

# Woodsmith Mine, North Yorkshire Moors



**Woodsmith Mine, located near to the hamlet of Sneatonthorpe, Whitby in North Yorkshire, is a deep potash and polyhalite mine, a venture started by York Potash Ltd, which later became a subsidiary of Sirius Minerals plc, whose primary focus is the development of the polyhalite project.**

The project involves Sirius Minerals constructing the UK's deepest mine, which over the next five years will see the company extract large quantities of Polyhalite for global distribution. Beyond this, the mine is expected to have a life of at least 100 years and has been labelled the biggest mining project in Britain for decades; its twin shafts will be the deepest commercial mineshafts in Britain, with the project expected to generate over £100 billion for the UK economy over a period of 50 years.

A sensitive project, having attracted many objections along the way, developing the mine to extract the material from 1.5km below the moors with minimal impact, was always going to require some complex ground engineering solutions. The geotechnical challenges and the many programme changes required to bring the mine live by early 2021, which is some six months earlier than originally planned, meant it is an evolving project. To comply with planning the mine also had to be low impact, which restricted it to having only two 60m deep chambers to house the headgear for the production and service shafts and a 37km long tunnel to take the material directly to port facilities at Wilton on Teeside. Three shafts were required from ground level at Woodsmith for production, services

and one for launching the 5m diameter tunnel boring machines (TBM) that will drive the first section of the 37km material transport system (MTS) tunnel at 360m depth from Woodsmith to Teeside.

With these requirements, Bauer Technologies was appointed to install three up to 120m deep diaphragm wall shafts, with diameters between 8m and 35m. To guarantee the specified vertical tolerance of 200mm, the site team had to combine various survey methods, which were documented in a 3D BIM model. In addition, as part of the works, a large quantity of bentonite slurry had to be reconditioned in a complex de-sanding plant and by use of specially designed polymer-based additives. Specifically, the service shaft headgear chamber was 60m deep,

32m dia; and the production shaft main shaft was 120m deep, 8m dia. The shafts were formed by 2.8m wide and 1.2m thick panels - 48 for the service shaft, 44 for the production shaft headgear chamber and 14 for the deep main shaft. The design of the structures was based on hoop force with steel cages extending to the full depth. The reinforcement cages were manufactured offsite in up to eight sections and assembled vertically during installation. The cages in the primary panels were slightly smaller than those in the secondary panels to allow for the panel over bite. Primary panel cages were also fitted with specially developed, lateral GFRP spacers centralising the reinforcement within the wall axis of each panel.

Notwithstanding the often-extreme weather conditions, such as high winds and heavy snow, the ground conditions at the Woodsmith site were also challenging. Variable lamination through which Bauer had to cut the diaphragm wall panels for the shafts was classed



as weak to medium-strong. The intermittent nature of the geological lamination made the cutting process technically challenging and required Bauer to deploy a number of combinations of cutter wheel configurations to optimise performance. In addition, the wheels were equipped with three types of teeth in nine variations of size, position and strength.

The project commenced October 2017, with work beginning on the first panel in December 2017. The extremely

challenging ground conditions demanded three cutters on the project; two MC96 machines and an MC128 carrying HDS120 hose drum systems and BC40 cutter units. Two BE500 and one BE550 de-sanding units fitted with BDS125 de-silters and a BD90 decanters were also used.

Bauer Technologies completed its scope of works successfully in December 2018, with all works completed to the agreed programme.

**Client:**

Sirius Minerals Plc

**Piling Contractor:**

BAUER Technologies Limited

**Contract Period:**

October 2017 - December 2018

**Equipment Used:**

- 2 no. MC96 machines
- MC128 carrying HDS120 hose drum systems and BC40 cutter units

**Bauer's Scope of Works:**

- Service shaft headgear chamber to 60m deep, 35m dia; 48no. 2.8m wide and 1.2m thick panels
- Production shaft headgear chamber to 60m deep, 32m dia; 44no. 2.8m wide and 1.2m thick panels
- Production shaft main shaft to 120m deep, 8m dia; 14no. 2.8m wide and 1.2m thick panels