular maintenance of vehicles and plant • Sweeping / dampening down areas of hardstanding when required

7. NATURE CONSERVATION

7.1. PROTECTED SPECIES AND PRECAUTIONARY METHOD OF WORKING FOR SITE CLEARANCE

Protected Species Management Plans (PSMPs) were produced for reptiles, birds, bats, badgers and water voles to partially discharge condition NYMNPA-52 for Phase 3. These remain applicable for the Phase 5 works, and the accompanying Precautionary Methods of Working will be applied. The measures detailed in these PSMPs will be implemented in Phase 5.

7.2. VEGETATION CLEARANCE

Utilities installation works will be carried out to avoid any Root Protection Zones (RPZ). An assessment by competent persons and consultation with the Project Ecologist will determine if any works impact on the peripheral tree line. Appropriate measures will be followed as outlined in the Arboricultural Method Statement (AMS) prior to any works commencing.

In the event trees require removal, pre-commencement checks for protected species will be carried out 48 hours prior to felling works. Further checks will be undertaken at three-day intervals while works are ongoing to ensure nesting birds have not returned.

7.3. LANDSCAPING AND ECOLOGICAL MANAGEMENT

A Landscape and Ecological Management Plan (LEMP) was produced during Phase 3 works to partially discharge condition NYMNPA-70. The management principles outlined in the Phase 3 LEMP are still applicable for the Phase 5 works.

8. ARCHAEOLOGY

Earthworks required for utilities installation will be carried out on previously surveyed areas of site. Therefore, the potential for interaction with archaeology is low. The principles set out in the Phase 2 Written Scheme of Investigation (WSI) will be applied to archaeology encountered during the Phase 5 works.

9. HYDROGEOLOGY, WATER QUALITY AND DRAINAGE

9.1. SURFACE WATER MANAGEMENT

As part of the Phase 5 works the full site surface water drainage network installed during the Phase 3 works will be adopted for surface water management on site. The Phase 3 Surface Water Management Plan (SWMP) and Phase 3 Surface Water Drainage Scheme provides further detail regarding the control measures and mitigation which will adopted during the Phase 5 works.

9.2. GROUNDWATER MANAGEMENT

Groundwater will be monitored and managed in accordance with the Phase 5 Hydrogeological Risk Assessment (HRA) and Phase 4 Construction and Operation Groundwater and Surface Water Monitoring Scheme.

9.3. SILT AND POLLUTANT MANAGEMENT

Silt and pollutant management remain as per the Phase 3 CEMP and SWMP.

9.4. SHAFT CUTTINGS LAGOON WATER MANAGEMENT

Recirculation process water from the shaft works will be managed within the cutting lagoon constructed during the Phase 3A works. The cuttings lagoon is suitably sized to maintain emergency process water volumes and flood risk requirements as outlined in the Phase 3 Surface Water Management Plan (SWMP). Following completion of the shaft reaming works the recirculated water will be tankered off site by a licensed waste contractor or treated to an appropriate standard and discharged to surface water under an accepted Environment Agency discharge permit.

Further information about the shaft works are detailed in the Phase 5 HRA and CMS.

10. SOILS AND CONTAMINATED LAND

As part of the Phase 5 works, there is no requirement to excavate topsoil or subsoil on site.

The control measures to be implemented for interaction with unidentified contamination is described within the Phase 3 CEMP, which remains applicable for Phase 5.

11. MATERIALS AND WASTE

A range of materials and waste materials will be stored on site, and these will be stored in a designated area on site. The areas used for storage of material have been planned to avoid excessive handling of material and to facilitate loading and unloading. Details of the measures taken to reduce potential pollution are detailed in **Sections 11.1 – 11.4**.

11.1. Waste Minimisation

Waste management practices will ensure that the waste will be managed in accordance with the Environmental Protection Act 1990 Part II: (Duty of Care); The Waste (England & Wales) Regulations 2011: and the Environmental Permitting (England & Wales) Regulations 2016 Waste Duty of Care requirements are met.

The national hierarchy for waste will be used as reference for management of all wastes produced on site:

Reduce: we will seek to minimise waste through design

Re-use: Wherever possible we will utilise waste exemptions to enable waste to be re-used both on and off-site.

Recycle: We will recycle material wherever technically, environmentally and economically practicable.

Recover: We will look to recover energy and material from waste (digestion, incineration, gasification etc.)

Dispose: We will look to avoid the disposal of waste to landfill and only use disposal as a last resort. Wastes will be minimised through adoption of the following procedures:

- Appropriate procurement of materials (volumes, and options to use recycled materials);
- Use of 'Just in Time' delivery of raw materials to ensure that raw materials (aggregate etc.) are not wasted or lost to the environment;
- Operation of a take-back scheme for excess materials when possible; and
- Adoption of energy management practices minimising use of plant and fuels.

11.2. EXCAVATED MATERIAL

11.2.1. *FORESHAFT PILING WORKS*

Materials produced during installation of the secant pile wall will be made up of natural rock to a depth of 25mbgl and concrete used during piling works. The materials produced will be temporarily stored in the muck bin pad constructed as part of the Phase 3a works. The materials will be removed from site by a licensed waste contractor and disposed at an appropriate licensed facility.

11.2.2. *SHAFT PILOT HOLE*

Materials produced during installation of the pilot hole will be a mixture of excavated drill cuttings to a depth of 363m potentially mixed with bentonite. The materials produced will be temporarily stored in the muck bin pad constructed as part of the Phase 3a works. The materials will be removed from site by a licensed waste contractor and disposed at an appropriate licensed facility.

11.2.3. *FORESHAFT EXCAVATION WORKS*

To excavate the foreshaft to the required depth (approx. 12m) an excavator will dig and cast the material outside of the shaft footprint. Once this becomes impractical, a muck skip will be lowered to the base of the shaft and will be filled by a smaller Brokk and / or excavator located within the shaft. A crawler crane at surface will raise and tip the skip at surface. The materials produced will be temporarily stored in the muck bin pad constructed as part of the Phase 3a works. The materials will be removed from site by a licensed waste contractor and disposed at an appropriate licensed facility.

11.2.4. *SHAFT SINKING WORKS*

It is estimated for the 3.81m cut diameter, to a depth of 363m, using a bulk factor of 1.5, approximately 6,500 m^3 of extractive material will be generated during the shaft construction. An attendant excavator will be used to clear cuttings from the cuttings pit and place within muckbin storage area. The excavated material will be temporarily stored in this location to dry out to an acceptable moisture content. The materials will be removed from site by a licensed waste contractor and disposed at an appropriate licensed facility. To increase treatment of the drill water and cuttings a desander unit may be used. The desander unit will ensure larger cuttings are separated from the water returning to the cuttings lagoon. The desander unit will sit within the footprint of the muck away area.

11.3. MATERIALS AND WASTE STORAGE

Details of generic materials and waste stored on site are provided in the Phase 3 CEMP and are applicable for Phase 5.

Additional storage measures for materials used in Phase 5 not covered by the Phase 4 CEMP are detailed in **Section 3.7**.

11.4. LIQUID WASTE MATERIAL

11.4.1. *WATER TREATMENT PLANT SLUDGES*

Waste sludges will be produced during the operation of the onsite Water Treatment Plant (WTP). The sludges will be pumped to a sludge tank for holding. A licensed waste contractor will carry out collection and disposal of sludges where required.

11.4.2. *OIL INTERCEPTOR OILS AND WATER*

The oil interceptor will undergo regular maintenance and servicing based upon the specification outlined in the supplier guidelines and manuals. The silt removed from the silt trap will be collected and disposed by a licensed waste contractor. The oil will be collected and disposed by a licensed waste contractor.

11.4.3. *CESSPIT FOUL SLUDGES*

The cesspit will undergo regular maintenance and servicing based upon the specification outlined in the supplier guidelines and manuals.

The foul sludge will be emptied from the tank on a routine basis based upon site footfall and supplier recommendations. The tank will be fitted with high level alarms as an additional layer of safety.

The site security cabins will require a cesspit to receive the foul sewerage generated. The cesspit will be installed to supplier requirements and using the appropriate British Standards for install. The cesspit will be fitted with a high-level alarm and regular collections will be carried out by a licensed waste contractor to ensure levels are managed with all waste disposal at an appropriately licensed facility.

11.5. CONCRETE WASHOUT

Concrete will be used for the construction of shaft piles and grouting of the casing annulus. Washout of equipment and trucks will be carried out in a demarcated area utilising washout skips or similar. The materials will be removed from site by a licensed waste contractor and disposed at an appropriate licensed facility.

12. INCIDENT AND EMERGENCY PLANNING

Potential environmental issues and emergencies are considered as part of the project planning, and the appropriate prevention and control measures put into place. These measures are communicated to all people working on the project including subcontractors through the site induction and toolbox talks.

The emergency contacts list and drainage plan/ site plan (including the location of spill kits) will be posted on notice boards. Spill kits will be located within the stores in the site compound, at strategic points around the site and within all working vehicles. Vehicles will carry enough spill kit to clean up the amount of diesel/ oils they are carrying.

All employees will be instructed to bring any environmental incidents they identify to the immediate attention of Site Management, after first taking what steps they can to contain/ remediate the incident (without putting the health and safety of themselves or others at risk).

Environmental Emergency Preparedness Plans (EEPP) have been prepared specifying the actions to be undertaken in the event of an environmental emergency or a breach of the measures set out in the EIA. The EEPP will be displayed on all site notice boards. In accordance with the EEPP, the Contractor's Environmental Manager will be notified of environmental incidents.

13. RELATED DOCUMENTS AND REFERENCES

Phase 3 Construction Traffic Management Plan (40-STS-LC-2100-LG-PL-00001)

Phase 5 Noise & Vibration Management Plan (40-STS-LC-2100-EN-PL-00027)

Phase 3 Landscape and Ecological Management Plan (40-STS-LC-2100-EN-PL-00014)

Phase 4 Emissions to Atmosphere (40-STS-LC-2100-EN-PL-00019)

Phase 3 Surface Water Management Plan (40-STS-LC-2100-PA-PL-20102)

Phase 5 Construction Method Statement (40-STS-LC-2100-CN-MS-00006)

Phase 2 Archaeological Watching Brief Written Scheme of Investigation (40-COT-LC-8324-EN-PL-00002)

Phase 3 Soil Management Plan (40-STS-LC-2100-EN-PL-00007)

Phase 5 Hydrogeological Risk Assessment (40-STS-LC-2100-EN-RA-00004)

Phase 3 Surface Water Drainage Scheme (40-STS-LC-2100-PA-22-20107)

Construction Phase Dust Management Plan (40-STS-LC-2100-EN-PL-00015)

Construction Phase Arboricultural Method Statement (40-STS-LC-21-CN-MS-00003)

Phase 5 Construction Vehicle & Plant Management Plan (40-STS-LC-2100-LG-PL-00004)

14. DEFINITIONS AND ABBREVIATIONS

NYMNPA – North York Moors National Planning Authoring

MTS – Mineral Transport System

CEMP – Construction Environmental Management Plan

HGV – Heavy Goods Vehicle

EIA – Environmental Impacts Assessment

PMWSP – Precautionary Method of Working Standard Procedures

CSEF – Community Stakeholder Engagement Framework

ANPR – Automatic Number Plate Recognition

AMS – Arboricultural Method Statement

MSDS – Material Safety Data Sheet

COSHH – Control of Substances Hazardous to Health

IBC – Intermediate Bulk Container

PSMP – Protected Species Management Plan

RPZ – Root Protection Zone

WSI – Written Scheme of Investigation

WTP – Water Treatment Plant

EEPP – Environmental Emergency Preparedness Plan

AIL – Abnormal Indivisible Loads

15. ATTACHMENTS

ATTACHMENT A – Community Stakeholder Engagement Framework

ATTACHMENT B – Complaints Procedure

ATTACHMENT C – Precautionary Method of Working

ATTACHMENT A - COMMUNITY STAKEHOLDER ENGAGEMENT FRAMEWORK

Community and Stakeholder Engagement Framework

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Community and Stakeholder Engagement Framework

Contents

Community and Stakeholder Engagement Framework

1 Purpose and Scope

1.1 Background

The Company takes its responsibility to the local area very seriously and is committed to taking an active and positive role in the local community. This means minimising the potential adverse impacts on people living and working in the area, making a meaningful contribution to the social and economic well-being of the area, keeping the community informed as the project develops and responding quickly to questions and concerns.

There is widespread interest in the Company's Woodsmith Project (the Project) at local, regional and national levels. This is demonstrated by the ongoing media and stakeholder enquiries, as well as the levels of participation during the planning consultations and at Company events.

Anglo American (the Company) successfully engaged the community and other key stakeholders during the planning period and has continued to do so beyond, gaining widespread support for the Project. This has helped to provide the Company with a social license to operate. Maintaining this throughout the construction period is important to the successful delivery of the Project and is a key objective of the Company's board and management team.

1.2 Purpose

This Community and Stakeholder Engagement Framework (CSEF or the Framework) aims to set out a clear communications approach during the construction period which, when implemented correctly, can help to maintain the Project's social license to operate.

1.3 Scope

The Framework sets out an approach to community and stakeholder communications during the construction period. It outlines the overall strategy, identifies the main stakeholder groups and details the engagement objectives and activities. Stakeholders have been identified as those groups in the local area who have the potential to be impacted by construction, and as such does not include wider corporate stakeholders such as investors or customers.

The Framework sets out the roles and responsibilities of the Company and the principle construction contractors for implementing and managing its delivery.

1.4 Standards and compliance

The Framework is in compliance with planning obligations relating to community and stakeholder engagement including: producing a communications plan; the establishment of the Liaison Group Forum and Traffic Management Liaison Group; notification to neighbours of construction activities, particularly in relation to noise; dealing with complaints and initiatives to promote local benefits.

It is not within the scope of this plan to include engagement with the planning authorities and other statutory bodies in relation to the compliance with planning obligations and further environmental requirements, other than those specifically regarding community engagement.

1.5 Document review

The Company is committed to regularly reviewing its approach. This is the fifth time this document has been updated since the off-site highways improvement works were undertaken on the main transport route and construction started at Woodsmith, Ladycross Plantation, Lockwood Beck and Wilton. The principles of the Framework therefore remain unchanged, with the addition of the good practice learnt over the last five years.

The Framework will be reviewed on annual basis by the General Manager External Affairs and Corporate Relations Director, in consultation with the land, environment and planning team, and updated as necessary. It will be distributed to the list shown in section 1.6. Lessons learnt will be adopted into the working practices of the social performance team under the direction of the Corporate Relations Director.

1.6 Distribution list

- North York Moors National Park Authority
- North Yorkshire County Council
- Principle contractors

2 Engagement Strategy

2.1 Rationale

The strategy is based on the principle that the local community and key stakeholders should be kept informed of developments and in advance of them occurring. The failure to communicate often leads to a communications vacuum and this in turn leads to misinformation and rumours which is unhelpful for all stakeholders.

Similarly, providing channels for feedback to the Company in the first instance, including direct contact with the community relations team, allows local people or spokespeople to be engaged in matters that might affect them. Since construction started on the off-site highways works over five years ago, the vast majority of questions or concerns about the Project have come directly to the Company. This demonstrates the importance of developing and maintaining relationships 'on the ground'.

Keeping people informed is not just about notification of physical activities during the construction period, but is also about allowing a channel for feedback that might raise an issue or local knowledge that the Company or its contractor teams were not aware of. It also enables a channel to promote the benefits of the Project as well as engaging in other positive public relations activities.

Any materials that are prepared for public consumption to explain parts of the construction work are designed and drafted in a manner that promotes the understanding of works or issues in as clear and straightforward manner as possible.

2.2 Approach

1. **Conduct pre-briefings for key events or activities**
   Providing clear information before each phase of works commences at the Project sites detailing what construction will involve, when it will take place and the measures to limit impacts. Since

construction started this has included newsletters, mailouts, direct face-to-face meetings, drop-in events, public meetings, press releases and notices in the local media.

2. **Have effective ongoing management of local communications**
   Providing ongoing updates about construction progress and establish mechanisms that enable concerns to be raised and acted upon. This includes participation in the various liaison groups and clear processes to manage incoming queries or complaints. These have worked well since construction started. The Company also operates a 24-hour community helpline.

3. **Community benefit initiatives**
   Undertaking and promoting regular initiatives that deliver community benefits such as education schemes and employment and business opportunity information sessions. These have been ongoing since construction started and have been well received by the community.

Further details on the methodology for pre-briefings, ongoing management and community benefits initiatives are available in sections 4.2 – 4.4.

3 Stakeholder Identification

Stakeholder groups have been identified and engaged as the Project has developed and can be broadly categorised as follows:

1. **Site neighbours**
   Residential neighbours and/or landowners, businesses and organisations close to the individual construction sites. This also includes those directly affected in other areas such as those living close to key transport corridors or junctions. Approximately 70 households have been identified as 'site neighbours' to the Woodsmith, Ladycross Plantation and Lockwood sites and regular contact has been maintained since construction commenced. In addition, links with the neighbourhood of Dormanstown have been established since construction commenced at the Wilton site.

2. **Community representatives**
   This group includes elected representatives of the community including parish and town councils, local authority officers and councillors, and local MPs.

3. **Interest groups**
   Business networks, environmental bodies, other local clubs and groups.

4. **Education Institutions**
   This includes local schools, colleges, universities and other training providers.

5. **Media**
   A wide range of online, print and broadcast outlets and journalists are considered key stakeholders.

6. **General public**
   The wider public as accessed through media channels, the website, social media or site signage etc.

A register has been developed for each Project site for of these broad groups, which is reviewed and updated. Stakeholder engagement takes into account the needs of vulnerable and disadvantaged groups, making sure that information about the Project is accessible and people are able to contact the

Company and receive a prompt response. This is ensured by utilising a broad range of engagement channels, as set out in section 4, and holding public events in accessible venues.

4 Engagement Methodology

This section sets out how community and stakeholder communications will be handled.

4.1 Identify stakeholders

The broad stakeholder groups have been identified, together with specific stakeholders relevant to each of the construction sites that are most likely to be impacted by the works. This includes landowners and local residents in close proximity to the sites.

4.2 Pre-briefings for key events

Before each phase of construction starts, or before a specific construction activity that has the potential to impact stakeholders, it is important to provide information to the local community. For the purpose of this Framework these stages are defined as "construction events" (these are listed in Appendix 1). Each construction event triggers the requirement for pre-briefing activities. The level of pre-briefing activity will vary, taking into account the extent of the local impact anticipated.

The pre-briefing information will include details about what construction will involve and how people can contact the Company if they have questions or concerns. Reassurance will be given that measures will be taken to limit adverse impacts to an acceptable level and that planning conditions and other requirements are in place to ensure that this happens. As a minimum, the pre-briefing activities will include:

- Letters – Letters and or emails should be sent to those that are likely to be immediately affected. This might include neighbouring residents or households and businesses on access routes. As a courtesy, the same information will be sent to the local Parish Council, borough and county councillors covering those areas.

- Visits and phone calls – In addition to letters, affected households and businesses will be visited, or at the very least receive a telephone call.

For construction activities that are more significant, in terms of their potential for stakeholders to be affected, the Company will use the following pre-briefing methods. The precise details and extent of pre-briefing will be a matter of judgement and as a result of discussions between the contractor and the Company and, where appropriate, the planning authorities. Activities may include:

- Newsletter / Leaflet – A short summary newsletter or leaflet about the works will be made distributed, including local noticeboards and community facilities.

- Exhibitions / Open days – In the case of certain key events, such as the main shaft sinking, it will be appropriate to inform local residents and the wider general public through open days prior to works starting. This includes further information on exhibition boards and will be attended by key personnel from the Company and contractors, who are be able to respond to queries and provide reassurance on potential concerns. Ten of these sessions have taken place since construction started.

- Press release – If appropriate (often where a wider audience is potentially affected or interested in the works planned) then a press release will be prepared detailing the key facts. Any press release needs to be signed off by the Company in a timeframe that makes sure newspaper deadlines are met. Where possible, coverage should always appear in the week prior to the proposed activities beginning. The local media has been particularly useful in instances where the community beyond the immediate site neighbours could be affected, such as public highways disruption.

- Website updates – Details of key events are uploaded to the Company website. Some works may also require more detailed information and documents to be uploaded.

- Social media updates – The Company will control its social media accounts. As above, the contractor will be expected to provide the relevant details to the Company in a timely fashion so the relevant information can be released through its social media channels.

- Stakeholder briefings – In some circumstances specific stakeholders will be individually briefed to inform them of key events. This may include elected representatives, local authority officers or interest groups. The Company will take the lead on such matters and will involve contractors where appropriate.

4.3 Ongoing management

Local residents and stakeholders will continue to be engaged throughout construction (i.e. general updates in addition to those covered under 'key events' in appendix 1). This will enable the Company to provide regular updates of the Project's progress, and that it is being delivered in accordance with planning consents and any other Company commitments. Alternatively, if the Project is not progressing as expected it is important that stakeholders are provided with an explanation and reassurance that corrective measures will be implemented.

In addition, on-going engagement will include a range of communication channels that enable stakeholders to raise issues and ask questions and for the Company to respond to these.

4.3.1 Liaison Group Forum

The Liaison Group Forum (LGF) was established prior to the commencement of construction and has met quarterly. It is chaired by the Company and its membership includes representatives from the National Park Authority, parish and town councils and wider community stakeholder representation as appropriate. The meetings take place in community venues, such as village halls, close to the Woodsmith site and are open to the general public to attend and to ask questions.

The purpose of the group is to facilitate liaison between local stakeholders about construction, providing updates about progress, and to enable issues and concerns to be raised and resolved.

4.3.2 Industrial Business Group

The Industrial Business Group (IBG) was established to facilitate liaison between the businesses based at Wilton International and residents from the neighbourhoods in close proximity of the site.

Meetings are held bi-monthly and attended by the major businesses on the site, local councillors and residents. The Company joined the group once construction started on the Wilton site.

4.3.3 Traffic Management Liaison Group

The purpose of this group is to facilitate liaison between local authorities and other interested stakeholders in regard to construction traffic. The group, which meets quarterly, oversees the management and monitoring of the Construction Traffic Management Plan (CTMP) and is chaired by the Company. The meetings take place after the LGF meetings, on the same day and venue, with traffic issues raised by the LGF addressed by the group.

There is representation from the National Park Authority, highways authorities, local authorities, the police and other stakeholders as invited.

4.3.4 24-hour community helpline

To ensure that there are accessible points of contact for the local community and wider stakeholders a 24-hour community helpline has been established, which is delivered by a specialist contractor. In addition there is a community email address, which is managed by the Company.

4.3.5 Regular briefings and updates

Key individuals and organisations are regularly briefed and updated. Similarly to pre-briefings for key events, updates are communicated through the following channels:

- Public meetings and presentations – Parish council and town council meetings are regularly attended, together with presentations to local interest groups.

- Site visits and meetings – visits to the Project sites for key stakeholders have been an effective way to communicate site activity and progress. In addition, drone footage of the project sites is regularly used to show progress and is used in Project presentations and on the Company's website.

- Press releases – the print and broadcast media are utilised extensively to communicate with the wider community and at a regional and national level.

- Newsletters, website and social media – regular updates produced throughout construction via the website, leaflets, newsletters, social media and publications relating to specific issues, such as careers. Videos, including footage of the sites and interviews with key Project personnel have also been an effective tool.

4.4 Community benefit initiatives

The Company has made a number of commitments to benefit the local area during construction such as providing employment and supply chain opportunities, training schemes, school outreach programmes and funding community projects. It important that these are implemented and widely promoted so that the community and stakeholders are aware that the Company's commitments are being delivered. The activities and initiatives, some of which are planning obligations in the S106 agreements, are outlined below:

- Funding to Scarborough Borough Council and Redcar and Cleveland Council to identify and prepare local people for employment opportunities.

- Funding to raise awareness of science, technology, engineering and maths (STEM) related careers in schools in North Yorkshire and Redcar and Cleveland.

- Targets specified in the S106 agreement - take on 50 apprentices, recruit 15 local students on the Company's Undergraduate Programme and train 300 adults.
- Quarterly employment opportunity sessions to promote job opportunities to local people and meet the buyer events for local businesses.
- Education outreach initiatives, careers events and presentations.
- Funding community projects through the Woodsmith Foundation.

4.5 Dealing with complaints

The Company aims to respond promptly to complaints and concerns, ensuring that issues are investigated and resolved as quickly as possible. The Company's approach is detailed in its Complaints Procedure – see Appendix C.

5 Roles and Responsibilities

This section provides a framework that identifies responsibilities for the delivery and management of community and stakeholder engagement, focusing on roles of the Company and the principle construction contractors. The Company will be responsible for all community and stakeholder engagement during construction, supported by each construction contractor as required.

5.1 Anglo American

The Company will be responsible for:

- Identifying key stakeholders likely to be impacted by the works.
- Undertaking pre-briefing activities before construction starts such as:
    - Open Days / exhibitions as appropriate.
    - Producing information outlining what is involved, impacts and mitigation, contact information, etc.
    - Direct correspondence with neighbours and landowners about construction events
- Liaison with the planning authorities and community representatives, including chairing the Liaison Group Forum and Traffic Management Liaison Group.
- Media relations.
- Manage the complaints procedure.
- Producing project newsletters, social media and updating the website.
- Direct engagement and briefings with key stakeholders including local residents, community representatives and interest groups.

5.1.1 Social performance team

The Company's social performance team is responsible for implementing the Framework in liaison with others in the Company as appropriate.

The Company's Corporate Relations Director has overall responsibility for all company communications and external relations. The Corporate Relations Director chairs the Liaison Group Forum.

The General Manager External Affairs, reporting to the Corporate Relations Director, manages the implementation of the approach detailed in the Framework. The Local Liaison Officer, Social Programmes Manager and Education Programme Manager report to the GM External Affairs, and are further supported by the EA to the Corporate Relations Director.

The social performance team work closely with other departments in the Company in the implementation of the Framework, particularly the land, environment and planning team as well as the project development team. They assist in providing relevant information, investigating and resolving complaints, and attending Company events and public meetings as required. The Company's Logistics Manager chairs the Traffic Management Liaison Group.

5.2 Construction Contractors

Having developed and maintained positive relationships with key local stakeholders since the Project was launched in 2011, Anglo American takes the lead role in all community and stakeholder engagement. Each of the construction contractors will be required to support the Company's stakeholder engagement approach as follows:

- Provide expected durations of phases or work, their potential impact on the local community and mitigation measures where required.
- Provide details of any expected public transport diversions, delays, planned road closures, impacts on highways, interrupted access for residents/ businesses, or other expected community disruption.
- Participate in employment opportunity sessions, meet the buyer events, and education outreach events as required.
- Cooperate with Anglo American in media events and provide information to the Company for publications, the website, newsletters, etc.
- Adherence to Anglo American's communications protocols and guidelines.
- Attend the liaison groups, parish/town council meetings and assisting Anglo American as required.
- Ensure that all sub-contractors comply with stakeholder and community relations requirements.

Appendix A – Construction Events

The following provides a list of construction events which trigger the requirement for pre-briefing activities, as outlined in section 4.2. The list is not exhaustive and there may be other events or activities not listed here that could be classified as construction events as a result of discussions between the Company and its contractors.

The construction events for the purposes of this Framework are:

- Any significant geotechnical investigation or drilling works
- Main Woodsmith Mine shaft sink
- Main Lockwood Beck shaft sinking
- Main Ladycross Plantation shaft sinking
- MHF construction
- Harbour construction
- Other construction activities with the potential to affect stakeholders including site neighbours or road users in regard to noise, light, disruption to the public highway, etc. Examples include an abnormal load arriving to site or a short period of piling.

Appendix B – Engagement Activities Summary

The table below provides an 'at a glance' overview of the main community and stakeholder engagement activities, together with the respective roles of Anglo American and contractors.

	Pre-briefing activities	Ongoing management	Community benefit initiatives
Anglo American	• Establish Liaison Group Forum and Traffic Management Liaison Group • Project update newsletter • Media, website update, social media • Briefings with site neighbours, landowners, community representatives and other key stakeholders as identified • Produce leaflet detailing upcoming construction activities • Send letters to stakeholders likely to be immediately affected • Hold public open days / exhibitions	• Chair Liaison Group Forum and Traffic Management Liaison Group • Attend the Industrial Business Group • Manage 24-hour community helpline and • Attend parish and town council meetings quarterly • Regular updates to site neighbours, landowners, community representatives and interest groups • Site visits • Media, website update, social media • Manage complaints procedure	• Training targets and promotion of initiatives funded by the S106 • Promote activities of the Sirius Minerals Foundation • Organise meet the buyer events • Organise regular employment opportunity sessions • Deliver education outreach programmes
Construction Contractor	• Provide information to Anglo American to be used in leaflets, letters, web content, etc., as required • Attend public open days/exhibitions and meetings with stakeholders as required	• Attend liaison groups, parish council and other meetings as required • Provide information to support on-going community and stakeholder relations • Participate in media events as required • Adherence to complaints procedure, media protocol and crisis response procedure	• Involvement in community benefit initiatives as required

Community engagement is tracked across these three elements. Activities and complaints are reported in the Company's annual Responsible Business Report. Minutes of the Liaison Group Forum, which includes community engagement as a standing agenda item, are published on the Company's website.

By being proactive in building and maintaining relationships in the community, the Company is always receiving feedback about its performance. This helps to inform the Company on what it could be doing better, enables it to respond quickly to concerns and pre-empt them in the future and is an important part of annual review of the Framework.

Appendix C – Complaints Procedure

This procedure outlines the Company's standards in handling complaints and the process of managing complaints from receipt through to resolution. The procedure has been updated to take into account the lessons learnt during the first two years of construction.

1 Standards for Handling Complaints

- All complaints will be treated seriously, fairly and with courtesy;
- Complaints will be responded to quickly – we will acknowledge a receipt of a complaint straight away wherever possible;
- We will investigate and aim to resolve complaints within a maximum of three days, making sure that initial feedback is provided within one day; and
- We publish information about complaints, with the identity of the complainant kept confidential, to the Liaison Group Forum and in the Company's annual Responsible Business Report.

2 Stages of the Complaints Procedure

2.1 Receipt of complaint

The vast majority of complaints are received directly by the Anglo American community relations team through a variety of channels, e.g. directly to a team member, via the general email, social media, parish council meetings or the 24-hour community helpline. Relationships with the regulatory authorities are well established and complaints received by them are forwarded to the Company's community relations team to investigate.

The team aim to acknowledge a complaint straight away and ascertain the relevant details as soon as possible.

Occasionally a complaint is made directly to a Project site. In this instance the community relations team will be informed and further communication with the complainant managed by them.

2.2 Investigation

In all cases the community relations team will notify the Anglo American site manager, the environment team and the logistics team (where complaints are related to traffic). The site manager will lead the investigation, delegating where appropriate and liaise with the relevant contractor. All relevant personnel will be kept updated.

If remedial action is required this will be implemented as quickly as possible in consultation with the environment and planning team, community relations team and others as appropriate.

2.3 Feedback

The community relations team will feedback to the complainant within a maximum of three days, with initial feedback given within one day. Further details will be sought from the complainant if required.

The complainant will be given the details of any remedial action taken and have the opportunity to discuss the outcome of the investigation with the community relations team, who will involve others as appropriate. If further relevant information comes to light, the complaint will be investigated again.

2.4 Log and Review

Complaints are logged and reported to the next Liaison Group Forum (LGF) meeting. The minutes of LGF meetings are published on the Company's website.

Complaints are reviewed to establish whether action can be taken to reduce the likelihood of similar complaints in the future, and whether the way in which the complaint was dealt with could be improved.

ATTACHMENT B – COMPLAINTS PROCEDURE

Complaints Procedure

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Document Verification				
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1	17/12/2020	M. Parsons	G. Edmunds	Issued for Use

Complaints Procedure

Contents

Complaints Procedure

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The vast majority of complaints are received directly by the Woodsmith community relations team through a variety of channels, e.g. directly to a team member, via the general Crop Nutrients email, social media, parish council meetings or the 24-hour community helpline. Relationships with the regulatory authorities are well established and complaints received by them are forwarded to the Company's community relations team to investigate.

The team aim to acknowledge a complaint straight away and ascertain the relevant details as soon as possible.

Occasionally a complaint is made directly to a Project site. In this instance the community relations team will be informed and further communication with the complainant managed by them.

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In all cases the community relations team will notify the Woodsmith site manager, the environment team and the logistics team (where complaints are related to traffic). The site manager will lead the investigation, delegating where appropriate and liaise with the relevant contractor. All relevant personnel will be kept updated.

If remedial action is required this will be implemented as quickly as possible in consultation with the environment and planning team, community relations team and others as appropriate.

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ATTACHMENT C – PRECAUTIONARY METHOD OF WORKING

Precautionary Method of Working (PMoW) for Site Clearance (Ecology)

The Precautionary Method of Working (PMoW) for site clearance predominantly relates to the protection of reptiles and nesting birds which may be present within the development site although requirements for otters and badgers have also been included for completeness.

General overview

The construction site manager will ensure that anyone undertaking construction works on the site (including sub-contractors) is made aware of the potential for the site to support nesting birds, common reptile species and other protected species, where to expect them, their protected status and the procedure (see below) to follow in the unlikely event that nesting birds or common reptiles are discovered during works. Where applicable this advice will be given through site inductions, ecological tool box talks or similar.

Should any nesting birds, reptiles or other species be discovered during construction, which are likely to be effected by the development, works will cease immediately. The construction site manager will then seek the advice of a suitably qualified and experienced ecologist and works will only proceed in accordance with the advice they provide.

Reptiles

Within the development's construction zone the following methods of working will be adopted:

- All clearance works will be undertaken when reptiles are likely to be fully active i.e. during the period March/April to September/October inclusive, but this is weather and temperature dependent;
- Where clearance works cannot be undertaken within this period, additional surveys and/or mitigation measures may be required to confirm the absence of reptiles prior to clearance works, and a suitably qualified ecologist (the project ecologist) should be on site during the works to inspect areas immediately prior to clearance;
- Clearance of dry stone walls, logs, brash, stones, rocks, or piles of similar debris will be undertaken carefully and by hand and supervised by a suitably qualified ecologist;
- Clearance of tall vegetation (any vegetation over 150mm) should be undertaken using a hand held strimmer or brush cutter with all cuttings raked and removed the same day. Cutting will only be undertaken in a phased way which may either include:
    - Cutting vegetation to a height of no less than 30mm, clearing no more than one third of the site in anyone day or;
    - Cutting vegetation over three consecutive days to a height of no less than150mm at the first cut, 75mm at the second cut and 30mm at the third cut;
- Following removal of tall vegetation using the methods outlined in above remaining vegetation will be maintained at a height of 30mm through regular mowing or strimming to discourage common reptiles from returning;

- Ground clearance of any remaining low vegetation (if required) and any ground works will only be undertaken following the works as above;
- Any trenches left overnight will be covered or provided with ramps to prevent reptiles from becoming trapped and enable escape; and
- Any building materials such a bricks, stone etc. will be stored on pallets to discourage reptiles from using them as shelter. Any demolition materials will be stored in skips or small containers rather than in piles on the ground.

Nesting Birds

Within the development's construction zone the following methods of working will be adopted:

- Vegetation clearance that is required will be undertaken outside of the breeding bird season (i.e. the works will be undertaken between September and February);
- Any demolition work that is required will be undertaken outside of the breeding bird season (i.e. between the works will be undertaken September and February);
- Where clearance works or demolition works cannot be undertaken out with this period, additional surveys maybe required to verify absence of breeding birds prior to clearance works and an ecologist should be on site during the works to inspect areas immediately prior to clearance, or at least no less than 24 – 48 hours before the works commence. The area of inspection should extend for at least 500m from the area of works;
- Where felling outside the breeding season is not possible a sensitive felling methodology will be implemented, involving the identification of specific areas to be felled, followed by surveys for occupied nests (or nests being built) being carried out by a suitably qualified ecologist (the project ecologist) undertaken a maximum of 24 - 48 hours prior to the commencement of works) and extending over an area of at least 500m from the area of works;
- If active birds' nests are found within the following distances from site, the area should be roped off and no works should be undertaken in the these exclusion areas until the birds have fledged and the nests are empty:
    - Common crossbill - 150m;
    - Nightjar - 500m;
    - Goshawk - 150m; and
    - All other species - 10m.
- Alternatively, liaison with Natural England may be undertaken to agree the approach to working within the exclusion zones of the nest sites specified above.

Other Protected Species

Within the development's construction zone the following methods of working will be adopted:

- Dust minimisation methodologies will be implemented and adhered to at all times;
- Construction lighting will be directed away from areas of retained habitat wherever possible;
- Pollution prevention controls will be implemented and adhered to at all times; and
- All excavations will be covered every night to reduce the risk of otters, badgers or any other species falling into the excavations and becoming stranded or if this is not possible then a means of enabling their escape will be provided.

Project Title / Facility Name:

Woodsmith Project

Document Title:

NOISE & VIBRATION MANAGEMENT PLAN - PHASE 5 - NYMNPA CONDITION 18 (ROYAL HASKONINGDHV) - LADYCROSS

NYMNPA

28/07/2022

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WOODMITH PROJECT

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NOISE AND VIBRATION MANAGEMENT PLAN - PHASE 5 - NYMNPA CONDITION 18 - LADYCROSS PLANTATION

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REPORT

Phase 5 - Ladycross Plantation Noise and Vibration Management Plan

Ladycross Phase 5 - NVMP

Client: STRABAG AG

Reference: 40-STS-LC-2100-EN-PL-00027 Rev B

Status: 00/Final

Date: 26 July 2022

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Checked by: TB

Date: 26 July 2022

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Date: 26 July 2022

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Project related

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Appendices

1 INTRODUCTION

1.1 Purpose of this Report

1.1.1 In 2014 a planning application (reference NYM/2014/0676/MEIA) was submitted to North York Moors National Park Authority (NYMNPA) for permission to develop a polyhalite mine and underground Mineral Transport System (MTS). Planning permission was subsequently granted in 2015 subject to conditions, as varied in February 2018 by NYM/2017/0505/MEIA.

1.1.2 This document has been prepared on behalf of STRABAG AG, who are the contractor delivering the works on behalf of Anglo American Ltd (Anglo American); and details the requirements with respect to noise and vibration management for the Phase 5 Works (see Paragraph 1.1.4 below) at the Ladycross Plantation site.

1.1.3 This document is required to partially satisfy the requirements of Condition 18 of the NYMNPA planning permission. This planning condition states that:

Table 1-1: Condition NYMNPA 18 Noise and Vibration Management Plan

NYMNPA 18	Compliance with Condition NYMNPA-18
Prior to the commencement of each Phase of Construction at Dove's Nest Farm or Lady Cross Plantation, a Noise and Vibration Management Plan (NVMP) for the control, mitigation and monitoring of noise and vibration for both construction and operational phases at the two sites shall be submitted to and approved in writing by the MPA in consultation with the SBC EHO. The scheme shall set out the following:	This document addresses Phase 5 Works at Ladycross Plantation. Works at Woodsmith Mine are addressed in a site specific NVMP and are therefore not addressed in this Plan.
Noise-sensitive receptors for which predictions shall be made and at which the noise and vibration limits shall apply and which shall include recreational receptors.	Section 3.1
Predicted noise levels at the noise-sensitive receptors from noise and vibration generated at the DNF and LCP sites for the key construction phases during the forthcoming year including any periods in which the higher daytime limit of 70 dB L_{Aeq} shall apply (permitted 56 days for temporary works to create noise-reducing bunds and/or barriers as per Conditions 20 and 22).	Section 3, and Appendix A
The best practicable means which will be used to control noise and vibration levels on site including such measures proposed in the Environmental Statement (September 2014 as updated by the Supplementary Environmental Statement dated February 2015) and the Supplementary Environmental Statement dated July 2017 (updated by further information dated October and November 2017) as relevant. Such measures shall include, but are not limited to: the use of the quietest available plant, equipment and techniques; the regular maintenance and inspection of such plant and equipment; the use of cladding, attenuators and barriers to reduce noise levels from noisy plant and operations; the specification of appropriate reversing alarms to minimise annoyance; and, measures to reduce vibration and air overpressure during blasting.	Section 5
Details of the noise and vibration monitoring system to be installed around the DNF and LCP sites to continuously log noise levels during construction and operation. The system shall include at least six noise monitors installed around the boundary of the Dove's Nest site and at least four monitors at key residential receptors near the Dove's Nest site and at least four noise monitors around the Lady Cross Plantation Site and at least three monitors at key residential receptors near the Lady Cross Plantation site.	Section 4

NYMNPA 18	Compliance with Condition NYMNPA-18
The precise number and location of noise monitors shall be set out in the NVMP. The developer shall use reasonable endeavours to obtain access to the residential receptor properties for the installation of noise monitors and only if access cannot be obtained the number or location of noise monitors may be reduced. The MPA and the SBC EHO and/or their advisers shall be granted access to inspect the noise and vibration data whenever required, records of the data should be kept for a reasonable period and these records should be accessible by the public.	Section 3, Section 4 and Figure B.1
Details of the procedure to be followed in the event that the noise predictions detailed in the NVMP or the noise limits detailed in conditions 20 to 23 are exceeded. Such procedures shall require the investigation of the reasons for the breach of the limits and the cessation of the activity causing the breach until such a time as additional mitigation can be provided.	Section 5
Details of how the residents will be informed and consulted about the site operations and progress, particularly in regard to blasting and especially noisy operations including details of complaints logging and management procedures and a 24-hour telephone incident hotline. Details of the procedure for investigating complaints and informing complainants of the results of such investigations and of any actions resulting from them.	Section 5
The NVMP shall be adhered to at all times unless agreed previously in writing by the MPA.	
The NVMP shall be updated and agreed whenever appropriate to reflect changes in the programme during construction and operation and at intervals not less than 6 months after the initial start on site and thereafter annually.	Section 1

1.1.4 This NVMP relates to the Phase 5 Works at Ladycross Plantation only. These works comprise the following:

- Mobilisation of shaft sinking contractors, including installation of shaft sinking equipment and shaft platform civils and infrastructure;
- Construction of foreshaft, including secant piling;
- Drilling of pilot borehole;
- Sinking of proposed MTS shaft via blind bore drilling method;
- Installation of the shaft lining;
- Grouting of shaft anulus and dewatering;
- Revised design to security cabin; and
- Addition of showers to existing welfare.

1.1.5 According to the Construction Environmental Management Plan (CEMP; reference 40-STS-LC-2100-EN-PL-00008), the following activities in the Phase 5 Works will be undertaken 24 hours per day: drilling of pilot borehole, excavation of the shaft via blind boring, installation of shaft lining, grouting of shaft anulus and dewatering. All other works will be undertaken during daytime hours only (07:00 – 19:00). Contractors responsible for implementing the Phase 5 Works have confirmed that all works associated with previous phases at the site will be completed prior to the start of the Phase 5 Works.

Planning Conditions

1.1.6 In addition to Condition NYMNPA 18, two further conditions NYMNPA 22 and NYMNPA 23 establish noise limits relating to the Ladycross Plantation site (see **Section 2.2**). Planning condition detail is provided in Table 1-2 and Table 1-3.

Table 1-2: Condition NYMNPA 22 Noise and Vibration Management Plan

NYMNPA 22	Compliance with Condition NYMNPA-22
Day-time (07.00 hrs to 19.00 hrs) noise levels $L_{Aeq,1hr}$ from mine construction at the Lady Cross Plantation site, excluding blasting operations, shall not exceed 55 dB $L_{Aeq,1hr}$ and for short-term, construction activities solely relating to the demolition of existing buildings and erection of new structures excluding earth mound and bunds shall not exceed 65dB $L_{Aeq,1hr.}$ An upper limit of 70 dB $L_{Aeq,1hr}$ for the purposes of temporary noisy operations to provide noise-reducing earth bunds and / or barriers may be permitted for up to 56 days in any calendar year provided such temporary operations are specified and agreed in the NVMP described in Condition 18. Each calendar day when the higher temporary noise level is exceeded shall be counted as one day. Noise levels shall be measured in accordance with BS 4142:2014 and shall apply at the curtilage boundary of residential properties and at the following recreational receptors: on the open access land to the north and east of the site at OS Grid Reference locations 810684 and 819077.	Section 3, and Appendix A

Table 1-3: Condition NYMNPA 23 Noise and Vibration Management Plan

NYMNPA 23	Compliance with Condition NYMNPA-23
Evening (19.00 hrs to 22.00 hrs) and night-time (22.00 to 07.00 hrs) noise levels $L_{Aeq,1hr}$ from mine construction at the Lady Cross Plantation site, excluding blasting operations, shall not exceed 42 dB $L_{Aeq,1hr}$. Noise levels shall be measured in accordance with BS 4142:2014 and the limits apply at the curtilage boundary of residential properties.	Section 3, and Appendix A

1.1.7 Condition NYMNPA 26 relates to vibration arising from construction activities other than blasting, details are provided in Table 1-4.

Table 1-4: Condition NYMNPA 26 Noise and Vibration Management Plan

NYMNPA 26	Compliance with Condition NYMNPA-26
Vibration from construction work on site and during operation (but excluding blasting) shall not exceed 0.3mm/s (PPV) at any residential property at any time.	Section 3.3

1.1.8 In this document, the term *"construction"* includes all physical and related engineering and construction activities associated with the Phase 5 Works, as described above. Updates to this plan will be prepared and submitted to the NYMNPA for approval in advance of subsequent construction phases and following any material design or method change.

2 GUIDANCE

2.1 Legislation and British Standards

2.1.1 Wherever practicable, construction will be carried out in accordance with:

- Planning Practice Guidance for Minerals (PPGM), 2014[1]
- BS 5228:2009+A1:2014 *Code of Practice for noise and vibration control on construction and open sites*[2].

2.2 Construction Limits

2.2.1 The PPGM includes noise limits which align with the established noise limits detailed in NYMNPA Condition 22 and NYMNPA Condition 23.

2.2.2 The established noise limits detailed in NYMNPA Condition 22 and NYMNPA Condition 23 (as measured at the identified receptors) remain as:

- 55 dB $L_{Aeq,1hr}$ for daytime (07:00 – 19:00);
- 65 dB $L_{Aeq,1hr}$ for the demolition of buildings and erection of new structures;
- Up to 70 dB $L_{Aeq,1hr}$ for temporary noisy operations to provide noise-reducing earth bunds and / or barriers; and
- 42 dB $L_{Aeq,1hr}$ for evening and night-time (19:00 – 07:00).

2.2.3 Established vibration limits for construction works (other than blasting) shall not exceed 0.3 mm/s. Vibration limits for blasting activities are outlined in Conditions 27 and 28, however blasting works are not anticipated at the Ladycross Plantation Site and are therefore not considered in the NVMP.

Construction Method

2.2.4 Contractors responsible for implementing these Phase 5 Works have provided details of the construction plan, number and type of plant items to be used and location/duration of construction activities within the site. Further detail is provided in the Phase 5 Construction Method Statement (CMS) (reference 40-STS-LC-2100-CN-MS-00005).

2.2.5 **Appendix A** details the plant items included within the model, their sound power level and location on site. Predictions of noise levels based upon these details are assessed within this NVMP.

[1] *Planning Practice Guidance for Minerals (PPGM), 2014 Department for Levelling Up, Housing and Communities (/government/organisation/department-for-levelling-up-housing-and-communities) and Ministry of Housing, Communities & Local Government (/government/organisations/ministry-of-housing-communities-and-local-government. (URL:https://www.gov.uk/guidance/minerals, accessed 03 February 2022)*
[2] *British Standards Institute (2014). BS 5228:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites*

3 PREDICTED CONSTRUCTION NOISE AND VIBRATION LEVELS

3.1 Baseline Receptor Locations

3.1.1 The Environmental Statement (ES) which accompanied the planning application included (Part 2, Chapter 8, Noise and Vibration) an assessment of construction noise at the following nearby residential locations:

- Ladycross Caravan Park Owner's Property, approximately 320m from the nearest site boundary;
- Davidson Farm, approximately 425m from the nearest site boundary; and
- Watergate Farm, approximately 365m from the nearest site boundary.

3.1.2 For the purposes of this NVMP the receptors detailed above are the residential receptors at which the noise limits in Conditions 22 and 23 apply, and for which predictions of construction noise were undertaken.

3.1.3 The following recreational receptors, detailed within Condition 22, were included within the construction noise calculations:

- Open access land to the north of the site (OS Grid Reference 816084), OSGB36 co-ordinates (m) X:481600, Y:508400; approximately 310m from the nearest site boundary; and
- Open access land to the east of the site (OS Grid Reference 819077), OSGB36 co-ordinates (m) X:481900, Y:507700, approximately 60m from the nearest site boundary.

3.2 Predicted Noise Levels

3.2.1 3-D noise modelling was undertaken using computational noise modelling software SoundPLAN (v8.2) to predict construction noise levels associated with the Phase 5 Works. **Table A.1** and **Table A.2** in **Appendix A** show the predicted construction noise levels for the Phase 5 Works.

3.2.2 Predicted noise levels from the Phase 5 Works do not exceed the agreed construction noise limits at any of the identified noise-sensitive receptors during the day or night-time when the activity timing and physical mitigation measures described in **Section 5.3** are adopted. It should be noted that the noise model setup and inputs are considered to be conservative and that exceedances of the noise limits during normal operations are therefore not anticipated.

3.3 Vibration

3.3.1 Ground-borne vibration assessments can be drawn from the empirical methods detailed in BS 5228-2:2009+A1:2014; in the Transport and Road Research Laboratory Research Report (TRRL) 246: Traffic induced vibrations in buildings 2; and within the Transport Research Laboratory (TRL) Report 429 (2000): Ground-borne vibration caused by mechanical construction works.

3.3.2 A series of calculations, in accordance with the empirical methods referred to above, were carried out based on typical construction activities, applying reasonable worst-case assumptions, in order to determine set-back distances at which critical vibration levels may occur. These were presented in the ES and are reproduced in **Appendix A**, **Table A.4**.

3.3.3 During Phase 5, the only potential source of vibration at residential receptors would be HGV movements along an uneven haul route.

3.3. The main haul routes through the site are shown on Drawing Phase 5 General Arrangement Plan (40-STS-LC-2100-PA-22-20116). The minimum distance between the primary haul route and any of the surrounding residential receptors is over 350m. At this distance, ground-borne vibration levels will be significantly lower than 0.3mm/s at all nearby sensitive receptors, i.e. significantly below levels which are considered to be *"just about perceptible in residential environments"*[3].

[3] British Standards Institution (2014). BS5228:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'

4 NOISE AND VIBRATION MONITORING PROGRAMME

4.1 Vibration Monitoring

4.1.1 As detailed within Section 3.3 of this NVMP, construction activities during Phase 5 will not give rise to significant levels of vibration at nearby residential receptors.

4.1.2 The construction methodology for the Ladycross Plantation site is similar to works that are being undertaken at Lockwood Beck. There have been no complaints or incidents from vibration at the Lockwood Beck site

4.1.3 Given the experience and knowledge gained from the Lockwood Beck site and the distance between the Ladycross Phase 5 Works and the residential receptors, vibration impacts are not anticipated. Vibration monitoring is therefore not proposed.

4.2 Noise Monitoring

4.2.1 Condition NYMNPA 18 specifies that continuous noise monitoring is undertaken during construction and operation at three key residential receptor locations near the Ladycross Plantation Site. Residential receptor locations are outlined in **Section 3.1.1**.

4.2.2 Monitoring is currently being undertaken both on and off site at the following monitoring locations:

- LC-NM1 – Ladycross Caravan Park Owner's Property;
- LC-NM2 – Centre of the site;
- LC-NM3 – Davidson Farm; and
- LC-NM4 – North-east boundary of the site.

4.2.3 Noise monitoring locations are presented in **Appendix B, Figure B1**. The redline boundary shown on **Figure B1** is the land ownership boundary.

4.2.4 Although Watergate Farm is closer to the site boundary than Davidson Farm, similar construction noise are anticipated at these receptors due to the distance to the works and the intervening ground between the works and the receptors. This is confirmed by the noise predictions presented in **Appendix A**.

4.2.5 The noise measurements are conducted in accordance with the guidance contained in BS 7445 parts 1[4] and 2[5].

[4] *British Standard Institution (2003) BS 7445-1:2013 Description and measurement of environmental noise – Guide to quantities and procedures*
[5] *British Standard Institution (1991) BS 7445-2:1991 Description and measurement of environmental noise – Guide to acquisition of data pertinent to land use*

4.2.6 The sound level meters are fully calibrated, traceable to United Kingdom Accreditation Service (UKAS) standards and satisfy the requirements of BS EN 61672-1:2013[6] for a 'Class 1' Sound Level Meter (SLM).

4.2.7 The SLMs record LAeq, LAmax, LA90, and LA10 data with a 'fast' time constant and A-weighting. **Appendix C** presents descriptions of these terms.

4.2.8 The noise measurements are being conducted in accordance with BS 7445 with the SLM microphone mounted on a tripod or secured mounting pole at 1.5m above ground level and 3.5m away from any reflecting surface other than the ground. The instruments will be calibrated at monthly intervals during the monitoring period, and before and after any battery change using a portable field calibrator. Any deviations in the calibration level will be noted and reported within the summary reports.

4.2.9 The SLMs operate using a system of real time alerting which allows remote monitoring of noise levels and indication of noise levels approaching and/or breaching the limits. Alerts are managed by the Contractors who, following an investigation as to the cause of any alert (assisted by live audio observations provided by the monitoring equipment located at the boundary), will report the alert to Scarborough Borough Council (SBC) and the NYMNPA as necessary.

4.2.10 The SLMs are inspected during each field calibration and maintenance visit and any faults will be identified and rectified during the visits. Should faults require off-site repair a replacement SLM will be installed during the repair period.

4.2.11 Monitoring of weather conditions including wind speed and direction, rainfall, temperature and humidity is being carried out simultaneously at the Ladycross Plantation Site.

4.2.12 Reports will be provided monthly to SBC and NYMNPA. The report will contain details of the type and system of sound level meters used and a summary of the measured noise data at each location with corresponding weather data and survey notes.

[6] *British Standard Institution (2013) BS EN 61672-1:2013 Electroacoustics. Sound level meters - Specifications*

5 MITIGATION AND PROCEDURES

5.1 Purpose of the Section

5.1.1 This section outlines measures to be taken by the Contractors to limit, and manage the impact of, noise. This section also outlines the Best Practicable Means and specific mitigation actions to be adopted.

5.2 Best Practicable Means

5.2.1 The Control of Pollution Act 1974 and BS 5228 define a set of Best Practice working methods and mitigation measures, referred to as Best Practicable Means (BPM). The following measures will be adopted:

- Weekly construction meetings will take place to discuss the minimisation of noise emanating from the site, the potential for noise reduction for any upcoming activities and to identify any potential concurrent activities which may lead to noise levels requiring the upper limit of 70 dB $L_{Aeq,1hr}$. Occasions requiring these upper limits will be reported to the NYMNPA and SBC prior to the activities occurring and will be included within the regular communication to residents detailed within **Section 5.4**;
- Locating temporary plant so that it is screened from receptors by on-site structures, such as site cabins;
- Where practicable, not undertaking noisy activities concurrently close to residential receptors;
- Using modern, quiet equipment and ensuring such equipment is properly maintained (see **Section 5.2.8** below) and operated by trained staff (see **Section 5.2.10** below);
- Applying enclosures to particularly noisy equipment where possible;
- Ensuring that mobile plant is well maintained such that loose body fittings or exhausts do not rattle or vibrate;
- Ensuring plant machinery is turned off when not in use;
  undertaking daily, pre-start inspections of plant and machinery;
- Providing local residents with 24-hour contact details for a site representative in the event that disturbance due to noise from the construction works is perceived, this number to be displayed at the site entrances (see **Section 5.4.1**); and
- Informing local residents about the construction works, including the timing and duration of any particularly noisy elements (see **Section 5.4.3**).

Management Structure and Responsibilities

5.2.2 While overall responsibility for compliance with environmental and approvals requirements will remain with Anglo American, all Contractors working on site are accountable for undertaking the construction activities in accordance with the requirements of this NVMP.

5.2.3 The CEMP provides details of the lines of responsibility for environmental management during the Phase 5 Works.

5.2.4 The Environmental Manager/Project Manager (or deputy) for each Contractor will be on site during working hours and will be responsible for robust implementation of noise management and mitigation measures.

5.2.5 The Operations Director/Project Manager (or deputy) for each Contractor is responsible for implementation of the appropriate Environmental Policy and the CEMP through:

- Compliance with contractual requirements regarding environmental matters;
- Adherence to the NVMP and associated control measures;
- Designated responsibility for environmental control during the works;
- Regular meetings with project team members to review environmental matters;
- Regular reporting to the employer on environmental matters;
- Ensuring adequate resources are made available;
- Managing and advising on environmental matters affecting the Project with the assistance of the Employer's Environment Manager, the Contractor's Environmental Manager and Environmental Inspector;
- Reporting to the Employer's Environment Manager on implementation of the NVMP;
- Carrying out regular internal audits and procedure review on environmental matters;
- Reviewing and mitigating all environmental impacts identified in submitted method statements;
- Recording and maintaining all environmental matters/incidents in accordance with reporting procedures; and
- Ensuring all team members work in accordance with the NVMP.

5.2.6 The Operations Director/Environmental Manager/Project Manager for the contractors, and their appointed subcontractors, engaged for the Phase 5 Works will, with the Employer's Environment Manager acting as coordinator, liaise to ensure regular review of environmental matters and appropriate assignment of responsibilities for Contractors' specific site activities.

Maintenance

5.2.7 Maintenance of plant will be carried out routinely and in accordance with the manufacturers' guidance.

5.2.8 A daily safety inspection of all plant and equipment will be undertaken to ensure that, as a minimum:

- all plant is in a good state of repair and fully functional;
- any plant found to be requiring interim maintenance has been identified and taken out of use;
- acoustic enclosures fitted to plant are in a good state of repair;
- doors and covers remain closed during operation (self-closing doors/covers are recommended); and
- any repairs are being undertaken by a fully qualified maintenance engineer.

Training

5.2.9 The site induction programme and site rules will include good working practice instructions for site staff, managers, visitors and contractors to help minimise noise whilst working on the site.

5.2.10 The good working practice guidelines/instructions will include, but not be limited to, the following points:

- avoid unnecessary revving of engines;
- plant used intermittently will be shut-down between operational periods, where possible;

- avoid reversing wherever possible;
- contractors to be advised that reversing alarms on mobile equipment must be specified as low/white noise where safety requirements allow;
- report any defective equipment/plant as soon as possible so that corrective maintenance can be undertaken; and
- handle material in a manner that minimises noise.

5.3 Specific Mitigation

Bunds and barriers

5.3.1 Temporary storage bunds northeast of the Works, constructed during Phase 2, were included in the noise model, providing screening between the proposed construction works and the residential receptors. Currently two of the three bunds have been completed, with the third temporary bund expected to be constructed and completed during Phase 3 and Phase 4 works.

5.3.2 The excavation of the shaft via blind boring works will be undertaken 24 hours a day. Without mitigation, the predicted construction noise levels at Davison Farm slightly exceed the night-time limit. To reduce the noise levels at Davison Farm from this activity, a temporary 2m height absorptive barrier will be erected around three sides of the C-Drill Rig (assuming a worst-case scenario with equipment located at the top of the shaft i.e., platform level), with the open side facing away from Davison Farm. As stated in **Section 3.2**, with this barrier in place, the predicted noise levels do not exceed the limits.

Activity timing

5.3.3 The following Phase 5 activities will be undertaken 24 hours per day: drilling of pilot borehole, excavation of the shaft via blind boring, installation of shaft lining, grouting of shaft anulus and dewatering. All other Phase 5 activities will be undertaken between 07:00 and 19:00 only.

5.4 Communications

5.4.1 If the noise limits are exceeded as a result of the works, or a complaint is received from a local resident, an investigation will be instigated in accordance with the Complaints Procedure provided in Appendix B to the Phase 3 CEMP.

5.4.2 Good relations with local residents in nearby noise-sensitive receptors will be maintained.

5.4.3 A Community and Stakeholder Engagement Plan is provided in Appendix A to the Phase 4 CEMP which details actions to be taken by Anglo American and the Contractors.

Appendix A Predicted Construction Noise Levels

The predicted noise levels detailed within the tables below are considered to represent the most conservative scenario. The modelled results for Phase 5 daytime construction works are detailed in **Table A.1**.

Table A.1 Calculated noise levels during Phase 5 – Daytime

Receptor location	Daytime (07:00–19:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum predicted $L_{Aeq,1hr}$ dB
Ladycross Caravan Park Owners Property	55	42
Davison Farm	55	46
Watergate Farm	55	44
Recreational Receptor OS Grid 816084	55	35
Recreational Receptor OS Grid 819077	55	46

The modelled results for Phase 5 evening and night-time construction works are detailed in **Table A.2**.

Table A.2 Calculated noise levels during Phase 5 – evening and night-time

Receptor location	Night time (19:00–07:00)	
	Limit $L_{Aeq,1hr}$ dB	Maximum predicted $L_{Aeq,1hr}$ dB
Ladycross Caravan Park Owners Property	42	38
Davison Farm	42	41
Watergate Farm	42	41
Recreational Receptor OS Grid 816084	N/A	32
Recreational Receptor OS Grid 819077	N/A	44

Modelling Assumptions

The works at the site are considered to comprise mineral extraction and the conditioned noise limits are in accordance with the Planning Practice Guidance for Minerals (PPGM). The PPGM does not specify the method to be used to predict noise propagation; therefore, in line with acoustics industry best practice, noise propagation from the site was calculated using the ISO 9613-2 methodology.

Noise modelling considered the following works in Phase 5 to be carried out as per the construction schedule:

- Mobilisation of shaft sinking contractors, including installation of shaft sinking equipment and shaft platform civils and infrastructure;
- Construction of foreshaft, including secant piling;
- Drilling of pilot borehole;
- Sinking of proposed MTS shaft via blind bore drilling method;
- Installation of the shaft lining;
- Grouting of shaft anulus and dewatering;
- Revised design to security cabin; and
- Addition of showers to existing welfare.

Overall, the model setup and assumptions made on the number of plant and their location within the site were conservative, and therefore the predicted impacts are considered to be worst-case.

Acoustic modelling input data

Data sources used for this modelling are shown in **Table A-3**.

Table A-3 Data sources

Data	Source file	Origin
Nearby building locations	OS Buildings.geo	Ordnance Survey Vectormap
Site topography	CAD drawing entitled '220609 LDX_group1_densified_point_cloud_tree_dwg_to_DXF_DTM Triangles'	Anglo American
Wider area topography	NZ80NW _DTM_2m.tif	Defra LiDAR survey data (available at Defra Survey Data Download)
Site layout	CAD drawing entitled 'Ladycross Plantation Phase 5 General Arrangement', reference (LADYCROSS 2022-06-01-SITE LAYOUT_Optimized).	Anglo American

Acoustic model settings

Acoustic modelling was undertaken using the following model settings:

- Maximum search radius of 5000m.
- Maximum number of reflections: 3

- Noise predictions carried out at each floor level of sensitive receptors, ground floor level is 1.5m above ground, each storey is 2.5m high.
- Side diffraction enabled.
- Ground absorption was set as:
  Areas within site red line boundary and roads/haul routes within site set to G=0;
  Ground outside of site red line boundary set to G=1 (representing soft ground).

The following Phase 5 equipment, associated sound power levels and conservative assumptions regarding plant 'on-times' were used within the SoundPLAN noise model:

General site
1 x 12T Excavator, 10% 24 hours per day, 103dB *L*wA
1 x 12T Dump Truck, 10% on-time 24 hours per day, 102dB *L*wA
1 x Ride on Roller, 5% on-time 24 hours per day, 103dB *L*wA
1 x 60T Mobile Crane, 25% on-time 24 hours per day, 95dB *L*wA
1 x Telehandler, 25% on-time 24 hours per day, 99dB *L*wA
1 x Road Sweeper, 25% on time 24 hours per day, travelling at 5 km/h, 104dB *L*wA
1 x Skid Steer, 25% on-time 24 hours per day, 104dB *L*wA
45 ft MEWP, 10% on-time 24 hours per day, 95dB *L*wA
Lorry movements, 2 per hour daytime only traveling at 16.1 km/h, 111dB *L*wA

Supporting equipment
1 x 250kVa Generator (Welfare), 100% on-time 24 hours per day, 95dB *L*wA
1 x 60kVa Generator (Workshop), 100% on-time 24 hours per day, 96dB *L*wA
1 x 60kVa Generator (SDI Container for Directional Drill), 100% on-time 24 hours per day, 96dB *L*wA
1 x 60kVa Generator (Siltbuster), 25% on-time 24 hours per day, 96dB *L*wA
1 x 60kVa Generator (Wheelwash), 25% on-time daytime only, 96dB *L*wA
6 x Supersilent Pumps, 25% on-time 24 hours per day, 87dB *L*wA
1 x Concrete Pump, 50% on-time 24 hours per day, 95dB *L*wA
1 x Air compressor (Rig), 90% on-time 24 hours per day, 86dB *L*wA
1 x Static Fuel Bowser, 50% on-time 24 hours per day, 101dB *L*wA
12 x Lighting Towers, 50% on-time 24 hours per day, 85dB *L*wA
1 x Towable Jet wash, 25% on-time 24 hours per day, 91dB *L*wA
1 x Towable Water Bowser, 25% on-time 24 hours per day, 114dB *L*wA
1 x 6m Ecowash Wheelwash, 25% on-time 24 hours per day, 91dB *L*wA
1 x Siltbuster, 25% on-time 24 hours per day, 93dB *L*wA
1 x 1250kVa Generator, 100% on time 24 hours per day 98dB *L*wA
1 x Desander, 80% on-time daytime only, 93dB *L*wA
1 x 60kVa Generator (Desander unit), 80% on-time daytime only, 96dB *L*wA

Foreshaft Construction
1 x Rotary Piling Rig, 75% on-time daytime only, 112dB *L*wA
1 x 20T excavator, 15% on-time daytime only, 106dB *L*wA
1 x 60T mobile crane, 100% on-time daytime only, 95dB *L*wA
1 x 12T Excavator, 50% on-time daytime only, 103dB *L*wA
1 x 12T Dumper, 50% on-time daytime only, 102dB *L*wA
1 x 30T Dumper, 50% on-time daytime only, 107dB *L*wA

Blind Bore Shaft Construction – General Plant
1 x Telehandler, 25% on-time 24 hours per day, 99dB *L*wA

1 x 80T crane, 50% on-time 24 hours per day, 105dB *L*wA
1 x 20T excavator, 80% on-time daytime only, 106dB *L*wA
1 x 30T Dumper, 80% on-time daytime only, 107dB *L*wA
1 x 12T Excavator, 50% on-time daytime only, 103dB *L*wA

Blind Bore Shaft Construction – Drilling of pilot borehole only
1 x Atlas RD20 Drilling Rig, 75% on-time 24 hours per day, 105dB *L*wA
1 x Air compressor (Rig), 100% on-time 24 hours per day, 86dB *L*wA

Blind Bore Shaft Construction – Reaming Works Only
1 x C-Rig Drilling Rig, 90% on-time 24 hours per day, 108dB *L*wA
1 x C-Rig Drilling Rig Compressor, 90% on-time 24 hours per day, 94dB *L*wA

Steel Casing Installation, Grouting Works and Dewater
1 x 80T crane, 50% on-time 24 hours per day, 105dB *L*wA
Grout Plant, 20% on-time 24 hours per day, comprising of:
- 1 x Colloidal Mixer, 20% on-time 24 hours per day, 90dB *L*wA
- 1 x Agitator, 20% on-time 24 hours per day, 90dB *L*wA
- 2 x Grout Pump, 20% on-time 24 hours per day, 105dB *L*wA
- 1 x Slurry Pump, 20% on-time 24 hours per day, 105dB *L*wA
- 1 x Colloidal Mixer, 20% on-time 24 hours per day, 90dB *L*wA
- 2 x L290 Compressor, 20% on-time 24 hours per day, 94dB *L*wA

1 x Grout Pump (Diesel Engine), 20% on time 24 hours per day, 105dB *L*wA

Noise propagation was calculated using the ISO 9613-2:1996 methodology.

Table A.4 Predicted Distances at which Specific Vibration Levels Occur

Activity	Set-back distance at which vibration level (PPV) occurs			
	0.3 mm/s	1.0 mm/s	10 mm/s	15 mm/s
Vibratory compaction (start-up)	*116m**	65m	9m	6m
Vibratory compaction (steady state)	102m	44m	8m	6m
Vibratory piling (start-up)	*154m**	56m	8m	6m
Vibratory piling (steady state)	75m	32m	6m	5m
Tunnelling	*137**	54m	*9m**	*7m**
HGVF movements on uneven haul route (assuming Alluvium surface)	277m	60m	3m	2m

Note These predicted distances are outside the limitations of the calculations and are therefore provided for information only.*

Appendix B Figures

480000 482000 484000

510000

508000

506000

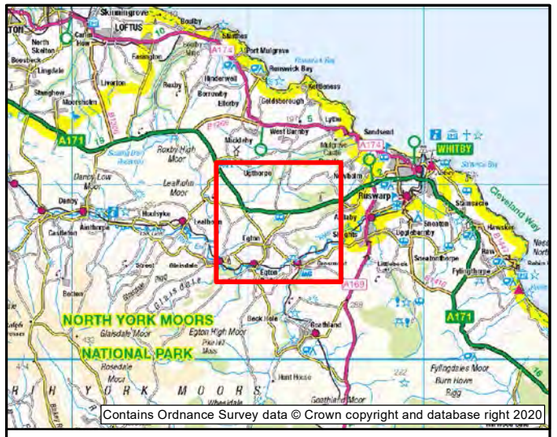
N

P1

P2

P3

0 0.5 1 Kilometres



Legend:

- Intermediate Shaft and Spoil Site – Extent of Works
- Receptor Location

Client: Anglo American	Project: Sirius NorthYorkshire Polyhalite Project

Title: Residential Receptor Locations for Ladycross Plantation Site

Figure:	Drawing No:
B1	PB1110-RHD-00-XX-DR-Z-0001

Rev:	Date:	Drawn:	Checked:	Size:	Scale:
0	22/12/2020	AZ	DC	A3	1:25,000

Co-ordinate system: British National Grid

ROYAL HASKONINGDHV
INDUSTRY, ENERGY & MINING
RIGHTWELL HOUSE
BRETTON
PETERBOROUGH
PE3 8DW

Royal HaskoningDHV
Enhancing Society Together

Appendix C Acoustic Terminology

Term	Definition
Noise sensitive receptors	People, property or designated sites for nature conservation that may be at risk from exposure to noise and vibration that could potentially arise as a result of the proposed development/project
Noise and Vibration study area	The area assessed for noise and vibration impacts during this assessment
Baseline scenario	Scenarios with the proposed development/project not in operation
Decibel (dB)	A unit of noise level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 µPa, the threshold of normal hearing is 0dB, and 140dB is the threshold of pain. A change of 1dB is only perceptible under controlled conditions. Under normal conditions a change in noise level of 3dB(A) is the smallest perceptible change.
dB(A)	Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with people's assessment of loudness. A change of 3 dB(A) is the minimum perceptible under normal conditions, and a change of 10 dB(A) corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB(A); normal conversation about 60 dB(A) at 1 metre; heavy road traffic about 80 dB(A) at 10 metres; the level near a pneumatic drill about 100 dB(A).
$L_{Aeq,T}$	The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.
$L_{A10,T}$	The A weighted noise level exceeded for 10% of the specified measurement period (T). L_{A10} is the index generally adopted to assess traffic noise
$L_{A90,T}$	The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142:2014 it is used to define the 'background' noise level.
L_{Amax}	The maximum A-weighted sound pressure level recorded during a measurement.
PPV	Instantaneous maximum velocity reached by a vibrating element as it oscillates about its rest position.
'A' weighting	A frequency weighting to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Fast time constant	Sound level meters have two conventional time weightings, F = Fast and S = Slow with time constants of 125ms and 1000ms respectively. Fast time constant relates to the response time of the meter which allows rapid variations in noise level to be registered.

Project Title / Facility Name:

Woodsmith Project

Document Title:

HYDROGEOLOGICAL RISK ASSESSMENT - PHASE 5 - NYMNPA CONDITION 88 & 90 - LADYCROSS

NYMNPA

28/07/2022

Document Review Status

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WOODSMITH PROJECT

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HYDROGEOLOGICAL RISK ASSESSMENT - PHASE 5 NYMNPA CONDITION 88 & 90 - LADYCROSS PLANTATION / 40-STS-LC-2100-EN-RA-00004

Revision	Date of issue	Prepared by	Checked by	Approved by	Changes
A (PLA)	06-07-2022	Stephen Foster	Carl Thomas	Paul Howlett	First Draft
B (PLA)	25-07-2022	Stephen Foster	Carl Thomas	Paul Howlett	Update following comments

TABLE OF CONTENTS

1. INTRODUCTION

1.1. GENERAL BACKGROUND

STRABAG has been commissioned by Anglo American to construct the Mineral Transport System (MTS) tunnel, a part of its wider Woodsmith Project. The tunnel will be used to transport polyhalite from the Woodsmith Mine site to the Material Handling Facility (MHF) at Wilton, Teesside.

In 2014 a planning application (reference NYM/2014/0676/MEIA) was submitted to the North York Moors National Park Authority (NYMNPA) for permission to develop a polyhalite mine and underground Mineral Transport System (MTS). Planning permission was subsequently granted in 2015 subject to conditions, as varied in February 2018 by NYM/2017/0505/MEIA. This permits the construction of intermediate shafts, including at Ladycross Plantation.

Phase 2 of the works at the Ladycross Plantation site comprised the mobilisation of STRABAG to site, topsoil and subsoil stripping, drainage works, and construction of roads. Phase 3 incorporated additional surface works intended to establish the basis for pre-grouting, including additional soil stripping and drainage works, development and installation of welfare and operational facilities, cuttings lagoon development as amended in Phase 3A and installation of a working pad for pre-grouting and shaft sinking works. Phase 4 works comprise the installation of additional utilities at the site and the implementation of the two-stage pre-grouting works.

Phase 5 of the works comprise construction of the Ladycross Plantation intermediate shaft.

1.2. PHASE 5 SCOPE OF WORKS

The Phase 5 Scope of Works is as follows:

- Mobilisation of shaft sinking contractors, including installation of shaft sinking equipment and shaft platform civils and infrastructure;
- Construction of foreshaft, including secant piling;
- Drilling of pilot borehole;
- Sinking of proposed MTS shaft via blind bore drilling method;
- Installation of the shaft lining;
- Grouting of shaft annulus and dewatering;
- Revised design to security cabin; and
- Addition of showers to existing welfare.

1.3. PURPOSE OF DOCUMENT

This Revised Hydrogeological Risk Assessment is required to partially discharge an element of condition NYMNPA-88 as stated in the planning permission ref. no NYM/2017/0505/MEIA. Table 1-1 details where the relevant information has been provided within this report.

1.4. SCOPE OF DOCUMENT

The scope of works covered by this document comprises shallow ground engineering works at the shaft site, shaft construction and lining. It does not include any previous phases of activity.

This document does not include an assessment of the risks relating to surface works (e.g. establishment of temporary welfare facilities, installation of shaft sinking equipment and surface civils and infrastructure) as the risks from activities of these types have been assessed in submissions supporting previous phases.

1.5. STRUCTURE OF DOCUMENT

The structure of this document is as follows:

Section 1 – Introduction - this section,

Section 2 – Geology – provides a summary description of the ground conditions pertinent to the risk assessment,

Section 3 – Hydrology - provides a summary description of the surface water environment pertinent to the risk assessment,

Section 4 – Hydrogeology – provides a summary of the current hydrogeological understanding of the site,

Section 5 – Construction Methodology – describes a summary of the proposed Phase 5 works,

Section 6 – Risk Statement – a statement of water related risks from the Phase 5 works,

Section 7 – Groundwater Management Scheme – describes proposed control measures to be used during the Phase 5 works to mitigate the identified risks, and

Section 8 – Groundwater and Surface Water Monitoring Scheme, Remedial Action Plan – describes any monitoring required to confirm the efficacy of the control measures during the Phase 5 activities.

1.6. COMPLIANCE WITH CONDITIONS

This document is required to partially discharge condition NYMNPA-88, NYMNPA-89 and NYMNPA-90. These parts of the planning conditions state that:

Table 1-1 NYNMPA Discharge Condition No 88 – Revised Hydrogeological Risk Assessment

NYMNPA Description	Compliance with Condition NYMNPA 88
Prior to Commencement of Development for the MTS at Lady Cross Plantation and informed by the most up-to-date monitoring, a Revised Hydro-geological Risk Assessment shall be submitted to and approved in writing by the MPA in consultation with the Environment Agency.	Whole text.
Following approval of the Revised Hydro-geological Risk Assessment, but prior to the Commencement of Development, a Construction and Operation Phase Ground and Surface Water Monitoring Scheme shall be submitted to and approved in writing by the MPA. The scheme shall include: • Groundwater quality and level triggers • Surface water quality triggers, including those necessary to protect the health of the River Esk Pearl Mussel beds • Details of the number, type and location of monitoring points • A protocol for the removal and replacement of any existing monitoring points • Details of the frequency with which monitoring points will be monitored during construction and operation • A list of the ground and surface water determinants to be tested for • Monitoring of groundwater levels and spring flows • Monitoring of groundwater quality against ground water triggers • A scheme of periodic review and refinement of the monitoring regime to take account of any approved changes to site layout/design, construction methods and monitoring data • A protocol for notifying the MPA of any breach of the trigger levels, including the timing of any such notification	**Section 7 & 8** **Phase 4 Construction and Operation Ground & Surface Water Monitoring Scheme**

NYMNPA Description	Compliance with Condition NYMNPA 88
• Details of the method and frequency with which monitoring results will be shared with the MPA and the Environment Agency The approved scheme shall thereafter be implemented in full, with monitoring continuing in accordance with the approved scheme until such time that it is agreed in writing with the MPA that monitoring may cease.	

Table 1-2 NYNMPA Discharge Condition No 89 –Remedial Action Plan

NYMNPA Description	Compliance with Condition NYMNPA 90
Prior to the commencement of development at Ladycross Plantation, a Remedial Action Plan, setting out the remedial actions to be taken in the event that any monitoring triggers of the approved Construction and Operation Phase Ground and Surface Water Monitoring Schemes are exceeded, shall be submitted to and approved in writing by the MPA in consultation with the Environment Agency. Should any monitoring result exceed those triggers set out in the approved Construction and Operation Phase Ground and Surface Water Monitoring Scheme, the MPA, the Environment Agency and Natural England shall be informed as soon as practicable, and the approved Remedial Action Plan shall thereafter be implemented as soon as practicable. Following remedial action, monitoring in accordance with the Construction and Operation Phase Ground and Surface Water Monitoring Scheme will be undertaken in accordance with a timescale to be submitted to and approved by the MPA in consultation with the Environment Agency, the results of which shall be reported to the MPA within four weeks of the monitoring date.	**Section 7 & 8** **Phase 4 Remedial Action Plan**

Table 1-2 NYNMPA Discharge Condition No 90 – Groundwater Management Scheme

NYMNPA Description	Compliance with Condition NYMNPA 90
Following the approval of the Revised Hydro-Geological Risk Assessment for the MTS, but prior to the Commencement of the Development of the MTS at Lady Cross Plantation, a Groundwater Management Scheme (covering construction, operation, and post-operation phases), shall be submitted to and approved in writing by the MPA. The Scheme shall include technical drawings detailing the conceptualised hydrogeology with the final detail designs of the proposed mitigation measures outlined in the York Potash Environmental Statement (September 2014 as updated by the Supplementary Environmental Statement dated February 2015). Development shall thereafter proceed only in strict accordance with the approved Scheme and a timetable to be included within it.	**Section 7 & 8**

2. GEOLOGY

2.1. REGIONAL GEOLOGY

A geological section of the shaft at Ladycross Plantation site is shown in **Attachment A**.

2.2. LOCAL GEOLOGY

The local geological model is reproduced from the Hydrogeological Baseline Report, FWS, Sept 2014 (ref 1433AmtsOR27Rev2), as updated by more recent borehole data.

2.2.1. GEOLOGICAL SEQUENCE

A detailed geological sequence established from on-site and near site boreholes is presented in Table 2-1, below. Locally, the strata dip gently (~2°) to the southwest.

Table 2-1 – Ladycross Plantation geological sequence

Formation Name		Approximate thickness (m)	Geological description
Topsoil		-	Now removed over large parts of the site and stockpiled for reinstatement.
Superficial deposits		2.4 to 4	Glacial till to depths of 2.9 m in the northern part of the site. Fluvioglacial interbedded sands, gravels, and clays to depths of 2.4 m to > 4 m in the southern part.
Scalby Formation (Long Nab Member and Moor Grit Member)	**Ravenscar Group**	9 to 15	Comprises two members: The upper Long Nab Member with yellow-grey sandstones and grey mudstones, siltstones with some heavily fractured zones. Up to ~12 m thick with up to 3 m of the upper surface weathered in places. The Long Nab Member is absent in the south-eastern half of the site. The lower Moor Grit Member which is mainly grey fine-grained sandstones, in places interbedded with siltstones and mudstones. Between ~5 m and ~ 7 m thick.
Scarborough Formation		12 to 16	Sandstone with thin beds of mudstones and siltstones that are often interlaminated and interbedded.
Cloughton Formation		38	Strong thinly laminated to medium bedded light to dark grey fine to medium sandstone with occasional interlaminations of mudstone, siltstones and thin coal laminae.

Formation Name	Approximate thickness (m)	Geological description
Saltwick Formation	51	The upper sandstone unit is a thinly bedded orange brown and medium grained with rare to occasional siltstone and coal/micaceous laminae and discontinuous coals. This is underlain by a sandy siltstone and a thickly bedded orange-brown sandstone basal unit with siltstone and carbonaceous mudstone laminae.
Dogger Formation	3	Thinly to thickly laminated grey to brownish grey argillaceous sandstone with laminae of mudstone and mica.
Whitby Mudstone Formation	60	Strong thinly interlaminated to thinly interbedded dark grey mudstone with pyritic inclusions and highly calcareous fossiliferous material.
Cleveland Ironstone Formation	27	A succession of grey mudstones, siltstones and sandstones with rare to occasional ironstone nodules and thin beds of ironstone. The upper sequence is calcareous with occasional fossils.
Staithes Sandstone Formation	28	Thinly to thickly laminated light to dark grey argillaceous silty fine sandstone. It contains occasional thin beds of shell fossils, ironstone nodules and green pyritic inclusions.
Redcar Mudstone Formation	Full depth not proven on site but expected to be > 190	The Redcar Mudstone Formation comprises grey silty mudstones and clayey siltstones with subordinate thin beds of limestone and sandstone. Bands of ironstone nodules and fossil shells as well as pyrite are present in places. The formation is divided into four main members, from youngest to oldest: • Ironstone Shale Member. Can be further subdivided into an upper ironstone shale and lower banded ironstone shale. Grey silty mudstone or clayey siltstone with occasional sandstone and siltstone laminations or beds and numerous ironstone bands and nodular horizons, as well as fossil shell (bivalve and belemnite) beds and occasional pyrite nodules. • Pyritious Shale Member. Similar to the ironstone shales above and also contains some ironstone

Formation Name	Approximate thickness (m)	Geological description
		bands / nodular horizons, but with a higher pyrite content. • Siliceous Shale Member. Grey silty mudstones and clayey siltstones with interbeds and laminations of calcareous or sandy siltstone and fine-grained sandstone. With rare pyrite and fossil shells. • Calcareous Shale Member. Grey silty mudstones and clayey siltstones with thin beds of shelly clayey limestone. Becoming sandy in places. This is unlikely to be encountered in the shaft.

2.2.2. STRUCTURAL GEOLOGY

No faults are recorded in site investigation boreholes, and seismic reflection or reported by the BGS within 800 m of the site. However, ground investigation at the site has identified a high permeability zone at approximately 113mbgl beneath the site. This feature may be partly related to a previously undefined fault zone extending beneath the shaft site.

3. HYDROLOGY

The Ladycross Plantation site is situated at an average elevation of approximately 200mAOD close to an east-west trending surface water drainage divide. Land to the south of the divide, including the Ladycross Plantation site, is located within the River Esk catchment, with surface water runoff from the area draining to the river via multiple ordinary watercourses that flow in a south to south-easterly direction. Land to the north of the divide is located within the East Row Beck catchment with surface water draining in a northerly direction via several ordinary watercourses. The location of the Ladycross Plantation site in relation to local hydrology is shown in **Attachment B**.

At Newbiggin Hall Farm, which is located downstream of tributaries draining land in the vicinity of Ladycross Plantation, the River Esk catchment extends to approximately 290km^2 with a catchment standard annual average rainfall of 886mm.

The catchment area consists predominantly of upland moorland with several dispersed towns and villages. As bedrock geology and topographic variation is reasonably consistent across the area, catchment-wide hydrological characteristics can be considered representative of hydrological characteristics in the area around Ladycross. The catchment has a standard percentage runoff (SPRhost) of 49.15 and a baseflow index (BFihost19) of 0.321. The relatively high SPR and low BFi value indicate that a high proportion of incident rainfall contributes to surface runoff to rivers with lower contribution from groundwater baseflow. A baseflow index of around 0.3 is typical of catchments with steeper topography and low permeability bedrock.

Long term hydrometric monitoring of the River Esk at Sleights (Station 25050) demonstrates average annual runoff equivalent to 487mm rainfall which is approximately 57% of incident rainfall. Applying long term average data, and hence neglecting changes in soil or groundwater storage, an indication of annual average catchment recharge can be derived as the baseflow component of average flow in the River Esk. On this basis, annual average recharge is estimated to be approximately 150mm/yr which is approximately 18% of incident rainfall. It is noted that this estimate infers an annual average evapotranspirative loss of only 210mm which is lower than expected for an upland catchment but may reflect the impact of steep topography and high percentage runoff.

3.1. SURFACE WATERCOURSES

The location of the Ladycross Plantation site in relation to local hydrology is shown in **Attachment B**. Several ordinary watercourses, that form tributaries of the River Esk, drain steeply sloping land to the west, south and south east of the site. Watercourses with a catchment area of greater than 0.5km^2 are listed in Table 2-1.

Watercourse Name	Catchment Area (km^2)	Relationship to Ladycross Plantation
Cold Keld Beck	4.23	West of the site
Starfoot Woods Stream	0.56	South west of the site
Cat Scar Beck	1.78	Includes the site and land to the south
Murk Beck	1.83	South east of the site
Dorsley Bank Woods Stream	0.94	South east of the site

Table 2-1: Local surface watercourses

A brief description of each tributary sub-catchment is provided below.

Cold Keld Beck: A small pond is located 500 m north of the site. The pond drains to an open field drainage channel that flows to the south around 500 m west of the site before combining with other local field drains to become Cold Keld Beck which flows away from the site in a south westerly direction to join the River Esk approximately 4km to the west. The headwaters of the beck also receive inflow from springs north of Egton Flats. The sub-catchment is almost entirely rural with increasing topographic gradient to the west.

Starfoot Woods Stream: Two ordinary watercourses drain from the Starfoot Woods area, west of Egton Bridge, with direct discharge to the River Esk. The sub-catchment consists of steeply sloping agricultural land and woodland.

Cat Scar Beck: The beck forms from the confluence of multiple headwaters. A stream exits from the Lady Cross Caravan Park, via a culvert then flows through the wooded area along the southern site boundary. This is joined by field drainage from the site as it flowed through the wooded area towards a culvert under Egton Road. On the southern side of Egton Road, the culvert discharges to an ordinary watercourse that flows southeast through Newstead Farm and combines with watercourses originating east of Egton to form Cat Scar Beck. The sub-catchment is predominantly rural, becoming increasingly steep and wooded downstream.

Murk Beck: A wet shallow valley with abundant aquatic vegetation is located 450 m northeast of the site. This is in the lowest area of Egton Low Moor and collects surface water draining from the moorland. The water collects and drains south in an ordinary watercourse that flows via Murk Beck Slack towards Grosmont Farm and the River Esk approximately 2km downstream. The sub-catchment is relatively steeply sloping and increasing wooded downstream.

Dursley Bank Wood Stream: An area of wet/saturated ground is located 400 m to the northeast. Water from this area feeds an ordinary watercourse that drains south, 200 m east of the site, which collects in a pond/boggy area, by the entrance track to Coopers Farm, before entering a culvert that discharges to an open watercourse east of Watergate Farm. Water collects in an ordinary watercourse approximately 800 m east of the works area by Coopers Farm North that flows south in an open channel to join the River Esk at Dorsley Bank Wood approximately 1.5km downstream.

Several surface watercourses originate from or incorporate flow from springs on the north bank of the Esk Valley. The location of springs identified in previous hydrogeological studies of the area are shown on **Attachment C**.

3.1.1. OTHER SURFACE WATER FEATURES

The only other mapped surface water features in the vicinity of Ladycross Plantation are a number of small ponds, likely to be associated with historic extraction of sand & gravel deposits or the development of small surface water ponds for agricultural supply. As shown on **Attachment B**, these features are located to the west of the site within the Cold Keld Beck sub-catchment and at East End Farm within the Cat Scar Beck sub-catchment.

3.2. SURFACE WATER DRAINAGE AT LADYCROSS PLANTATION SITE

Surface water runoff from the Ladycross Plantation site is managed by drainage to a site-wide surface water drainage system with final off-site discharge to the upstream end of Cat Scar Beck. During Phase 1 and 2 of the site development, surface water drainage works were undertaken at the site as follows:

- A swale was installed alongside the site road. It discharges to the culvert beneath Egton Road, and into the southerly flowing ordinary watercourse. The drainage from the road junction built in Phase 1, including drainage from a significant length of Egton Road, also enters this watercourse;
- Site perimeter drainage ditches have been installed around the entire perimeter of the site to intercept notionally clean surface water runoff from surrounding land and shallow field drainage. The interceptor drainage system is intended to minimise overland flow across the site and hence minimise risk of silt entrainment in surface water runoff. The site interceptor drainage system discharges to the existing culvert beneath Egton Road;
- Field drainage pipes that previously entered the site from higher ground to the north east and north west have been intercepted by the peripheral site drainage system to reduce shallow soil water flow onto the site with associated reduction in risk of site waterlogging;
- The pipe which collected field drains before discharging into the stream in the wooded area to the south of the site has been isolated in order to prevent silt laden runoff from discharging directly into the stream; and

- A temporary site surface water drainage system has been installed within the works area to control surface water falling directly onto the area and any groundwater arising during the preparatory soil stripping activities. A temporary attenuation pond was constructed to provide additional storage of site surface water. The system comprises a network of temporary ditches and sumps that drain to the temporary attenuation pond. Accumulated site surface water is passed through a silt removal system prior to off-site discharge of clean water via a shallow swale with outfall to the culvert beneath Egton Road.

During Phase 3 the provisional surface water drainage works installed during Phases 1 and 2 were expanded and upgraded in accordance with the Phase 3 Surface Water Management Plan (40-STS-LC-2100-PA-PL-20102). The Phase 3 surface water drainage scheme is designed to manage surface water from all areas of the site including areas of hardstanding within the site, the internal site access road and temporary earthworks storage bunds.

The site drainage system has two functions as follows:

- To provide stormwater attenuation capacity to restrict off-site discharge to the pre-development QBar greenfield rate; and

- To manage surface water quality within the site to mitigate risk to the receiving watercourse and downstream sections of Cat Scar Beck.

As detailed in the Phase 3 Surface Water Management Plan, stormwater attenuation capacity is provided through installation of an attenuation lagoon, swale systems and flow control structures in the peripheral interceptor drains. On-site silt management systems, including swales, filter drains, silt fences and a surface water treatment facility are designed to prevent off-site discharge of silt to the receiving watercourse. An oil separator will be installed at the downstream end of drainage components serving operational areas of the site.

4. HYDROGEOLOGY

4.1. REGIONAL HYDROGEOLOGY

Regionally, the formations of the Ravenscar Group have potential as aquifers although flow is restricted by numerous interbedded, thin mudstone aquitards (BGS, 2000). Of particular note, the thick sequence of the Whitby Mudstone Formation is a regionally significant aquiclude. Beneath the Whitby Mudstone Formation, the Staithes Sandstone Formation and Cleveland Ironstone Formation are generally found to be in close hydraulic continuity, although hydraulic conductivity is expected to be low. Whilst where the Redcar Mudstone Formation subcrops at the MTS portal site in Wilton, flow is dominated by bedding parallel fractures, it is anticipated that at the proposed tunnel depths at Ladycross Plantation, any bedding parallel fractures will be geomechanically tight and the conductivity will be low.

In some locations close to the MTS route, abandoned ironstone mine workings in the Cleveland Ironstone Formation have a significant influence on the groundwater regime in the hydraulically connected Cleveland Ironstone Formation and Staithes Sandstone Formation. Flooded mine workings that overflow to the surface water system via former water levels, drifts or natural outlets tend to regulate water levels within the workings. With high storage capacity within the workings, mine water levels tend to exhibit low variation.

The presence of thick mudstone formations above and below the Cleveland Ironstone and Staithes Sandstone Formations tends to isolate the overlying Ravenscar Group Formation and underlying Redcar Mudstone Formation from the effects of mine drainage.

4.1.1. HYDROLOGICAL INFLUENCES

Hydrological review included at Section 3 of this document has indicated a potential catchment-wide recharge rate of approximately 18% of incident rainfall. As aquifer hydraulic conductivity is generally expected to reduce with increasing depth, particularly where dominated by fracture flow, groundwater present within the Ravenscar Group Formation aquifers tends to drain laterally with final discharge to the surface water system. The deeply incised River Esk valley, which extends throughout the study area, creates multiple open faces in the Ravenscar Group Formation with potential for emergence of groundwater at multiple horizons. Groundwater baseflow to tributary watercourses, therefore, has a dominant influence on local groundwater flow directions and rates particularly, in shallower aquifers.

The Esk Valley sides are characterised by the presence of multiple springs emerging at the base of more permeable sandstone units or at discrete fracture outlets from Ravenscar Group aquifers. Spring discharges that form the headwaters of multiple tributary watercourses establish hydraulic connectivity between the groundwater system and the River Esk.

4.1.2. STRUCTURAL AND STRATIGRAPHIC INFLUENCES

Bedrock strata in the vicinity of the Ladycross Plantation site and surrounding area exhibit shallow stratigraphic dip of approximately 2º to the south. Deeper formations are gently folded and the area is locally faulted. Sandstone, siltstone and mudstone units tend to have a well-developed fracture based secondary porosity that influences the potential for storage and transmission of groundwater. The presence of multiple low permeability mudstones within the sequence restricts the potential for vertical hydraulic continuity and promotes lateral drainage of groundwater within hydraulically connected formations.

The hydrogeological significance of faulting in the area is likely to be variable with some fault zones resulting in local increase in vertical and lateral hydraulic conductivity, and others acting to reduce the potential for lateral groundwater flow due to cross-fault stratigraphic variation or fault disturbance/infill features.

At a regional scale, stratigraphic displacement due to faulting and the presence of multiple lower permeability mudstone horizons are likely to impart greatest physical influence on the groundwater regime. Enhanced hydraulic conductivity zones at specific horizons may have more local significance where linked to groundwater discharges locations but, due to poor vertical hydraulic connectivity, are unlikely to influence regional groundwater flow patterns.

4.2. LOCAL HYDROGEOLOGY

Characterisation of the local hydrogeological flow regime at the Ladycross Plantation site has been undertaken on the basis of site-specific investigation, testing and monitoring information derived from existing monitoring boreholes and the on-going ground investigation programme. The investigation programme has provided information to define local geological conditions, site-specific groundwater levels, aquifer hydraulic properties and provisional evaluation of local groundwater - surface water linkages.

4.2.1. WATER BEARING STRATA

The geological formations at Ladycross Plantation constitute a series of water bearing aquifer units separated by lower permeability mudstone formations. For the purpose of this assessment, aquifers and aquicludes are defined as indicated in Table 4-1.

Formation Name	Description	Thickness (m)	Basal Depth (mAOD)
Superficial deposits	Aquifer	2 – 4	199
Scalby Formation	Aquifer	9 – 15	187
Scarborough Formation	Aquifer	12 – 16	172
Cloughton Formation	Aquifer	54	134
Saltwick Formation	Aquifer	32	102
Dogger Formation	Aquifer	3	99
Whitby Mudstone	Aquiclude	60	21
Cleveland Ironstone Formation	Aquifer	27	-6
Staithes Sandstone Formation	Aquifer	28	-39
Redcar Mudstone Formation	Aquiclude	>190	<-154

Table 4-1 Aquifers and aquicludes

The Whitby Mudstone Formation, with an average thickness of approximately 60m, acts to isolate groundwater systems in overlying formations from the underlying Cleveland Ironstone and Staithes Sandstone Formations. In general, the presence of multiple thin mudstone horizons within sandstone and siltstone units in formations above the Whitby Mudstone Formation results in low vertical hydraulic continuity between these formations and promote the development of high lateral continuity within individual formations. However, groundwater monitoring data for the Site indicates that some formations in the upper 100m retain high enough vertical hydraulic conductivity to produce comparable groundwater heads at various depth.

4.2.2. GROUNDWATER LEVELS AND AQUIFER CONNECTIVITY

Groundwater levels in the superficial deposits and the Ravenscar Group Formation at Ladycross Plantation are monitored at 31 monitoring boreholes within the site boundary. The monitoring installations were designed to monitor groundwater conditions in hydraulically connected strata as indicated in Table 4-2. Boreholes BH409, BH410 and BH411 form part of the site-wide groundwater monitoring network but are not included in the groundwater compliance monitoring programme. The borehole BH413 series was operational until April 2022 but then decommissioned to facilitate construction of the working platform and replaced within the compliance monitoring programme with more recently constructed boreholes as listed in Table 4-3.

Superficial Deposits	Scalby Formation	Scarborough Formation	Cloughton/Saltwick Formations
	BH401A	BH401B	BH401C
BH402	BH402A	BH402B	BH402C
BH403			
BH404	BH404A	BH404B	BH404C
BH405	BH405A		
BH406	BH406A		
BH407	BH407A		
BH408	BH408A		
BH409	BH409A		
BH410	BH10A		
BH411	BH411A		
BH413	BH413A	BH413B	BH413C

Table 4-2 Groundwater Monitoring Installations

Observed groundwater levels for the period November 2021 to February 2022 are presented graphically in Figure 4-1. In general, monitoring results demonstrate lower groundwater elevations with increasing depth. Although such conditions may reflect a vertical hydraulic gradient and the potential for vertical drainage, it is considered more likely that, due to highly anisotropic hydraulic conductivity and the presence of multiple perching horizons, that groundwater level variation in successive formations is outfall controlled with deeper formations draining to lower level discharge points.

As indicated on Figure 4-1, Observed groundwater levels in the Scarborough Formation are generally consistent with groundwater levels in the underlying Cloughton Formation suggesting a degree of hydraulic continuity between these units. Groundwater levels in the underlying Saltwick Formation are significantly lower, indicating hydraulic separation from overlying aquifers.

Groundwater levels in the overlying Scalby Formation, consisting of the Long Nab Member and Moor Grit Member, are approximately 10m higher than groundwater levels in the Scarborough Formation, indicating a degree of hydraulic separation with perching at the base of the Scalby Formation. Reference to detailed geological logs for the area does not indicate the presence of a persistent perching horizon, although the top of the Scarborough Formation is marked by a weathered mudstone in some locations.

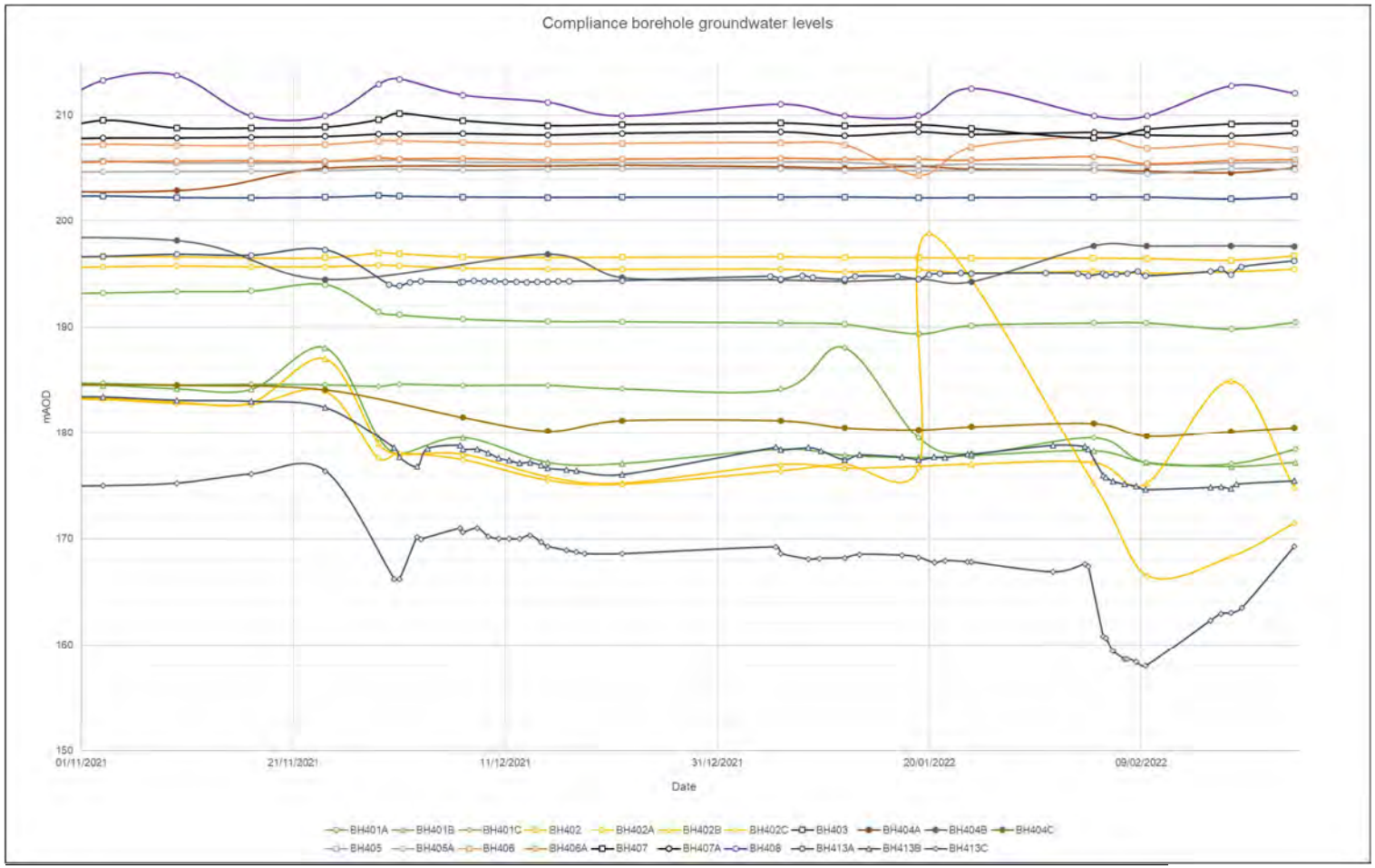
Scalby Formation groundwater levels are typically approximately 10m below groundwater levels observed in the superficial deposits suggesting a perched groundwater system in the superficial deposits.

In addition to the 2014 monitoring installations listed in Table 4-2, more recent ground investigation works have included the installation of an additional 6 new investigation boreholes that have provided an opportunity for additional monitoring of groundwater levels at the Site. The 6 new boreholes have been drilled within the site boundary to depths of between 36.40mbgl to 396.40mbgl, extending into geological strata of the Ravenscar Group Formations, Whitby Mudstone Formation and underlying formations. One of the recent boreholes (Borehole 34_BH01) has been equipped with multiple level VWP's to monitoring groundwater heads at multiple elevations within the borehole. The other five boreholes have been fitted with piezometer installations targeting specific formations. Borehole response zones for these boreholes are detailed in Table 4-3.

Borehole	Basal Depth (mbgl)	Response Zone (mbgl)	Contributing Formations
34_BH01	396.40	See Table 4.4	See Table 4.4
34_BH03	117.90	11.26 – 117.9	Saltwick Formation
34_BH04	71.30	54.0 – 68.0	Cloughton Formation Saltwick Formation
34_BH05	100.00	70.0 – 80.0	Saltwick Formation
34_BH6	55.30	31.5 – 50.5	Cloughton Formation
34_BH07	36.40	17.5 – 30.5	Cloughton Formation

Table 4-3 Recent borehole response zones

Figure 4-1 Observed Groundwater Levels (mAOD)



Six Vibrating Wire Piezometers (VWP's) have been installed in Borehole 34_BH01 which was constructed to a depth of 396.40mbgl and located in close proximity to the shaft centre. VWP depths and target formation are summarised in Table 4-4.

VWP ID	Depth of install (mbgl)	Geology
34_BH01_1	12	Scalby Formation
34_BH01_2	37	Cloughton Formation
34_BH01_3	53	Cloughton Formation
34_BH01_4	76	Saltwick Formation
34_BH01_5	111.5	Saltwick Formation
34_BH01_6	118.5	Saltwick Formation

Table 4-4 VWP installations in 34_BH01

Groundwater level data for borehole 34_BH03, 34_BH04 and 34_BH05 for the period December 2021 to February 2022 are presented as Figure 4-2.

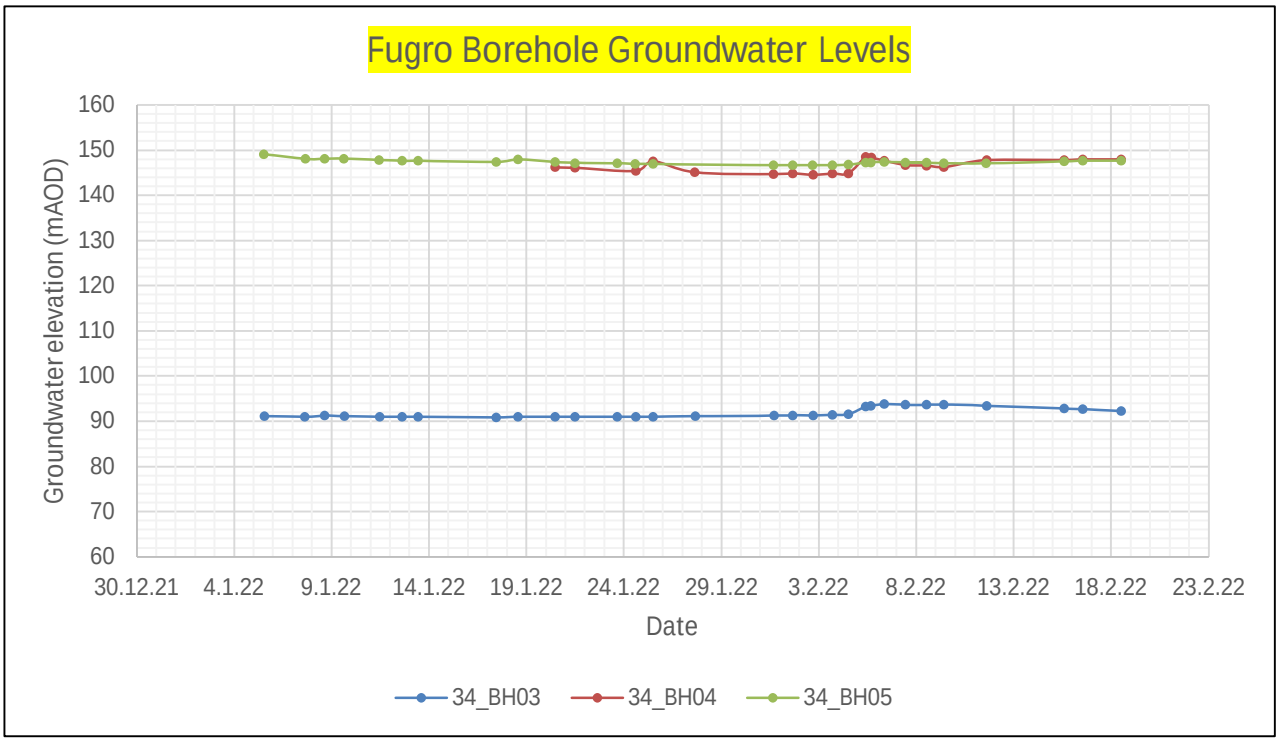


Figure 4-2 Fugro Borehole Groundwater Levels

During the drilling of borehole 34_BH01 and 34_BH03, a high hydraulic conductivity zone was encountered at a depth of approximately 117mbgl which corresponds to the lower section of the Saltwick Formation. Observed groundwater level at borehole 34_BH03, as shown in Figure 4-2, is approximately 91mAOD within the lower Saltwick Formation.

During the monitoring period November 2021 to February 2022 as shown on Figure 4-1, groundwater levels in the superficial deposits have varied within a range of approximately 2m with a hydraulic gradient to the south, consistent with local topographic variation. Groundwater levels in the underlying Scalby Formation have shown lower variation.

Groundwater levels in the underlying Scarborough and Cloughton Formations in the southern part of the site have averaged 184mAOD during the monitoring period with variation generally within a 5m range. Groundwater levels in the Scarborough and Cloughton Formations indicate a hydraulic gradient to the south and southwest.

On 24th November 2021 during the recent current ground investigation, groundwater levels in some boreholes fell by several metres. On this date, borehole 34_BH01 extended through the high hydraulic conductivity zone at the lower Saltwick Formation resulting in sudden loss of head in the borehole. The response in surrounding monitoring boreholes suggest that loss of head in borehole 34_BH01 resulted in lateral drainage from strata within the Ravenscar Group Formations into borehole 34_BH01 for drainage at depth. It is noted that, following the grouting of borehole 34_BH01 in February 2022, water levels in surrounding boreholes began to recover to previous levels.

As the Whitby Mudstone Formation, with an average thickness of approximately 60m, acts to isolate the Ravenscar Group Formation aquifers from underlying strata, monitoring of groundwater levels in the Cleveland Ironstone Formation, Staithes Sandstone Formation and Redcar Mudstone Formation has been less intensive. Groundwater level data for these formations is available for borehole BH06 which extends to the Redcar Mudstone Formation. Average groundwater elevation in the Cleveland Ironstone Formation and underlying Staithes Sandstone Formation is approximately 50mAOD. Historic mine workings in the Cleveland Ironstone Formation extend from the River Esk valley to within approximately 1km of the Ladycross Plantation site. Groundwater levels in the Cleveland Ironstone Formation in the area are likely to be controlled by mine drainage outfalls to the River Esk at an elevation of 45mAOD – 50mAOD.

The underlying Redcar Mudstone Formation consists primarily of low permeability mudstone units with groundwater storage capacity restricted to fracture systems. Available monitoring data indicates that groundwater head in the Redcar Mudstone Formation is comparable to that in the overlying Cleveland Ironstone/Staithes Sandstone Formations at approximately 45mAOD.

4.2.3. GROUNDWATER FLOW

The above analysis provides evidence to demonstrate the presence of three separate active aquifer systems beneath the Ladycross Plantation site, as follows.

Aquifer group 1 – Superficial deposits

Aquifer group 2 – Scalby Formation

Aquifer group 3 – Scarborough/Cloughton Formations

Aquifer group 4 – Saltwick Formation

Although defined as separate aquifer groups, it is apparent from the above analysis that there is a degree of vertical connectivity between some bedrock strata, and with the superficial deposits, where groundwater discharge occurs via the superficial deposits.

The direction and rate of groundwater flow through the site and surrounding area is influenced by topography, geological structure and the location and elevation of groundwater discharge points. In general, groundwater in all formations is expected to flow in a southerly direction towards the River Esk Valley, subject to local variation.

Indicative groundwater contour plans have been prepared for the superficial deposits, Scalby Formation and the Scarborough/Cloughton Formation. There is currently not enough data to define groundwater flow directions in the high permeability zone in the lower Saltwick Formation. Groundwater contour plans are included as **Attachment D**. Groundwater contours have been prepared to represent groundwater levels on 6th January 2022.

Monitoring data within the Ladycross Plantation site provides a reasonable basis for evaluation of groundwater levels in the superficial deposits beneath the site. Review of local hydrological data indicates that groundwater in the superficial deposits is likely to be the source of spring flows in the vicinity of Bull Rigg to the west of the site and emergence of groundwater to the east of the site. Ground elevation at these locations, plus superficial geological boundaries, have been used to support development of groundwater contours for the superficial deposits in the area.

Superficial deposits groundwater contour mapping indicates groundwater flow to the south at an average hydraulic gradient of approximately 0.030 with potential for baseflow discharge to Cat Scar Beck and Murk Beck in the south plus spring flow contribution to Cold Keld Beck in the west.

Surfaces watercourses in the vicinity of Egton are too high to receive inflow from the superficial deposits beneath the site and surface watercourse east of Murk Beck Slack are underlain by low permeability Till.

Observed groundwater levels in the Scalby Formation within the site are comparable to superficial deposit groundwater levels with groundwater flowing in a southerly direction.

With the exception of potential for direct discharge to the headwaters of Cat Scar Beck, there are no other obvious outlets for groundwater within the Scalby Formation. It is considered likely that groundwater draining from the Scalby Formation discharges at the same locations as identified for superficial deposits groundwater.

With regard to the Scarborough/Cloughton Formation, reference has been made to known groundwater discharges from the system. Groundwater linkage to Cold Keld Beck has been established by tracer testing and hydrogeological analysis indicates that the spring at Newstead Farm may be sourced from this formation. The spring drains to Cat Scar Beck. Groundwater level mapping indicates that the Scarborough/Cloughton Formation flows in a south and south westerly direction with an average hydraulic gradient of approximately 0.042, reflecting a lower bulk hydraulic conductivity than the superficial deposits. With the exception of spring discharge at Newstead Farm, all other outlets from the Scarborough/Cloughton Formation are likely to occur as baseflow to Cat Scar Beck, Murk Beck and Cold Keld Beck. The formation may also discharge to the headwaters of watercourses further east at Haystones Manor but these watercourses are not directly down-gradient of Ladycross Plantation.

Tracer testing has demonstrated direct hydraulic connection between the high permeability zone in the lower Saltwick Formation and surface water at Cold Keld Beck and Murk Beck. Discharge at Cold Keld Beck occurs via the overlying Scarborough/Cloughton/Saltwick Formation whilst discharge to Murk beck could occur directly from the Saltwick Formation.

4.2.4. HYDRAULIC PARAMETERS

An assessment of formation hydraulic conductivities and potential groundwater flow rates is required to support evaluation of potential hydrological and hydrogeological risk associated with Phase 5 intermediate shaft construction works. Formation hydraulic conductivity values have been derived from the following sources:

- Historic pumping test data
- Literature sources
- Borehole discontinuity logs
- Packer test results
- Tracer test analysis

Packer test results provide the most accurate site-specific hydraulic conductivity data. Groundwater contour mapping and tracer test results provide a basis to estimate groundwater flow rates.

Summary details related to average permeability values and rest water levels have been updated on the basis of data derived from the recent ground investigation.

Permeability values have been established in two of the recent boreholes (BH03 and BH05) by packer testing at defined intervals in each borehole. The results are summarised in Table 4-5.

Through a combination of the analysis of borehole core logs and downhole geophysical surveying it has been demonstrated that the majority of competent bedrock formations beneath the site contain multiple discontinuities consisting of bedding planes, faults and fractures. Groundwater storage and transmission is therefore likely to be dominated by flow through discontinuity systems. As indicated in Table 4-5, downhole permeability testing in on-site boreholes resulted in hydraulic conductivity values in the range 2.8 x 10^{-5} m/s to 1.4 x 10^{-8} m/s with a tendency to lower hydraulic conductivity with depth, consistent with increasing discontinuity closure with depth. Pumping tests undertaken in the Cloughton Formation at the Doves Nest South Shaft, 8km from the Ladycross site, resulted in the determination of higher hydraulic conductivity values within the range 2 x 10^{-4} m/s to 8 x 10^{-4} m/s.

Stratigraphic Unit		Base level of unit (m AOD)	Inferred groundwater surface (m AOD)	Mean permeability** ($m \cdot s^{-1}$)	Water quality
Scalby Formation	**Long Nab Member**	192.88	195	1.2 x 10^{-5} to 5.6 x 10^{-6} With discreet zones of higher permeability	Good
	Moor Grit Member	185.86			
Scarborough Formation		172.17	174	2.8 x 10^{-5} to 6.8 x 10^{-6}	
Cloughton Formation		134.16	174	6.10 x 10^{-6} to 7.20 x 10^{-8} With discreet zones of higher permeability	
Saltwick Formation		82.86	173	5.21 x 10^{-6} With discreet zones of higher permeability	
Dogger Formation		76.68	146	5.5 x 10^{-8} With discreet zones of higher permeability	
Whitby Mudstone Formation		2.07	88	-	-
Cleveland Ironstone Formation		-26.64	-	2.36 x 10^{-6}	Probably poor
Staithes Sandstone Formation		-53.91	-	2.5 x 10^{-6}	Probably poor

Stratigraphic Unit		Base level of unit (m AOD)	Inferred groundwater surface (m AOD)	Mean permeability** ($m \cdot s^{-1}$)	Water quality
Redcar Mudstone Formation	**Banded Ironstone and Pyritious Shale**	-154.87	-	1.43×10^{-8}	If present probably poor
	Siliceous Shale	< -195	165	1.40×10^{-8}	

Table 4-5 Summary of Hydrogeological Conditions

4.3. CONCEPTUAL HYDROGEOLOGICAL MODEL

A Conceptual Hydrogeological Model for the Ladycross Plantation site was presented in the Phase 4 HRA report 40-STS-LC-2100-EN-RA-00002. Detailed review of local hydrogeological linkages supports a review of the pathways and receptor components of the model.

4.3.1. PATHWAYS AND RECEPTORS

The ground investigation and hydrogeological monitoring programme has demonstrated that groundwater is present in both superficial deposits and bedrock formations beneath the site and that groundwater flow to the south and southwest is likely to be dominated by flow through secondary porosity fracture flow systems. Groundwater in the superficial deposits, and hence the Scalby Formation, is likely to be in hydraulic continuity with the surface water drainage system in the vicinity of the site.

Monitoring evidence indicates that deeper groundwater in the underlying strata may be draining to the surface water system via fracture flow systems in the Cloughton and Saltwick Formations.

Detailed hydrogeological analysis has established potential groundwater flowpaths for four separate aquifer groups. Pathways are summarised Table 4-6.

Aquifer Group	Groundwater Receptors	Groundwater Pathways
Aquifer group 1 – Superficial deposits	Cold Keld Beck Cat Scar Beck Murk Beck	Source of spring flow at headwaters of Cold Keld Beck and source of baseflow to Cat Scar Beck and Murk Beck
Aquifer group 2 – Scalby Formation	Cold Keld Beck Cat Scar Beck Murk Beck	Direct drainage to headwaters of Cat Scar Beck. Indirect drainage via superficial deposits to provide

		baseflow to Cold Keld Beck and Murk Beck
Aquifer group 3 – Scarborough/Cloughton Formations	Cold Keld Beck Cat Scar Beck Murk Beck	Source of spring flow at Newstead Farm and source of baseflow to Cold Keld Beck, Cat Scar Beck and Murk Beck
Aquifer group 4 – Saltwick Formations	Cold Keld Beck Murk Beck	Baseflow to Cold Keld Beck via Cloughton/Saltwick Formation and potential direct discharge to headwaters of Murk Beck

Table 4-6 Groundwater Pathways from Aquifer Groups

The analysis included in this document reconfirms groundwater pathways identified in the Phase 4 HRA and does not identify any new groundwater pathways, although flow mechanisms and potential aquifer interaction are defined in more detail.

In addition to the surface water systems detailed in Table 4-6, the Phase 4 HRA identified four groundwater abstractions that take water from springs sourced from the Cloughton or Saltwick Formations and a single borehole that may be abstracting groundwater from the same formations. The following comments are relevant.

Springs at Duns Bog Farm: Aquifer group 3 – Scarborough/Cloughton Formations the most likely source.

Springs at Newbiggen Hall: Aquifer group 3 – Scarborough/Cloughton Formations the most likely source.

Springs at Lamplands Farm: Springs located at boundary of superficial sand & gravel with Till deposits. Source may be superficial deposits.

Springs at Toplands Farm: Aquifer group 3 – Scarborough/Cloughton Formations the most likely source.

Borehole at Ladycross Plantation Caravan Park: Borehole may receive inflow from multiple formations from Scalby to Saltwick Formations.

Groundwater contour mapping for the Scarborough/Cloughton Formations indicates that, of the five identified groundwater abstractions, only the springs at Lamplands Farm are located down-gradient of the Ladycross Plantation site.

Groundwater quality monitoring in superficial deposits and bedrock formations above the Whitby Mudstone Formation has been undertaken on a monthly basis since January 2021.

In general, the quality of groundwater is relatively good but there is consistent evidence of high background concentrations of iron and manganese together with slightly elevated concentrations of other heavy metals. Groundwater quality is consistent with presence of groundwater flow through iron-rich sedimentary formations which form the bedrock beneath the site.

A conceptual interpretation of local hydrogeological conditions at the site is shown on a drawing prepared by Geo-Design and included for reference at **Attachment E**. The drawing shows probable local groundwater flowpaths and measured groundwater heads in respective aquifer units.

Current understanding of local hydrogeological conditions, based on site-specific investigation, testing and monitoring, provides a robust basis for evaluation of potential hydrological and hydrogeological risk and the development of effective risk management strategies.

5. CONSTRUCTION METHODOLOGY

5.1. SHAFT CONSTRUCTION WORKS

A detailed Construction Method Statement has been provided to accompany the submissions for the proposed Phase 5 works (40-STS-LC-2100-CN-MS-00006).

The Phase 5 Scope of Works is as follows:

- Mobilisation of shaft sinking contractors, including installation of shaft sinking equipment and shaft platform civils and infrastructure;
- Construction of foreshaft, including secant piling;
- Drilling of pilot borehole;
- Sinking of proposed MTS shaft via blind bore drilling method;
- Installation of the shaft lining;
- Grouting of shaft annulus and dewatering;
- Revised design to security cabin; and
- Addition of showers to existing welfare.

A secant piled wall will be installed through unconsolidated superficial deposits to establish a dry stable basis for establishment of the drill pad and capping beam. The shaft construction process will commence with pilot hole installation followed by blind boring of the shaft. On completion, the shaft will be lined and sealed by annular grouting.

Shaft construction will take place within the peripheral grout curtain established during Phase 4 works. The pre-excavation grouting works are designed to improve ground stability and reduce formation permeability around the shaft. The works were undertaken in two stages, as follows.

- **Stage 1** – installation of a 'grout curtain' using a low bleed colloidal silica grout with associated additives around the proposed shaft area to act as an external barrier and reduce hydraulic connectivity with the surrounding strata, and:
- **Stage 2** - a standard pre grouting programme to create a stable rock mass which holds ground water.

The presence of a peripheral grout curtain around the shaft, pre-construction, is a significant factor in assessment of hydrogeological risk associated with Phase 5 works.

6. RISK STATEMENT

The consideration of the risks from Phase 5 activities is based on source-pathway-receptor linkages. The following sections describe the sources, pathways and receptors which have been considered here. An assessment of the risks relating to surface works (e.g. establishment of temporary welfare facilities, installation of shaft sinking equipment and shaft platform civils and infrastructure) has not been undertaken as the risks from activities of these types have been assessed in submissions supporting previous phases, and appropriate mitigation agreed.

6.1. SOURCES

The sources of potential impact which have been considered are detailed in Table 6-1.

Table 6-1 - Sources

Source	Discussion	Potential Magnitude
Physical effects		
Changes to groundwater levels/pore pressure	Increase in superficial groundwater level in response to secant pile wall construction	**Minor**
	Groundwater level reduction/increase due to vertical connection of aquifers during pilot hole and shaft construction	**Minor**
	Groundwater level increase due to flow obstruction resulting from lined and grouted shaft installation	**Negligible**
	Groundwater level increase due to drilling fluid elevation in pilot hole and shaft during construction	**Minor**
Changes to groundwater flow paths	Increased vertical hydraulic connection between successive aquifer formations during pilot hole and shaft construction	**Moderate**
	Changes to groundwater flowpaths due to obstruction created by installation of lined and grouted shaft.	**Negligible**
Quality effects		
Drilling fluid	Drilling fluid will be water based but will also contain cuttings fines and may contain amendments such as bentonite. There is potential for localised migration of drilling fluid into shaft wall discontinuities during shaft construction.	**Minor**

Source	Discussion	Potential Magnitude
Grout	Cementitious grout will be used to grout the shaft anulus once lined. There is potential for localised migration of grout to upper formation aquifer groundwater during the grouting process. Grout migration potential is likely to be significantly restricted by the presence of the grout curtain.	**Minor**
Reactivated sediment	Sediment held within subsurface conduits has the potential to be mobilised due to hydraulic head variation in the pilot hole and shaft during construction.	**Negligible**

6.2. RECEPTORS

The receptors which have been considered are detailed in Table 6-2. The water quality in the Staithes Sandstone Formation, Cleveland Ironstone Formation and Redcar Mudstone Formation is likely to be poor and of limited resource value. Strata beneath the Whitby Mudstone Formation have not been considered as receptors in this assessment. The location of defined receptors is shown on Drawing 1433AmtsOD27Rev1 which is included at Attachment C.

The groundwater within the Ravenscar Group is of generally good quality and has water resource value. Strata within the group are defined as Secondary A aquifers with low-medium groundwater vulnerability at surface.

There are a number of abstractions in the proximity of the site which take water from boreholes in the aquifer units within the Ravenscar Group, or from springs fed from the same aquifers. These are provided in Table 6-2.

Table 6-2 Receptors

Receptor	Discussion	Sensitivity
1) Duns Bog Farm	Used for general farming and domestic purposes, from springs issuing from the Cloughton Formation upgradient of the site.	**Moderate**
2) Newbiggin Hall	Used for general farming and domestic purposes, from springs issuing from the Cloughton Formation or Saltwick Formation upgradient of the site.	**Moderate**

Receptor	Discussion	Sensitivity
3) Lamplands Farm	Used for general farming and domestic purposes, from springs issuing from the superficials downgradient of the site. It is possible that the source is actually the underlying Cloughton Formation.	**Moderate**
4) Topstone Farm	A private water undertaking and general farming and domestic purposes, from springs issuing from the Cloughton Formation upgradient of the site. Source Protection Zone (SPZ) II	**High**
5) Ladycross Plantation Caravan Park	Used for general domestic purposes from a borehole which abstracts from the Cloughton Formation up- or cross-gradient of the site	**Moderate**
6) Church Cliff	Confluence of springs providing base flows to Cat Scar Beck. No known abstractions, medium base flow rates observed from multiple springs.	**Moderate-High**
7) Newstead Farm	Spring head providing base flow to Cat Scar Beck and water for cattle.	**Moderate**
8) Priory Farm	Confluence of springs providing base flows to Cat Scar Beck. Situated close to Haggs Farm mine drift. High base flow rates observed from multiple springs. Close to the Esk and likely influence from ironstone mines.	**Moderate**
9) Egton Bridge	Confluence of springs providing base flows to unnamed tributary of the River Esk. High base flow rates observed from multiple springs. No abstractions and close to the Esk.	**Moderate-High**
10) Grosmont Farm	Confluence of springs providing base flows to Murk Beck Slack. High base flow rates observed from multiple springs. No abstractions and close to the Esk.	**Moderate-High**

Receptor	Discussion	Sensitivity
All watercourses	Surface watercourses in the area can be defined as those that combine to form Cold Keld Beck, Cat Scar Beck and the un-named system that flows through Grosmont Farm. All are tributaries of the River Esk. All watercourses which flow in the proximity of the site have been considered together. They collectively have: 1) high ecological value (the River Esk and its tributaries support populations of salmonids and protected populations of Freshwater Pearl Mussels) 2) value as a water resource, and 3) high visual amenity value due to the location within the North York Moors National Park.	**Moderate-High**

6.3. PATHWAYS/MECHANISMS

The pathways/mechanisms which have been considered are detailed in Table 6-3.

Table 6-3 Pathways

Mechanism			
Key	**Source**	**Receptor**	**Pathway**
1	Changes to groundwater levels/pore pressure during secant pile wall construction	Ravenscar Group aquifers	Groundwater in superficial aquifers draining through the shaft site area may be obstructed
2	Changes to groundwater levels/pore pressure due to aquifer interconnection during pilot hole/shaft construction	Ravenscar Group aquifers	Pilot hole or shaft could act as temporary conduit for connection between discrete aquifers
3	Changes to groundwater levels/pore pressure due to flow obstruction by shaft	Ravenscar Group aquifers	Interception and/or obstruction of groundwater flow due to physical presence of sealed shaft
4	Changes to groundwater levels/pore pressure due to drilling fluid column head during pilot hole/shaft construction	Ravenscar Group aquifers	Local groundwater level change due to hydraulic head within pilot hole or shaft

Mechanism			
Key	**Source**	**Receptor**	**Pathway**
5	Changes to groundwater levels/pore pressure during secant pile wall construction	Surface watercourses, springs & issues	Hydraulic continuity between groundwater in superficial deposits and surface watercourses
6	Changes to groundwater levels/pore pressure due to aquifer interconnection during pilot hole/shaft construction	Surface watercourses, springs & issues	Hydraulic continuity between groundwater in superficial deposits and surface watercourses
7	Changes to groundwater levels/pore pressure due to flow obstruction by shaft	Surface watercourses, springs & issues	Hydraulic continuity between groundwater in superficial deposits and surface watercourses
8	Changes to groundwater levels/pore pressure due to drilling fluid column head during pilot hole/shaft construction	Surface watercourses, springs & issues	Hydraulic continuity between groundwater in superficial deposits and surface watercourses
9	Changes to groundwater flow paths due to aquifer interconnection during pilot hole/shaft construction	Ravenscar Group aquifers	Temporary interconnection of discrete aquifers in the Ravenscar Group during pilot hole and shaft construction resulting in localised alteration of groundwater flow paths in the vicinity of the shaft
10	Changes to groundwater flow paths due to shaft obstruction	Ravenscar Group aquifers	Groundwater flowpath obstruction resulting from presence of sealed shaft
11	Changes to groundwater flow paths due to aquifer interconnection during pilot hole/shaft construction	Surface watercourses, springs & issues	Hydraulic continuity between groundwater in superficial deposits and surface watercourses
12	Changes to groundwater flow paths due to shaft obstruction	Surface watercourses, springs & issues	Hydraulic continuity between groundwater in superficial deposits and surface watercourses
13	Drilling fluid	Ravenscar Group aquifers	Direct discharge of drilling fluid into the aquifer during pilot hole and shaft construction.
14	Drilling fluid	Surface watercourses	Indirect discharge of drilling fluid into surface watercourses as a consequence of migration through strata of the Ravenscar Group aquifers.

Mechanism			
Key	**Source**	**Receptor**	**Pathway**
15	Drilling fluid	Surface watercourses	Loss of containment in the cuttings lagoon leading to overtopping and overland flow into the site interceptor drainage system or the boundary watercourse.
16	Grout	Ravenscar Group aquifers	Migration of grout into Ravenscar Group aquifers via high permeability flow horizons during shaft annular grouting works.
17	Grout	Surface watercourses	Indirect discharge of grout into surface watercourses as a consequence of migration through strata of the Ravenscar Group aquifers.
18	Reactivated sediment	Surface watercourses	Changes to groundwater level or pore pressure mobilise sediment in the subsurface leading to discharge of sediment laden groundwater into local watercourses.

6.4 RISK ASSESSMENT

Assessment of hydrological and hydrogeological risk has been undertaken by consideration of receptor sensitivity, the potential magnitude of any impacts and the potential significance of any consequent effect. The risk assessment methodology is summarised at **Attachment F**. The conclusion of the risk assessment process is summarised in the Risk Statement which is included as Table 6-4.

Table 6-4 Risk Statement

Key	Mechanism	Discussion	Impact Significance
1.	Changes to groundwater levels/pore pressure during secant pile wall construction impacting groundwater resources in Ravenscar group aquifers	The secant pile wall will be established within the peripheral grout curtain and extend through unconsolidated superficial deposits. The relatively high hydraulic conductivity of the superficial deposits will allow continued groundwater flow around the shaft site with negligible change in groundwater elevation upstream or downstream of the site.	**Low**
2.	Changes to groundwater levels/pore pressure due to aquifer interconnection during pilot hole/shaft construction impacting groundwater resources in Ravenscar group aquifers.	The pilot hole and shaft will extend through multiple aquifer units creating hydraulic connection via the borehole/shaft. Groundwater level monitoring during ground investigation and grouting programmes has demonstrated that groundwater levels in the upper aquifers may fall temporarily by a few metres due to drainage into the borehole/shaft. However, the peripheral grout curtain established in Phase 4 ensures that there is limited lateral hydraulic continuity with the surrounding formation. As a consequence, there is unlikely to be any significant variation in formation groundwater levels outside the shaft site.	**Low**
3.	Changes to groundwater levels/pore pressure due to flow obstruction by shaft impacting groundwater resources in Ravenscar group aquifers	The radius of the shaft site within the peripheral grout curtain is approximately 14m. Within this area lateral hydraulic conductivity will be reduced by shaft installation and grout curtain development. Groundwater in the Ravenscar Group aquifers flows in a south south-westerly direction. Hydrogeological testing and analysis has demonstrated that lateral hydraulic conductivity is relatively high and aquifers extend over a significant area around the shaft site. Available evidence indicates that groundwater will continue to flow around the shaft site with no significant change in upstream or downstream groundwater level.	**Very Low**

Key	Mechanism	Discussion	Impact Significance
4.	Changes to groundwater levels/pore pressure due to drilling fluid column head during pilot hole/shaft construction impacting groundwater resources in Ravenscar group aquifers	Maintenance of an excess hydraulic head in the pilot hole and shaft during construction could result in loss of drilling fluid to the formation. However, formation hydraulic conductivity around the pilot hole/shaft and within the peripheral grout curtain is expected to be significantly reduced. Groundwater levels outside the grout curtain are therefore unlikely to be affected by hydraulic pressure associated with drilling fluid.	**Low**
5	Changes to groundwater levels/pore pressure during secant pile wall construction impacting surface water resources	As secant pile wall construction will have negligible impact on superficial groundwater levels there would be negligible change in flow to surface water receptors.	**Very Low**
6	Changes to groundwater levels/pore pressure due to aquifer interconnection during pilot hole/shaft construction impacting surface water resources	As temporary inter-aquifer connection would have no significant impact on groundwater levels outside the peripheral grout curtain there would be no significant effect on surface water receptors.	**Very Low**
7	Changes to groundwater levels/pore pressure due to flow obstruction by shaft impacting surface water resources	As groundwater would continue to flow without significant variation in level or flow rate around the shaft site there would be no adverse impact on surface water receptors.	**Very Low**

Key	Mechanism	Discussion	Impact Significance
8	Changes to groundwater levels/pore pressure due to drilling fluid column head during pilot hole/shaft construction impacting surface water resources	As any groundwater level variation would be restricted to the area within the peripheral grout curtain there would be no effect on surface water resources.	**Very Low**
9	Changes to groundwater flow paths due to aquifer interconnection during pilot hole/shaft construction impacting groundwater resources in Ravenscar group aquifers	During pilot hole and shaft construction groundwater may temporarily flow from upper aquifers into the borehole/shaft. However, any effects would be localised within the peripheral grout curtain with no adverse impact on external groundwater flow in Ravenscar Group aquifers.	**Low**
10.	Changes to groundwater flow paths due to aquifer interconnection during pilot hole/shaft construction impacting surface water resources	With no observable impact on the groundwater regime in the Ravenscar Group aquifers there would be no effect on groundwater flow to surface water systems.	**Very Low**
11.	Changes to groundwater flow paths due to shaft obstruction impacting groundwater resources in Ravenscar group aquifers	As groundwater levels and aquifer hydraulic conductivities outside the peripheral grout curtain would be unaffected by development there would be no definable effect on groundwater flow in the Ravenscar Group aquifers.	**Very Low**

Key	Mechanism	Discussion	Impact Significance
12	Changes to groundwater flow paths due to shaft obstruction impacting surface water resources	As there would be no effect on groundwater flow there would be no change in groundwater discharge rates to surface water systems.	**Very Low**
13	Direct discharge of drilling fluid into the aquifer during pilot hole and shaft construction impacting groundwater in Ravenscar group aquifers.	The presence of an elevated hydraulic head in the pilot hole or shaft during construction could allow migration of drilling fluid into Ravenscar Group aquifers. However, the peripheral hydraulic conductivity reduction achieved by the grout curtain is expected to limit the potential for lateral drilling fluid migration with low risk to groundwater resources.	**Low**
14	Direct discharge of drilling fluid into the aquifer during pilot hole and shaft construction impacting surface water resources.	As migration of drilling fluid into aquifers would be highly localised there would be low risk of drilling fluid migration to surface water systems.	**Low**
15	Loss of containment in the cuttings lagoon leading to overtopping and overland flow to surface watercourses. If storage tanks are used in place of lagoon, loss of containment from storage tanks or burst hose.	The cuttings lagoon is designed to accommodate a significant freeboard in excess of the volume of storage required to accommodate pilot hole and shaft cuttings.	**Very Low**

Key	Mechanism	Discussion	Impact Significance
16	Migration of grout into Ravenscar group aquifers	Following lining the annular space around the shaft lining would be grouted. Shaft grouting would take place fully within the peripheral grout curtain established during Phase 4 works. The grout curtain is designed to act as an external barrier between the shaft and surrounding aquifers. The potential for migration of grout outside of the grout curtain is considered to be low.	**Low**
17.	Transport of grout into surface watercourses via migration in groundwater .	As the potential for grout migration in groundwater is considered to be low there is low risk of grout migration to surface water systems.	**Low**
18.	Changes to groundwater level or pore pressure mobilise sediment in the subsurface leading to discharge of sediment laden groundwater into surface watercourses	During pilot hole and shaft construction, it is intended that unconsolidated drift and soils will be cased to maintain borehole stability. The potential for change to groundwater levels or pressures within such superficial deposits would therefore be negligible.	**Very Low**

7. GROUNDWATER MANAGEMENT SCHEME

To demonstrate the effectiveness of the groundwater management measures adopted during the Phase 5 works, the Phase 4 Groundwater and Surface Water Monitoring Scheme (see Section 8, below) and the Phase 4 Remedial Action Plan (40-STS-LC-2100-EN-PL-00017) will be implemented.

7.1. SHAFT CONSTRUCTION

7.1.1. SECANT PILE WALL AND DRILL PAD

Once the pile wall is installed through unconsolidated superficial deposits near surface excavations would be locally dewatered as required to support construction of the drill pad and capping beam. Any groundwater removed from within the pile wall would be discharged to the on-site attenuation pond.

7.1.2. PILOT HOLE AND SHAFT

Groundwater inflow into the pilot hole and shaft is expected to be low due to the reduction in hydraulic conductivity achieved by the peripheral grout curtain. As rest groundwater levels in all aquifers are expected to be below design borehole/shaft drilling fluid elevation there is no expectation that borehole/shaft dewatering will be required during the drilling programme.

Drill cuttings from both pilot hole and shaft will be discharged via a circulatory system to the cuttings lagoon established during Phase 3 works at the site.

7.1.3. SHAFT LINING AND GROUTING

It is anticipated that there may be low level groundwater inflow to the shaft during the lining process but no requirement for any additional groundwater control measures. Once lined, the shaft anulus would be sealed by annular grouting to fill any residual void space between the lining external wall and the formation. Once the shaft is fully lined and sealed, it would be dewatered by pumping out accumulated water into on-site cuttings lagoon for treatment prior to off-site discharge or disposal.

7.2. GROUNDWATER ABSTRACTION AND WATER DISCHARGE

7.2.1. GROUNDWATER ABSTRACTION

There would be no requirement for abstraction of groundwater from strata surrounding the shaft. The only potential requirement for removal of accumulated would be following the lining and sealing of the shaft when any residual water within the shaft would be removed by pumped abstraction. As the shaft would be hydraulically sealed, the volume of water to be removed would not exceed the internal volume of the shaft. All abstracted water would be discharged to the on-site cuttings lagoon.

7.2.2. WATER DISCHARGE

All water discharged from the Ladycross Plantation site will discharge to the existing drainage culvert beneath Egton Road. Surface water discharged from the site will comprise:

- clean surface water and field drainage water collected by the site interceptor drainage system;
- treated site surface water that is subject to primary settlement in the attenuation pond, followed by active silt removal and flow via an oil interceptor; and
- water will be discharged under an Environment Agency Permit, currently in process, or disposed off site at a suitably licenced facility

7.3. CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

The Phase 5 works will be operated in accordance with the Ladycross Plantation Phase 5 Construction Environmental Management Plan (CEMP) (40-STS-LC-2100-EN-PL-00025).

8. GROUNDWATER AND SURFACE WATER MONITORING SCHEME

Phase 5 works will be operated in accordance with the Ladycross Plantation Phase 4 Groundwater and Surface Water Monitoring Scheme (40-STS-LC-2100-EN-PL-00020). The scheme comprises the following:

- Details of the monitoring locations
- The frequency of monitoring
- Determinants to be analysed for
- Control and Compliance Trigger Values
- Reporting procedures

Following review of Phase 5 activities in relation to the Phase 4 Groundwater and Surface Water Monitoring Scheme (GWSWMS) and Remedial Action Plan (RAP) it has been agreed that the Phase 4 GWSWMS and RAP will provide effective monitoring of Phase 5 activities and therefore no changes to the schemes are required.

9. RELATED DOCUMENTS AND REFERENCES

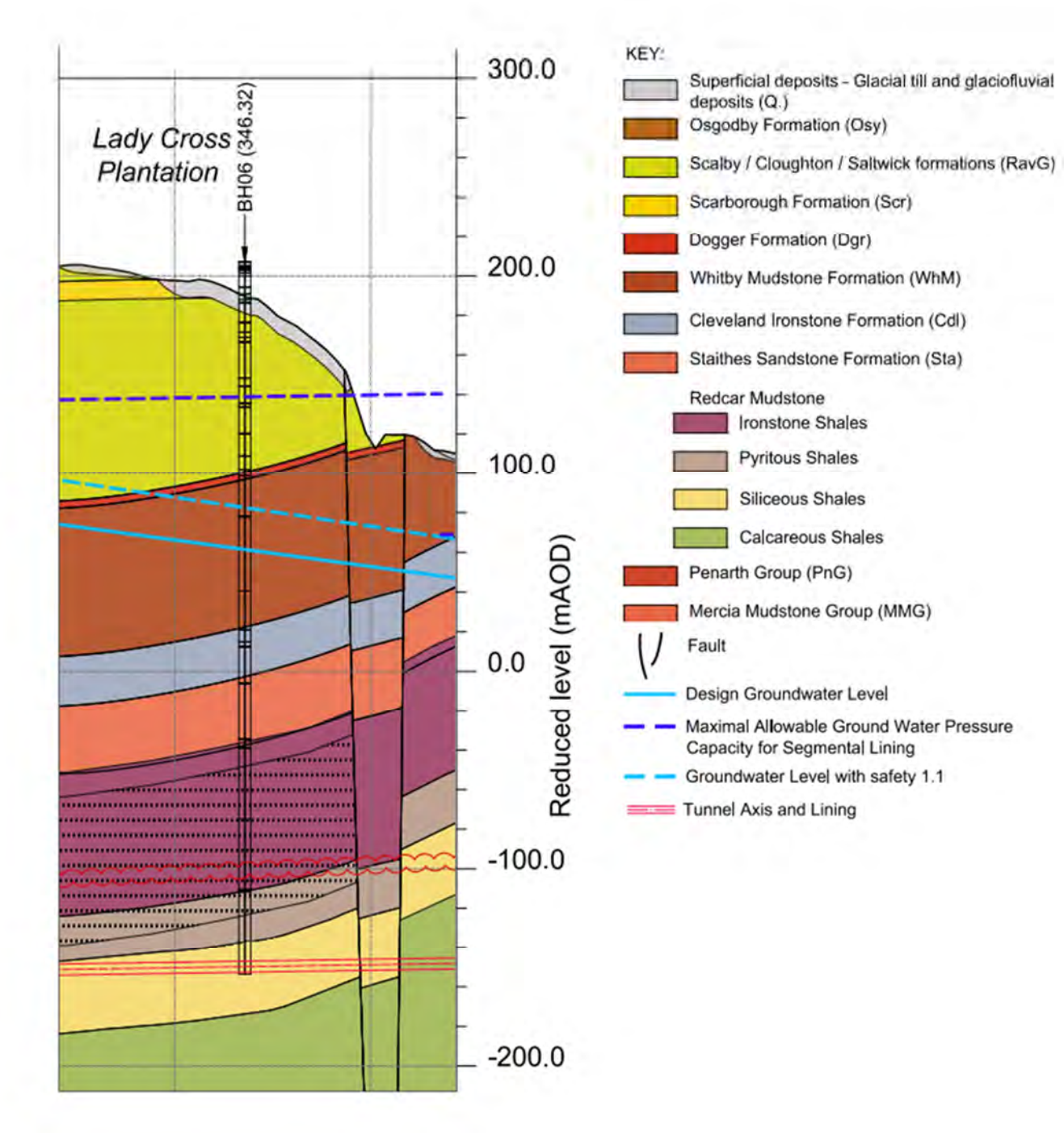
BGS, 2000	Jones, H K, Morris, B L, Cheney, C S, Brewerton, L J, Merrin, P D, Lewis, M A, MacDonald, A M, Coleby, L M, Talbot, J C, McKenzie, A, Bird, M J, Cunningham, J, and Robinson, V K. 2000. The physical properties of minor aquifers in England and Wales. British Geological Survey Technical Report, WD/00/4. 234pp. Environment Agency R&D Publication 68.
40-STS-LC-2100-CN-MS-00006	CONSTRUCTION METHOD STATEMENT - PHASE 5 -NYMNPA CONDITION 94 - LADYCROSS
40-STS-LC-2100-EN-PL-00025	CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN - PHASE 5 - NYMNPA CONDITION 93 - LADYCROSS
40-STS-LC-2100-EN-PL-00017	REMEDIAL ACTION PLAN - PHASE 4 – NYMNPA CONDITION 89 - LADYCROSS
40-STS-LC-2100-EN-PL-00020	CONSTRUCTION & OPERATION GROUNDWATER & SURFACE WATER MONITORING SCHEME - PHASE 4 - NYMNPA CONDITION 88 - LADYCROSS

10. DEFINITIONS AND ABBREVIATIONS

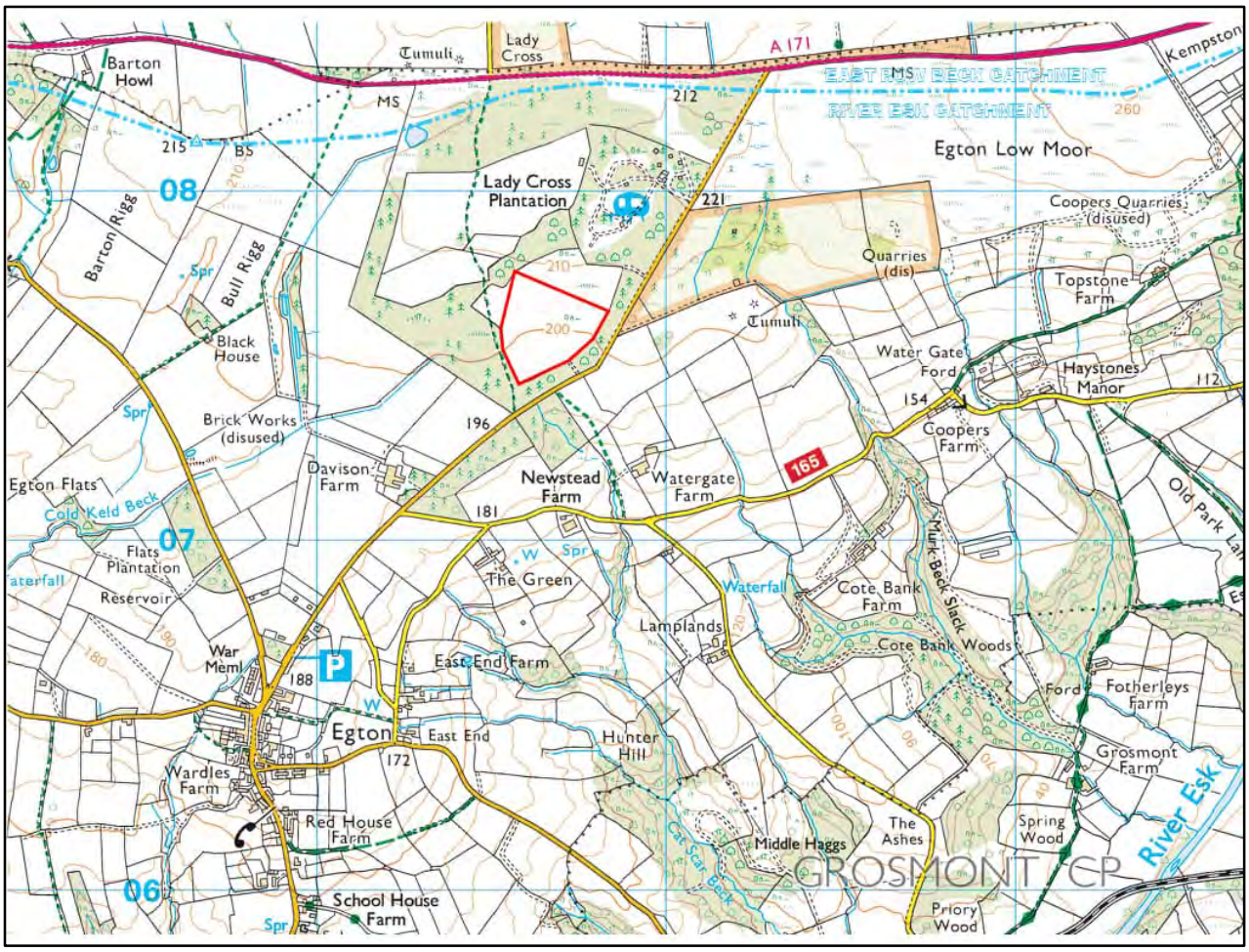
BGS	British Geological Survey
BH	Borehole
HRA	Hydrogeological Risk Assessment
mAOD	Metres Above Ordnance Datum
m bgl	Metres below ground level
MHF	Material Handling Facility
MTS	Mineral Transport System
NYMNPA	North York Moors National Park Authority
RCBC	Redcar and Cleveland Borough Council
TBM	Tunnel Boring Machine

11. ATTACHMENTS

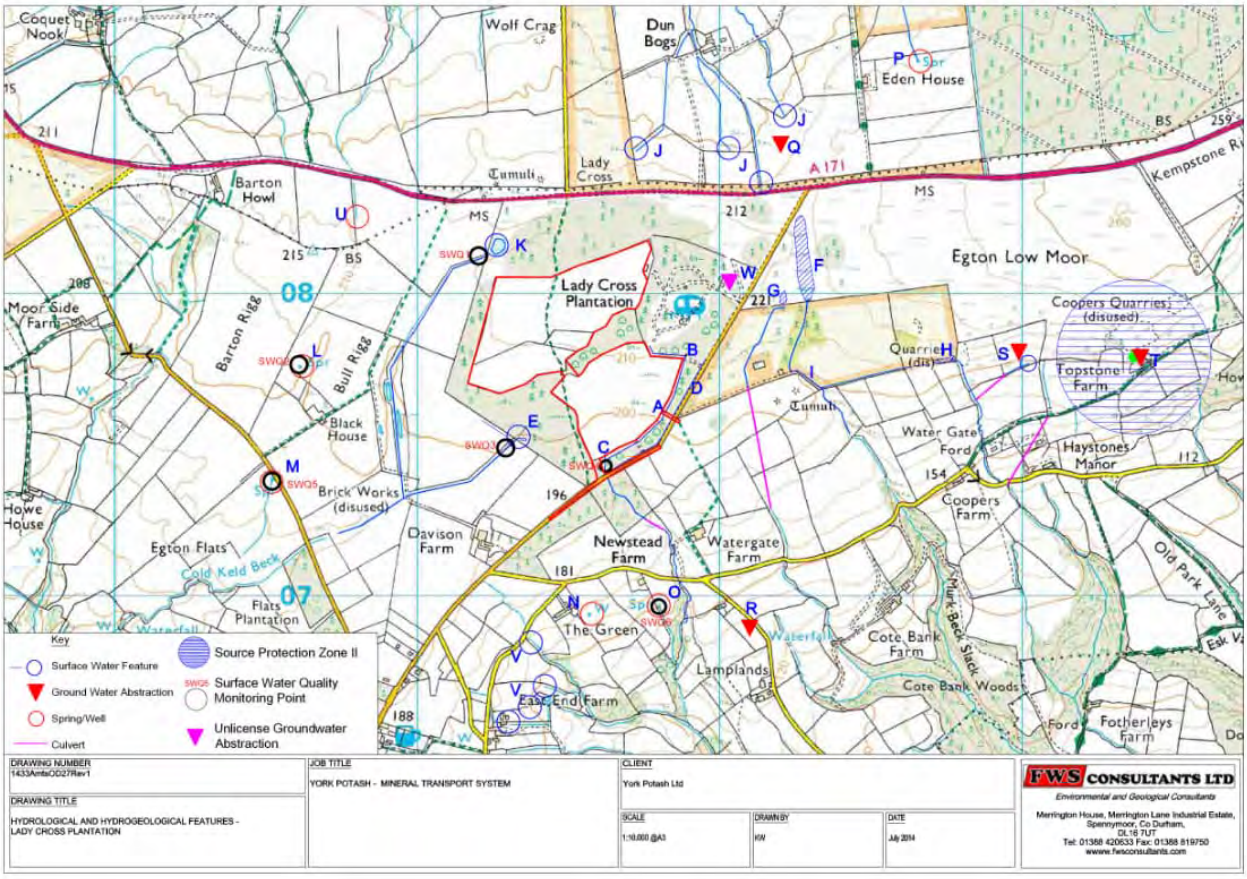
11.1. ATTACHMENT A – GEOLOGICAL SECTION



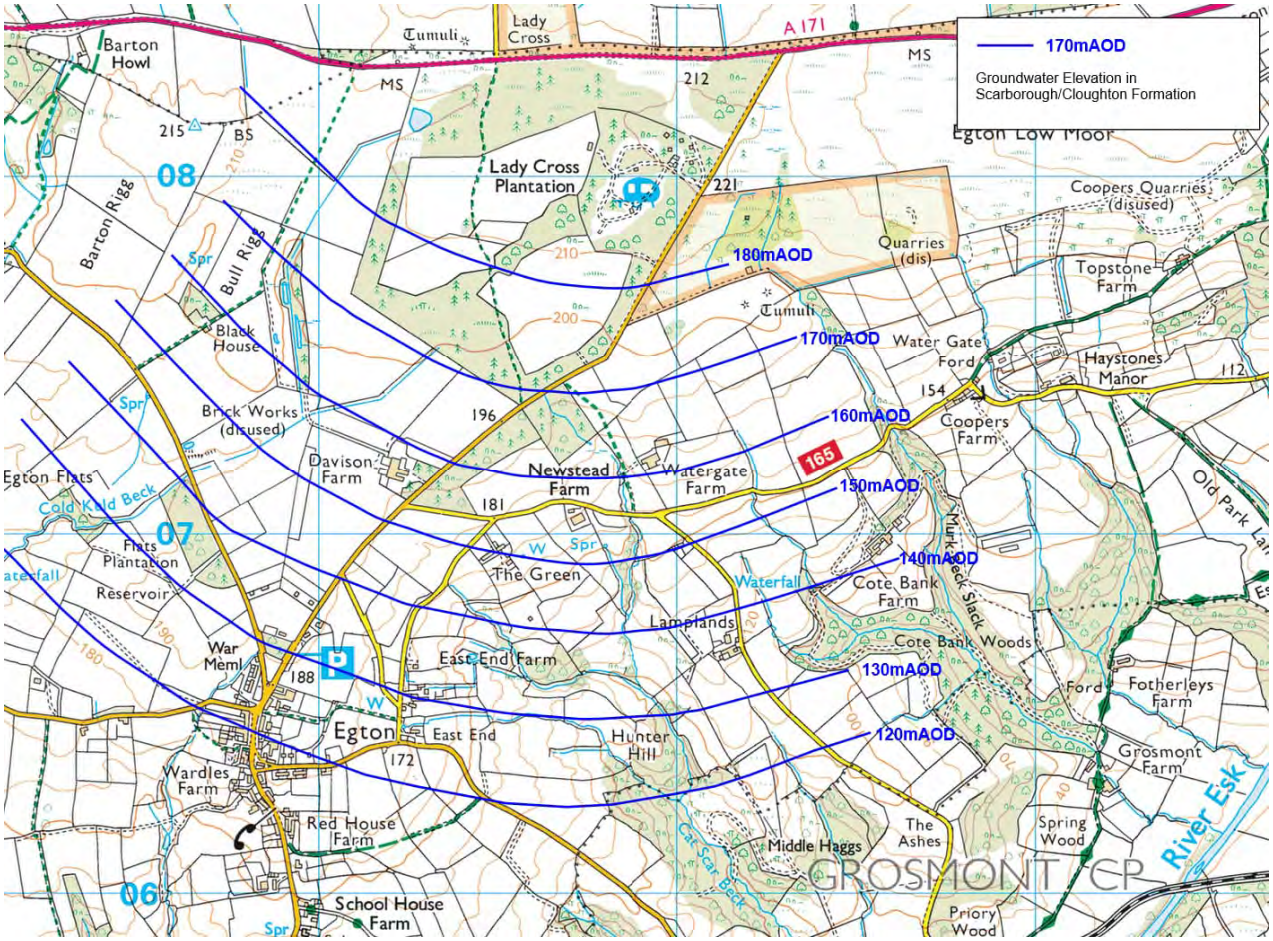
11.2. ATTACHMENT B – LOCAL HYDROLOGY

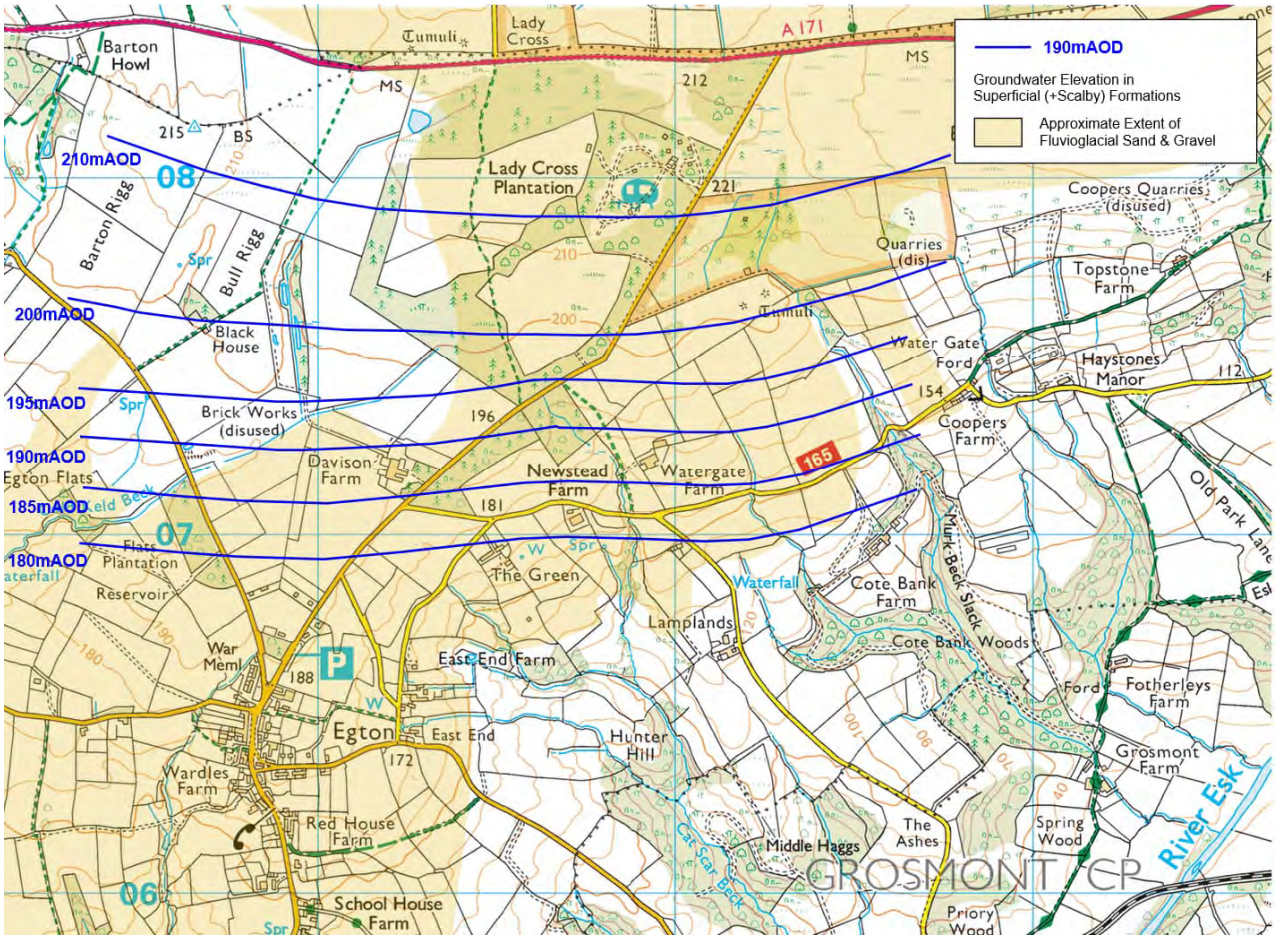


11.3. ATTACHMENT C – POTENTIAL RECEPTORS

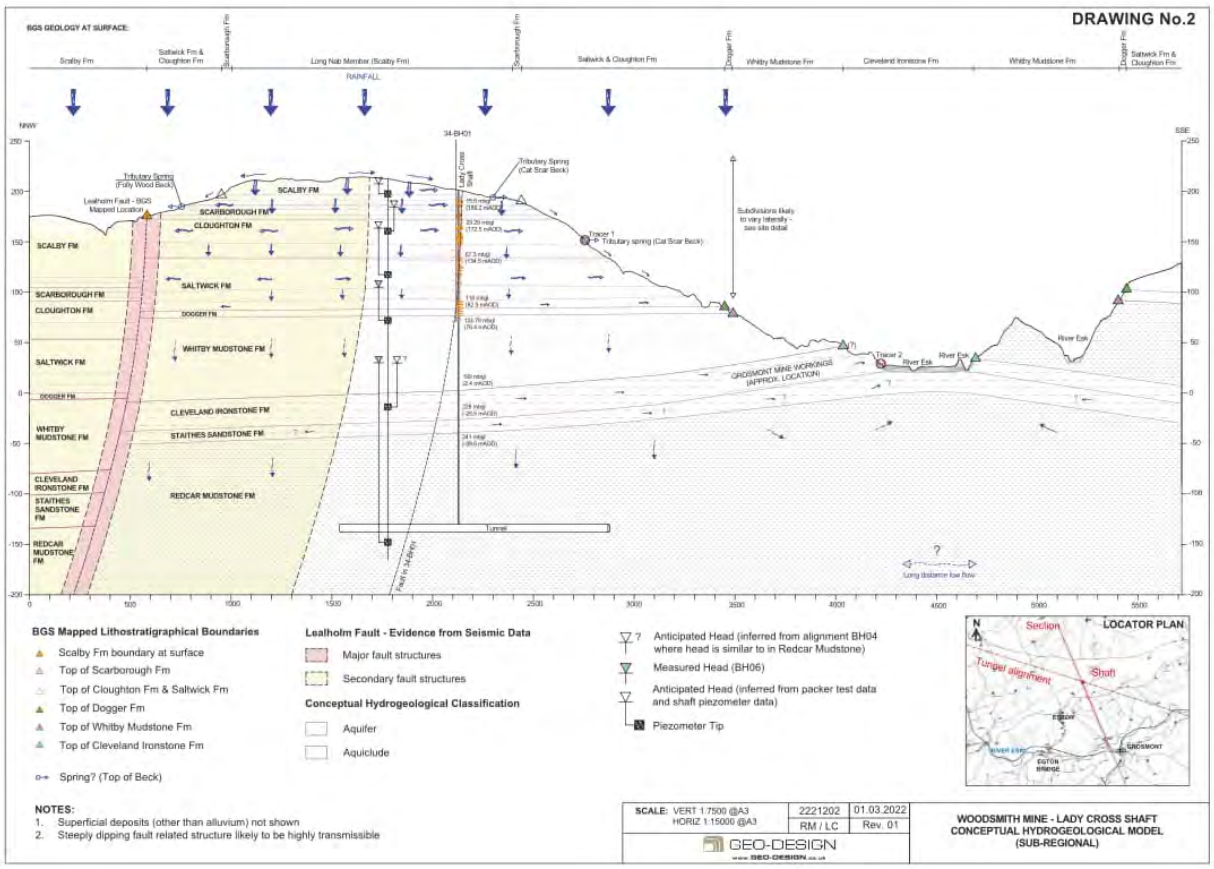


11.4. ATTACHMENT D – GROUNDWATER CONTOUR PLANS




190mAOD
Groundwater Elevation in Superficial (+Scalby) Formations
Approximate Extent of Fluvioglacial Sand & Gravel
210mAOD
200mAOD
195mAOD
190mAOD
185mAOD
180mAOD
Lady Cross Plantation
Egton
Egton Flats
Newstead Farm
Watergate Farm
Davison Farm
Brick Works (disused)
Black House
Barton Howl
Barton Rigg
Bull Rigg
Quarries (dis)
Coopers Quarries (disused)
Topstone Farm
Water Gate Ford
Haystones Manor
Coopers Farm
Old Park Lane
The Green
East End Farm
East End
Lamplands
Cote Bank Farm
Cote Bank Woods
Turk Beck Slack
Waterfall
Hunter Hill
Middle Haggs
The Ashes
Spring Wood
Grosmont Farm
Fotherleys Farm
Ford
Red House Farm
School House Farm
Wardles Farm
War Meml
Reservoir
Cat Scar Beck
River Esk
GROSMONT CP
Priory Wood
A 171
08
07
06

11.5. ATTACHMENT E – CONCEPTUAL HYDROGEOLOGICAL MODEL



11.6. ATTACHMENT F – RISK ASSESSMENT METHODOLOGY

Assessment of potential development impacts on local hydrology and hydrogeology has been undertaken through a combination of desk-based analysis, site survey work, qualitative and quantitative impact assessment, and consideration of potential impact mitigation requirements. The criteria for determining the significance of effects is based upon the following method:

(i) Assessment of potential receptor sensitivity
(ii) Assessment of potential effect magnitude.
(iii) Determination of potential effect significance

Effect magnitude is considered in relation to the potential impact on the receptor with magnitude defined in a range from negligible to major. The receptor sensitivity is defined as low, medium, or high depending on the specific receptor character on its ability to tolerate change. Effect significance is defined in relation to both effect magnitude and receptor significance. If the significance of the potential impact is Medium or High, then mitigation measures may need to be considered. In considering effect significance account is taken of effect duration; reversibility and compatibility with relevant environmental policies and standards.

Table E1: Methodology for determining sensitivity

Sensitivity	Examples of receptor
High	The receptor/resource has little ability to absorb change without fundamentally altering its present character, or is of international or national importance
Moderate	The receptor/resource has moderate capacity to absorb change without significantly altering its present character, or is of high importance
Low	The receptor/resource is tolerant of change without detriment to its character, is of low or local importance

Table E2: Methodology for determining impact magnitude

Magnitude of impact	Criteria for assessing impact
Major	Total loss or major/substantial alteration to key elements/features of the baseline (pre-development) conditions such that the post development character/composition/attributes will be fundamentally changed
Moderate	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of the baseline will be materially changed
Minor	A minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible/detectable but not material. The underlying character/composition/attributes of the baseline condition will be similar to the pre-development circumstances/situation
Negligible	Very little change from baseline conditions. Change barely distinguishable, approximating to a 'no change' situation

Table E3: Impact significance matrix

	Sensitivity		
Magnitude	**High**	**Moderate**	**Low**
Major	High	High-Medium	Medium-Low
Moderate	High-Medium	Medium-Low	Low
Minor	Medium-Low	Low	Low-Very Low
Negligible	Very Low	Very Low	Very Low

Project Title / Facility Name:

Woodsmith Project

Document Title:

CONSTRUCTION VEHICLE & PLANT MANAGEMENT PLAN - PHASE 5 - NYMNPA CONDITION 92 (ROYAL HASKONINGDHV) - LADYCROSS

NYMNPA

28/07/2022

Document Review Status

- [x] 1. Reviewed – Accepted – Work May Proceed — By: Robert Staniland
- [ ] 2. Reviewed – Accepted As Noted, Work May Proceed, Revise & Resubmit — On: 19 Jul 2022 15:30
- [ ] 3. Reviewed – Work May Not Proceed, Revise & Resubmit
- [ ] 4. For information only
- [ ] 5. On Hold – Pending Project Restart & Ramp Up

Rev.	Revision Date (dd mmm yyyy)	Reason For Issue	Prepared by	Verified by	Approved by
B	15-Jul-2022	Planning	PLA		
A	07-Jul-2022	Planning	PLA		

Document ID:

40-STS-LC-2100-LG-PL-00005

WOODSMITH PROJECT

(788.5030)

CONSTRUCTION VEHICLE & PLANT MANAGEMENT PLAN - PHASE 5 - NYMNPA CONDITION 92 - LADYCROSS PLANTATION

/

40-STS-LC-2100-LG-PL-00005

(Royal HaskoningDHV)

Revision	Date of issue	Prepared by	Checked by	Approved by	Changes
A (PLA)	07/07/2022	Charlotte Goodman (RHDHV)	John Drabble (RHDHV)	John Drabble (RHDHV)	First Draft
B (PLA)	15/07/2022	Charlotte Goodman (RHDHV)	John Drabble (RHDHV)	John Drabble (RHDHV)	Changes in accordance with Rev A comments

REPORT

NYMNPA-92 Construction Vehicle and Plant Management Plan

Ladycross Plantation Phase 5

Client: STRABAG AG

Reference: 40-STS-LC-2100-LG-PL-00005 Rev B

Status: 00/Final

Date: 15 July 2022

Royal HaskoningDHV

Enhancing Society Together

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Document title:	NYMNPA-92 Construction Vehicle and Plant Management Plan
Document short title:	Ladycross Plantation Phase 5 CVPMP
Reference:	40-STS-LC-2100-LG-PL-00005 Rev B
Status:	00/Final
Date:	15 July 2022
Project name:	Woodsmith Project
Project number:	PB1110
Author(s):	CG
Drafted by:	CG
Checked by:	JD
Date:	15/07/2022
Approved by:	JD
Date:	15/07/2022

Classification
Project related

Royal HaskoningDHV

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1 Introduction

1.1.1 In 2014 a planning application (reference NYM/2014/0676/MEIA) was submitted to North York Moors National Park Authority (NYMNPA) for permission to develop a polyhalite mine and underground Mineral Transport System (MTS). Planning permission was subsequently granted in 2015, subject to conditions, as varied in February 2018 by NYM/2017/0505/MEIA.

1.1.2 This document has been prepared on behalf of STRABAG AG, the contractor delivering the Phase 5 Works on behalf of Anglo American, and details the requirements with respect to construction vehicles and plant for Phase 5 of the development at Ladycross Plantation (see paragraph 1.1.5 below). This document is required to partially discharge Condition 92 of the NYMNPA planning permission NYM/2017/0505/MEIA and has been prepared in accordance with current good practice. The planning condition states that:

"Prior to the commencement of each Phase of Construction at either Dove's Nest Farm or Ladycross Plantation, a Construction Vehicle and Plant Management Plan (CVPM) shall be submitted to and approved in writing by the MPA. The CVPM shall include details of monitoring locations and baseline particulate emissions; predicted traffic movements into/out of the sites including levels at the A171/Mayfield junction; predicted particulate emissions from plant and HGVs during the construction period; proposed particulate control levels; proposed avoidance or mitigation measures to comply with control levels, and arrangements for monitoring over the construction period. Development shall only occur in strict accordance with the measures set out in the CVMP [sic], unless otherwise agreed in writing with the MPA."

1.1.3 The specific requirements of the planning condition are detailed in **Table 1-1**.

Table 1-1 Condition NYMNPA-92 Construction Vehicle and Plant Management Plan

Condition NYMNPA-92	Compliance with Condition NYMNPA-92
Details of monitoring locations and baseline particulate emissions	Section 2
Predicted traffic movements into/out of the sites including levels at the A171/Mayfield junction	Section 3
Predicted particulate emissions from plant and Heavy Goods Vehicles (HGVs) during the construction period	Section 4
Proposed avoidance or mitigation measures to comply with control levels	Section 5
Proposed particulate control levels	Section 5
Arrangements for monitoring over the construction period	Section 2

1.1.4 This management plan details only the Phase 5 Works at Ladycross Plantation. Updates to this plan will be prepared for subsequent construction phases (as required) and following any design review or method change. The NYMNPA has confirmed that it supports this approach.

1.1.5 The activities required for the Phase 5 Works comprise the following:

- Mobilisation of shaft sinking contractors, including installation of shaft sinking equipment and shaft platform civils and infrastructure;

- Construction of foreshaft, including secant piling;
- Drilling of pilot borehole;
- Sinking of proposed MTS shaft via blind bore drilling method;
- Installation of the shaft lining;
- Grouting of shaft anulus and dewatering;
- Revised design to security cabin; and
- Addition of showers to existing welfare.

1.1.6 Meetings to discuss the scope and content of this document were held with the Environmental Health Officer (EHO) of Scarborough Borough Council (SBC) and NYMNPA on 17 March 2016 and 27 April 2016 respectively for earlier Phases of Works at Woodsmith Mine. The scope was re-confirmed with the EHO in a meeting on 1 December 2016. This document follows the agreed approach, and is in line with the CVPMPs previously submitted for Woodsmith Mine.

2 Baseline Conditions

2.1 Definitions of Dust and Fine Particulate Matter

2.1.1 Definitions of dust and fine particulate matter are provided in **Appendix A1**.

2.2 Site-Specific Dust Deposition Survey

2.2.1 Baseline dust deposition monitoring was not undertaken at Ladycross Plantation as part of the Environmental Statement (ES) which supported the planning application. As such, there are no historical baseline datasets at the site.

2.2.2 Dust deposition monitoring has commenced at four locations around the site, as shown in **Figure 1**, which will continue throughout the construction works.

2.2.3 Wind roses of hourly sequential meteorological data from the Fylingdales recording station were provided in the ES[1]. The predominant wind direction is from the south-west, and locations downwind of particulate sources are likely to experience the greatest deposition.

2.2.4 Regulatory authorities conventionally consider a threshold of 200 mg/m^2/day[2,3] to be the dust deposition rate above which complaints are likely[4]. It is expected that, given the nature of the area and that the ground has a covering of vegetation, baseline dust deposition rates would be below 200 mg/m^2/day. This would be expected in a rural and relatively undeveloped location.

2.3 Background Particulate Matter Concentrations

2.3.1 Background PM_{10} and $PM_{2.5}$ concentrations were sourced from pollutant maps provided by Defra[5] for a 1km x 1km resolution of the UK. The relevant 2022 background pollutant concentrations at Ladycross Plantation were obtained for the grid squares covering the area, and are detailed in **Appendix A2**.

2.3.2 Background PM_{10} and $PM_{2.5}$ concentrations at Ladycross Plantation are well below the annual mean Air Quality Objectives (in England) of 40µg.m^{-3} and 25µg.m^{-3} respectively. The main contributor to PM_{10} concentrations within the above grid squares is secondary PM_{10} (aerosols formed in atmospheric condensation reactions), sea salt and calcium and iron rich dusts, reflecting the proximity of Ladycross Plantation to the coast.

[1] Royal HaskoningDHV (2014) York Potash Project Mine, MTS and MHF Environmental Statement: Part 2 Chapter 9 Air Quality
[2] Environment Agency (2013) Technical Guidance Note (Monitoring) M17 Monitoring Particulate Matter in Ambient Air around Waste Facilities
[3] Institute of Air Quality Management (2016) Guidance on Air Quality Monitoring in the Vicinity of Demolition and Construction Sites
[4] Vallack & Shillito (1998) Suggested guidelines for deposited ambient dust, Atmospheric Environment **16** (32), 2737-2744
[5] Defra (2020) 2018-based background maps https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

2.4 Additional Monitoring

2.4.1 Construction activities will be subject to a range of dust and vehicle management measures, as set out in the Construction Environmental Management Plan (CEMP), submitted to partially discharge planning condition NYMNPA-93. The measures detailed in the CEMP include regular visual site inspections to monitor compliance with dust control procedures set out within the document. The results of the inspections will be recorded within the site log book, and included in monthly reporting. Details of dust management are included within the Phase 5 CEMP, and within the Phase 3 Dust Management Plan which remains applicable for this Phase.

2.4.2 The programme of site inspections will assist with interpretation of the results of the ongoing dust deposition monitoring which will be undertaken throughout the construction works, and which will provide retrospective information about dust levels generated during construction to inform site management practices.

3 Predicted Traffic Movements Associated with Phase 5 Works

3.1 Construction Phase Road Traffic Movements

3.1.1 The anticipated traffic movements associated with Phase 5 align with the targets for vehicle movements presented in the Construction Traffic Management Plan (CTMP), submitted to partially discharge planning condition NYMNPA-34, and are based on the peak number of movements permitted at Ladycross Plantation. The Phase 5 Works will be undertaken over a 42 week period, totalling approximately 294 working days. It is expected that due to their scale, the Phase 5 Works would not generate the peak number of permitted vehicle movements; the assessment is therefore conservative.

3.1.2 The number of traffic movements generated during the Phase 5 Works is detailed in **Table 3-1**.

Table 3-1 Traffic Movements Generated During Phase 5 at Ladycross Plantation

Vehicle Type	Number of Vehicles During Phase 5 (Two-Way)*	Maximum Number of Vehicles per Day (Two-Way)
HGV	14,364	56
Light Goods Vehicles (LGVs)**	35,280	120

*HGVs are restricted on Sundays and therefore the total number of HGVs during Phase 5 does not equate to the duration multiplied by the number of HGVs per day
**Includes cars, minibuses and vans

3.1.3 As the primary source of construction materials within the area will be from Teesside, no HGVs would travel through the A171/Mayfield junction. It is expected that, based upon forecast employee distribution, there would be a negligible increase in traffic movements through the A171/Mayfield junction.

3.2 On-Site Plant

3.2.1 The number and types of plant that would be operating for the duration of Phase 5 at Ladycross Plantation are provided in **Table 3-2**. An electrical supply will be installed on site, and it is expected that this would be in operation during Phase 5. As such, it is expected that this would remove the requirement for generators for the welfare/workshop facilities and for powering the siltbuster. Other facilities/items of plant would still require generators due to their location, particularly the drill rig. For the purposes of this assessment, it was assumed that all generators would be operational in Phase 5, which is expected to be conservative if the electrical supply becomes operational.

Table 3-2 Plant Required During Phase 5

Task	Plant Type	Duration of Phase 5 That Plant Will Be Used*
General site use	12T Excavator	75%
	12T Dumper	75%
	Ride on Roller	75%
	60T Mobile Crane	75%

Task	Plant Type	Duration of Phase 5 That Plant Will Be Used*
	Telehandler	75%
	Road Sweeper	75%
	Skid steer	75%
	Mobile Elevated Working Platform (MEWP)	25%
Foreshaft construction	20T excavator	13%
	60T mobile crane	13%
	12T Excavator	7%
	12T Dumper	11%
	30T Dumper	11%
Blind bore shaft construction	Telehandler	5%
	80T Crane	27%
	20T excavator	7%
	30T Dumper	7%
	12T Excavator	7%
Steel casing installation, grouting works and shaft dewater	80T Mobile Crane	20%
	Grout pump	5%
General equipment	Concrete pump	34%
	4" Supersilent Pump x6	75%
	Lighting Tower x 12	50%
	Towable Jet Wash	75%
	Towable Water Bowser 7000l	75%
	Rig generator (1,250 kVA)	52%
	Welfare generator (100 kVA)	100%
	Wheel wash generator (60 kVA)	25%
	Siltbuster generator (60 kVA) x2	100%
	Workshop generator (60 kVA)	100%
	SDI container generator (60 kVA)	100%

* This takes into account the utilisation of the plant throughout the 42-week construction period and the expected on-time of the plant

4 Predicted Particulate Emissions from Plant and HGVs during Phase 5

4.1 Methodology

4.1.1 Particulate matter will be generated by the combustion of fuel and brake and tyre wear associated with the following activities during Phase 5:

- Transportation of workforce to site;
- HGV deliveries and movements; and
- The operation of on-site plant (referred to as Non-Road Mobile Machinery (NRMM)) and generators.

4.1.2 Data on the above activities are provided where the required information is known. Where data were not available, information used in the assessments undertaken for the Environmental Statement are used, which included the average trip length and speeds. This is considered to be a reasonable worst-case scenario.

4.1.3 The quantification of emissions from road traffic was undertaken using the Defra Emission Factor Toolkit (version 11.0). The Emission Factor Toolkit is regularly updated to reflect the latest vehicle technologies and fleet compositions, and is the primary method of deriving emissions from road transport in the UK. The standard UK fleet composition for 2022, built into the Emission Factor Toolkit, was utilised.

4.1.4 The Emission Factor Toolkit does not provide specific emission factors for NRMM. As such, emissions of NRMM were calculated using the methodology detailed in European Environment Agency (EEA) Guidance[6]. This document details specific emission factors for NRMM, based on the power rating of the plant and the various emission stages, which correspond to the emission standards set out in relevant EU Directives.

4.1.5 The guidance provides three tiers of emission factors; the appropriate tier for use is dependent on the level of information available on the types of plant. As specific information on the make and model of plant used at Ladycross Plantation were provided by STRABAG, Tier 3 emission factors were used.

4.1.6 Emissions associated with generators were derived using the Tier 1 approach in EEA Guidance[7]. Fuel consumption was derived using the electrical power of the plant, the electrical efficiency, the anticipated load and hours of use per day as provided by STRABAG. Emission factors were obtained from the EEA Guidance.

[6] EMEP/EEA (2019) *Emission Inventory Guidebook – Non-Road Mobile Sources and Machinery*
[7] EMEP/EEA (2019) *Emission Inventory Guidebook – Small Combustion*

4.2 Assumptions

4.2.1 The following assumptions were made in the assessment of particulate emissions from NRMM and vehicle movements:

- NRMM was assumed to be in operation for 75% of the working day, with more specialist items of plant (the MEWP) and the wheel wash generator assumed to be in operation for 25% of the working day;
- Phase 5 may commence in 2022 – emission factors for 2022 were therefore used;
- Some activities will be undertaken during a 12-hour working day, with others undertaken 24/7. To provide a conservative assessment, it was assumed that all activities will be undertaken 24/7;
- All generators were assumed to operate at 40% efficiency;
- The duration of Phase 5 will be 42 weeks, with all Sundays worked; and
- HGV deliveries are restricted to 10% of weekday volumes on Sundays (as per the CTMP). It was therefore assumed that, on Sundays, HGV deliveries would be 10% of weekday trips.

4.2.2 Data were provided by STRABAG on the expected loading for all items of plant during their use, and this information was applied in the assessment.

4.2.3 Average HGV speeds were obtained from GIS smartphone data on the road links that comprise the haul route, and average speeds of cars were obtained from route mapping and estimated distance over time.

4.3 Emissions from Construction Phase Road Traffic Movements

4.3.1 The quantification of particulate emissions generated by construction-phase traffic movements was undertaken using the following input data:

- Number of daily HGV and car movements;
- Average trip lengths (km);
- Average speed vehicles will be travelling; and
- Emission factors for each vehicle type.

4.3.2 Input and output data from the Emission Factor Toolkit are detailed in **Appendix A3**.

4.4 Emissions from the Operation of On-Site NRMM and Generators

4.4.1 The input data used to calculate particulate (PM_{10}) emissions from NRMM and generators are detailed in **Appendix A4** and **Appendix A5**. The calculated particulate emissions from NRMM and generators are detailed in **Table 4-1**.

Table 4-1 Total PM_{10} Emissions from NRMM during Phase 5

Task	Plant Type	Total PM_{10} Emission (tonnes)
General site use	12T Excavator	0.0015
	12T Dumper	0.0013
	Ride on Roller	0.0011

Task	Plant Type	Total PM_{10} Emission (tonnes)
	60T Mobile Crane	0.0079
	Telehandler	0.0024
	Road Sweeper	0.0084
	Skid steer	0.0320
	Mobile Elevated Working Platform (MEWP)	0.0037
Foreshaft construction	20T excavator	0.0006
	60T mobile crane	0.0053
	12T Excavator	0.0007
	12T Dumper	0.0015
	30T Dumper	0.0023
Blind bore shaft construction	Telehandler	0.0003
	80T Crane	0.0438
	20T excavator	0.0019
	30T Dumper	0.0025
	12T Excavator	0.0007
Steel casing installation, grouting works and shaft dewater	80T Mobile Crane	0.0322
	Grout pump	0.0010
General equipment	Concrete pump	0.0263
	4" Supersilent Pump x6	0.3367
	Lighting Tower x 12	0.1247
	Towable Jet Wash	0.0221
	Towable Water Bowser 7000l	0.6735
	Rig generator (1,250 kVA)	0.6985
	Welfare generator (100 kVA)	0.2667
	Wheel wash generator (60 kVA)	0.0040
	Siltbuster generator (60 kVA) x2	0.0320
	Workshop generator (60 kVA)	0.0640
	SDI container generator (60 kVA)	0.0640

4.5 Total Particulate Emissions Generated During Phase 5

4.5.1 The total particulate predicted to be generated during Phase 5 as a result of emissions from construction-phase traffic, NRMM and generators is detailed in **Table 4-2**.

Table 4-2 Total PM Emissions from Construction Traffic, NRMM and Generators

Source	Total PM Emission (tonnes)
Construction Traffic	0.134
NRMM and Generators	1.768
TOTAL	**1.902**

4.5.2 The total PM_{10} emission within the SBC area was derived from National Atmospheric Emission Inventory (NAEI) mapping[8], as detailed in **Figure 2**.

4.5.3 The total PM_{10} emission within the whole SBC area of jurisdiction was 255.29 tonnes in 2019. Particulate emissions generated during Phase 5 will therefore contribute 0.75% of the total emissions within this local authority area.

[8] National Atmospheric Emission Inventory (2019) Emission Maps for the UK http://naei.defra.gov.uk/data/map-uk-das?pollutant_id=24&emiss_maps_submit=naei-20160526090831

5 Mitigation Measures

5.1 Construction Dust and NRMM Mitigation Measures

5.1.1 Details of mitigation measures to minimise construction phase dust emissions are included in the CEMP.

5.1.2 All NRMM and plant will be well maintained. If any emissions of dark smoke occur then the relevant machinery will stop immediately and any problem rectified. In addition, the following controls will apply to NRMM:

- All NRMM should use fuel equivalent to ultralow sulphur diesel (fuel meeting the specification within EN590:2004);
- All NRMM will comply with the appropriate NRMM emission standards;
- All NRMM will be fitted with Diesel Particulate Filters (DPF) conforming to defined and demonstrated filtration efficiency (load/duty cycle permitting);
- The ongoing conformity of plant retrofitted with DPF, to a defined performance standard, will be ensured through a programme of onsite checks; and,
- Fuel conservation measures will be implemented, including instructions to:
  - throttle down or switch off idle construction equipment;
  - switch off the engines of trucks while they are waiting to access the site and while they are being loaded or unloaded; and,
  - ensure equipment is properly maintained to ensure efficient fuel consumption.

5.1.3 The vehicle fleet accessing Ladycross Plantation will be fitted with DPFs, which will control particle emissions[9].

[9] DPFs are commonly fitted to cars and commercial vehicles to reduce particulate emissions and ensure compliance with the latest Euro standards. It is an offence under the Road Vehicles (Construction and Use) Regulations (1986) to use a vehicle that has had the DPF removed.

Figures

Key:

Location of Dust Monitor

Title
Ladycross Plantation Dust Monitoring Locations

Project
PB1110 Woodsmith Project

Client
STRABAG AG

Date	*Scale*
07/07/2022	1:3300

Figure
Figure 1

Checked by	*Number*
JD	1

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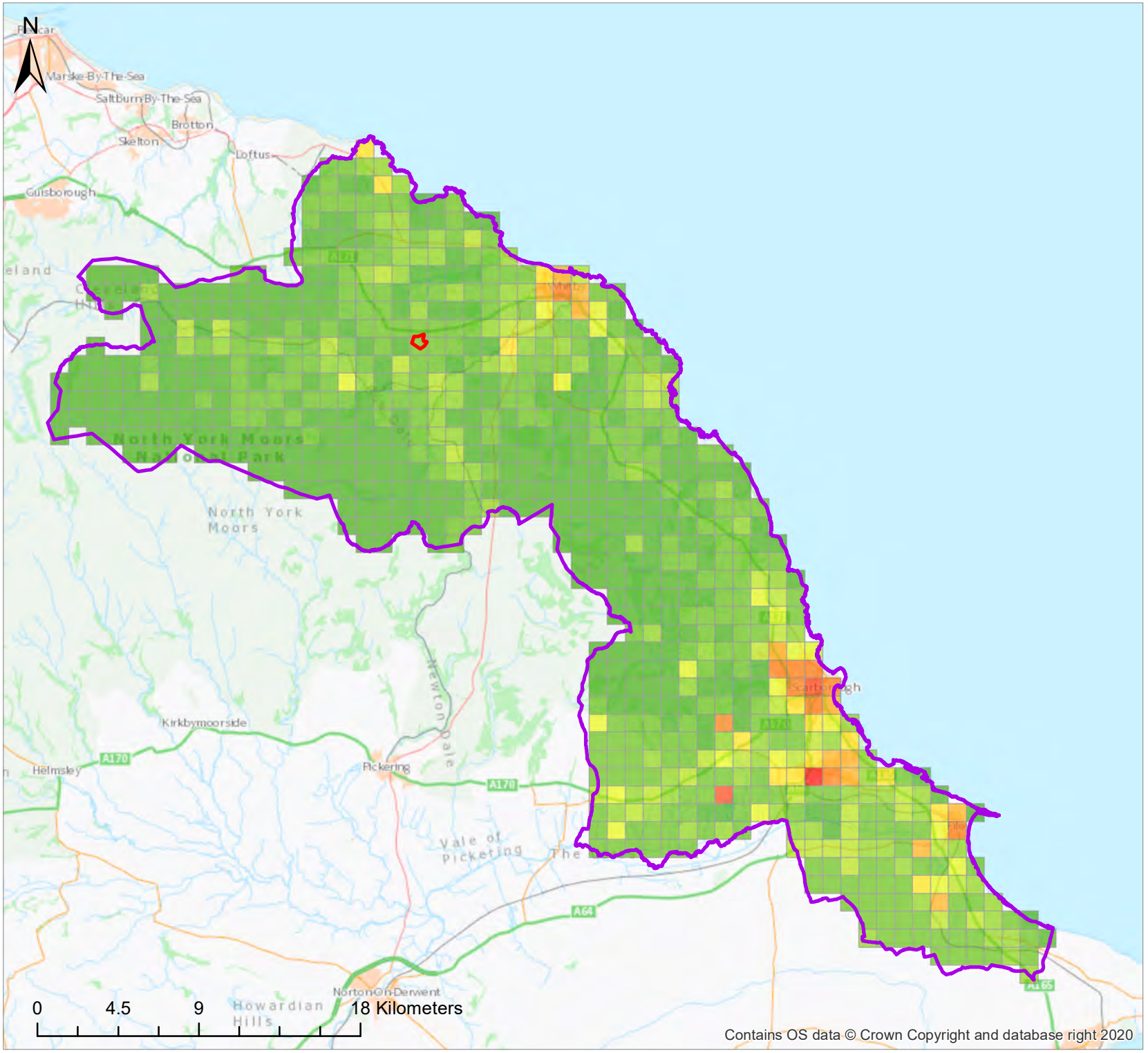

Key:

- Ladycross Plantation
- Scarborough Borough Council Area

Tonnes PM10/km2 2019

- 0.00 - 0.08
- 0.09 - 0.19
- 0.20 - 0.35
- 0.36 - 0.64
- 0.65 - 1.20
- 1.21 - 1.82
- 1.83 - 3.40
- 3.41 - 6.37
- 6.38 - 11.53
- 11.54 - 30.08

Title
2019 NAEI PM10 Emissions Mapping

Project
PB1110 Woodsmith Project

Client
STRABAG AG

Date	*Scale*
07/07/2022	1:291578

Figure
Figure 2

Checked by	*Number*
JD	1

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Appendix A

A1 Definitions of Dust and Fine Particulate Matter

Atmospheric particles are generally categorised by size fraction and by their source, and are usually measured by mass concentration (although particle number and 'black carbon' techniques are available). The generic term of 'dust' and the two size fractions most commonly used to consider human health environmental effects are defined below.

'Dust' is considered to be the mass of solid particles that are suspended in air or have settled out onto a surface after having been suspended in air. In IAQM Guidance[10] and within this document, the term 'dust' has been used to include the particles that give rise to soiling, and to potential human health and ecological effects. BS 6069:1993 provides a definition of dust as particles up to 75µm in diameter.

The smaller size fractions considered in the UK Local Air Quality Management regime are defined in Regulations[11] as follows:

- "PM_{10}" means particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM_{10}, EN 12341, with a 50% efficiency cut-off at 10µm aerodynamic diameter; and,

- "$PM_{2.5}$" means particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of $PM_{2.5}$, EN 14907, with a 50% efficiency cut-off at 2.5µm aerodynamic diameter.

The term 'aerodynamic diameter' is a reference to the terminal velocity in air of a spherical particle of unit density, therefore this is a way of standardising the range of irregular airborne particle loading for measurement and standard-setting.

Particulate matter is generally described by source as being either 'primary' or 'secondary'. Primary particles such as carbon particles from fuel combustion, sea salt and mineral particles derived from construction activities are released directly into the air, whereas secondary particles are formed in the atmosphere by chemical reactions that lead to the formation of low volatility compounds that condense into particles.

The main sources of primary particulate are road transport (combustion emissions, brake and tyre wear and re-entrainment of dust from road surfaces); stationary combustion (such as domestic coal burning); and industrial processes (production of metals, cement, lime, coke and chemicals, bulk handling of dusty materials, construction, mining and quarrying).

Secondary particles are less easy to ascribe to their original sources. They are comprised mainly of ammonium sulphate and nitrate, originating from the oxidation of sulphur and nitrogen oxides in the atmosphere to acids, which are then neutralised by atmospheric ammonia derived mainly from agricultural sources. The chemical processes involved in their formation are relatively slow and their persistence in the atmosphere is prolonged. Thus, secondary particles are distributed more evenly

[10] Institute of Air Quality Management (2016). Guidance on the assessment of dust from demolition and construction.
[11] The Air Quality Standards Regulations 2010 (SI 2010 No.1001)

throughout the air with fewer differences between urban and rural areas. They can also travel large distances, resulting in the transport of particles across national boundaries (AQEG, 2005)[12].

[12] Air Quality Expert Group (AQEG), (2005). Particulate Matter in the United Kingdom. Defra, London

A2 Background Particulate Matter Concentrations

Table A2 2022 Background Particulate Matter Concentrations

Grid Square	PM_{10} Background Concentration ($\mu g.m^{-3}$)	$PM_{2.5}$ Background Concentration ($\mu g.m^{-3}$)
481500,507500	9.68	5.97
481500,508500	9.42	5.93

A3 Inputs and Outputs of the Emission Factor Toolkit

Table A3 Input Data into the Emission Factor Toolkit

Vehicle Type	Number of Vehicles During Phase 5	Number of Vehicles per Day (Averaged over Phase 5)	Speed (kph)	Trip Length (km)
HGV	14,364	49	69	46
Cars	35,280	120	62	45.5

Table A4 Output from the Emission Factor Toolkit

Vehicle Type	Emissions of PM_{10} over Phase 5 (kg)
HGV	83
Cars	50.8
Total	**133.8**

A4 Calculation of Emissions from NRMM

The European Monitoring and Evaluation Programme (EMEP)/European Environment Agency (EEA) Emission Inventory Guidebook 2019[13] provides the following equation to calculate emissions from NRMM:

$$E = N \times HRS \times P \times (1+DFA) \times LFA \times EF_{(base)}$$

Where:

E = mass of emissions generated
N = source population
HRS = hours of use over the period
P = engine size (kW)
DFA = deterioration factor adjustment
LFA = load factor adjustment
$EF_{(base)}$ = base emission factor (g/kWh).

The average kilowatt (kW) power ratings for the proposed NRMM are provided in **Table A5**.

Table A5 Power Ratings of Required Plant During Phase 5 at Ladycross Plantation

Task	Plant Type	Power in kW
General site use	12T Excavator	78.5
	12T Dumper	108
	Ride on Roller	117
	60T Mobile Crane	270
	Telehandler	81
	Road Sweeper	172
	Skid steer	82
	Mobile Elevated Working Platform (MEWP)	36
Foreshaft construction	20T excavator	129
	60T mobile crane	270
	12T Excavator	78.5
	12T Dumper	108
	30T Dumper	276
Blind bore shaft construction	Telehandler	81
	80T Crane	315
	20T excavator	129
	30T Dumper	276
	12T Excavator	78.5
Steel casing installation, grouting works and shaft dewater	80T Mobile Crane	315
	Grout pump	23

[13] EMEP/EEA (2019) *Emission Inventory Guidebook – Non-Road Mobile Sources and Machinery*

Task	Plant Type	Power in kW
General equipment	Concrete pump	110
	4" Supersilent Pump x6	18
	Lighting Tower x 12	2.5
	Towable Jet Wash	0.59
	Towable Water Bowser 7000l	18

The input data used to calculate emissions from NRMM are detailed in **Table A6**.

Table A6 Input Data Used to Calculate Particulate Emissions from NRMM

Plant	kW	Hours of Use During Phase 5	Deterioration Factor	Load Factor	Emission Factor Stage	Emission Factor (g/kWh)
12t excavator	78.5	5,292	0.473	0.1	Stage 4	0.025
12t dumper	108	5,292	0.473	0.1	Stage 5	0.015
Ride on roller	117	5,292	0.473	0.05	Stage 4	0.025
60t mobile crane	270	5,292	0.473	0.25	Stage 5	0.015
Telehandler	81	5,292	0.473	0.25	Stage 5	0.015
Road sweeper	172	5,292	0.473	0.25	Stage 4	0.025
Skid steer	82	5,292	0.473	0.25	Stage 3A	0.2
Mobile Elevated Working Platform (MEWP)	36	1,764	0.473	0.1	Stage 3A	0.4
20T excavator	129	882	0.473	0.15	Stage 4	0.025
60T mobile crane	270	882	0.473	1	Stage 5	0.015
12t excavator	78.5	504	0.473	0.5	Stage 4	0.025
12t dumper	108	756	0.473	0.5	Stage 4	0.025
30t dumper	276	756	0.473	0.5	Stage 5	0.015
Telehandler	81	378	0.473	0.5	Stage 5	0.015
80t crane	315	1,890	0.473	0.5	Stage 3A	0.1
20T excavator	129	504	0.473	0.8	Stage 4	0.025
30t dumper	276	504	0.473	0.8	Stage 5	0.015
12t excavator	78.5	504	0.473	0.5	Stage 4	0.025
80t mobile crane	315	1,386	0.473	0.5	Stage 3A	0.1
Grout pump	23	378	0.473	0.2	Stage 2	0.4
Concrete pump	110	2,394	0.473	0.5	Stage 3A	0.2
4" supersilent pump x6	18	5,292	0.473	0.25	Stage 3A	1.6
Lighting tower x 12	2.5	3,528	0.473	0.5	Stage 3A	1.6
Towable jet wash	0.59	5,292	0.473	0.25	Stage 3A	1.6
Towable water bowser 7000l	18	5,292	0.473	0.25	Stage 3A	1.6

A5 Calculation of Emissions from Generators

The EMEP/EEA Emission Inventory Guidebook 2019[14] provides the following equation to calculate emissions from small combustion sources such as generators:

$$E_{pollutant} = AR_{fuelconsumption} \times EF_{pollutant}$$

Where:

$E_{pollutant}$ = the emission of the specified pollutant ($g.h^{-1}$)
$AR_{fuelconsumption}$ = the activity rate for fuel consumption ($GJ.h^{-1}$)
$EF_{pollutant}$ = the emission factor for the pollutant (g/GJ)

The fuel consumption (AR) of each generator was derived using the power rating of the generators, the load, the electrical efficiency and the utilisation percentage. The EF was taken from EMEP/EEA Guidance. The inputs are detailed in **Table A7**.

Table A7 Input Data Used to Calculate Particulate Emissions from Generators

Generator	Power (kVA)	Power (kW*)	Power Load (%)	Percentage of Phase 5 Used (%)	Efficiency (%)	AR Fuel Consumption ($GJ.h^{-1}$)	EF (Emission Factor) PM_{10} (g/GJ)**
Rig generator	1,250	1,000	100	52	40	9.00	21
Welfare	250	200	100	100	40	1.80	21
Wheel wash	60	48	25	25	40	0.11	21
Siltbuster x 2	60	48	25	100	40	0.11	21
Workshop	60	48	100	100	40	0.43	21
SDI container	60	48	100	100	40	0.43	21

*Based on kVA to kW conversion of 0.8
** The Emission Factor for liquid fuel was used

[14] EMEP/EEA (2019) *Emission Inventory Guidebook – Small Combustion*