

wassara

WATER-POWERED DRILLING IN MINING





"When I came to LKAB from mining school, I had the prejudice that straight drilling was linked to air ITH. I soon learnt that the alternative is Wassara. Today, drilling long and straight production blast holes is a condition for the continuous improvement of our overall mining costs."

Monica Quinteiro, Manager, LKAB Kiruna mine, Sweden

STRAIGHT FORWARD DRILLING

The Wassara technology uses water to power the hammer. This gives unrivalled benefits and possibilities in mining. Wassara meets the need for drilling deeper and narrower, more cost-efficient and more environmental-friendly. This makes the water-powered technology the optimal choice.

A giant leap in drilling for mining

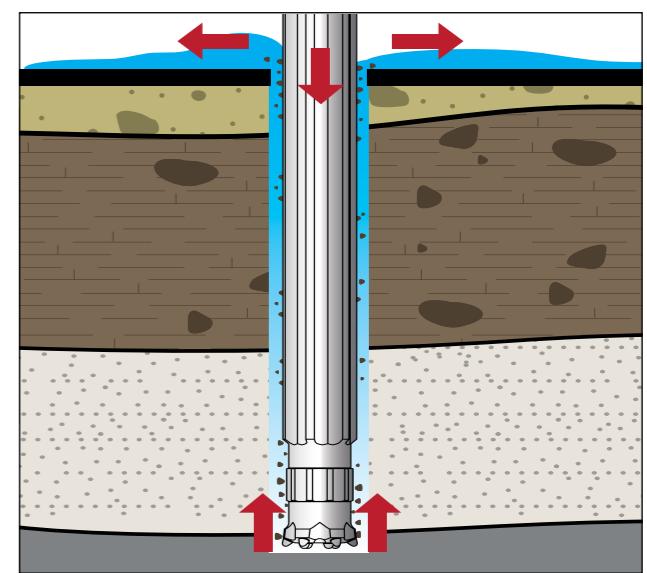
The mining business is in great need of new drilling solutions that meet the challenges of mining deeper, bigger and narrower – and at the same time protecting the environment and reducing the costs. Many existing underground mines are reaching extreme depths that current mining methods cannot manage cost-efficiently. New deposits are deeper with leaner ores. These factors demand larger scale mining and resource planning based on facts, not assumptions – and new, more efficient and precise drilling. The straight forward drilling of Wassara.

Large-scale improvements

Wassaras water-powered drilling is the biggest improvement in drilling since the air ITH, by providing accuracy that moves mining boundaries and eliminates the earlier limitations in drilling. The Wassara technology is suitable for all types of mines and most drilling applications in mining operations. In short, it enables mining companies to scale up, improve safety, lower their energy consumption and minimize the impact on the environment.

How Wassara works

The Wassara technology uses high pressure water to power the ITH hammer. Water gives a high frequency and high energy per blow. When the water leaves the hammer it has sufficient velocity to bring the cuttings and debris to the surface and clean the hole. Besides smooth and straight holes with a minimum of deviation, Wassara offers superior benefits like high productivity, borehole quality and minimum impact on the formation you are drilling in.



The principles of water-powered drilling

STRAIGHT DRILLING MATTERS – REGARDLESS OF MINING METHOD

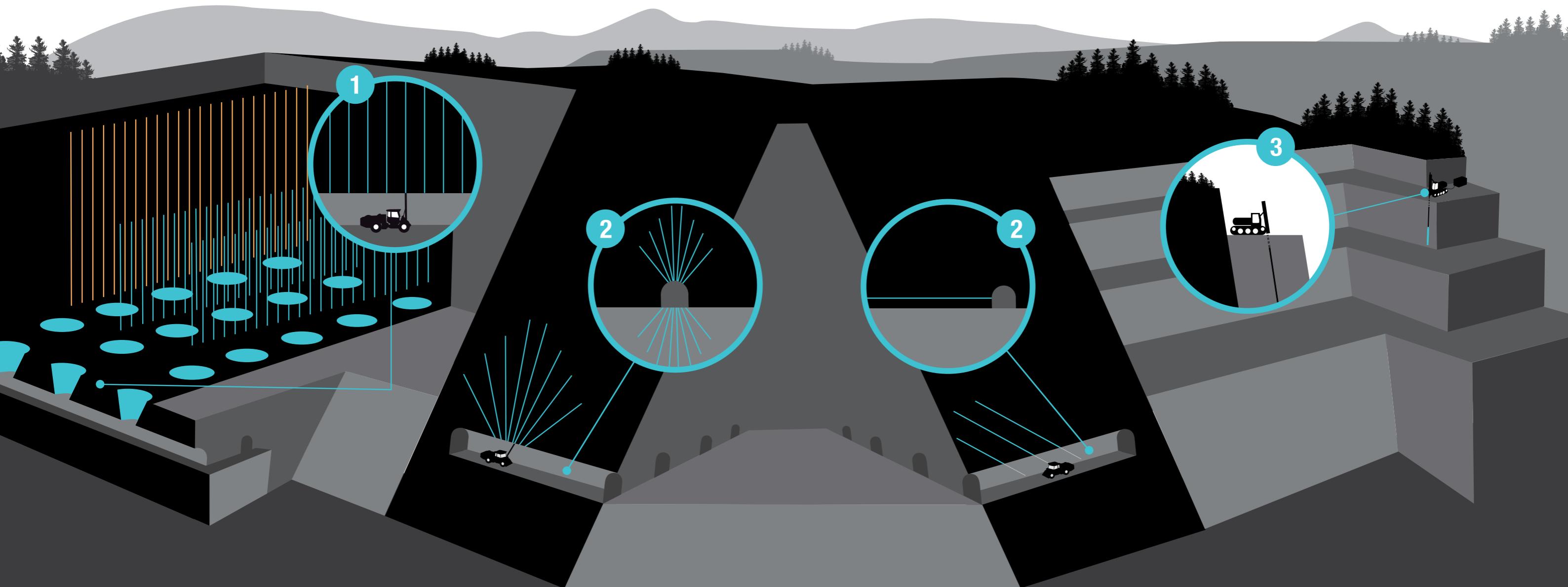
With Wassara you can choose mining methods optimal for the ore bodies, instead of optimal for the drilling methods.



LKAB KIRUNA AND MALMBERGET IRON ORE MINES IN SWEDEN

Mission: Scaling up production by drilling longer and straighter blast holes in two block caving mines.

Result: By extending the borehole lengths from 28 to 56 meters, the total production efficiency has increased by 500%. The Wassara technology was fully implemented in 1995 and has until today been used to drill more than 17 million metres.



Underground mining

Common for all mining operations is the significance of accurate drilling. Wassara offers a unique drilling system that takes away the limitations of most existing methods, by superior accuracy and efficiency. Our water-powered technology gives mining companies the ability to choose mining methods optimal for the ore bodies instead of optimal for the drilling methods – a big step towards real optimized mining.

① BLOCK CAVING

- a) Preconditioning/propagation
- b) Hydrofracture
- c) Drawbells / finger raises

② SUB LEVEL CAVING

- a) Long blast holes
- b) Investigation holes
- c) Slot drilling / rises
- d) Raises
- e) Service holes (utility, drainage, backfill)

③ OPEN PIT MINING

- a) Drilling for dewatering
 - b) Pre-split
- The drilled holes for pre-split must remain parallel and shall not deviate from the plane of the proposed slope. The Wassara technology gives you optimal conditions for this.

THE KEY BENEFITS WITH WASSARA

Extraordinary accuracy

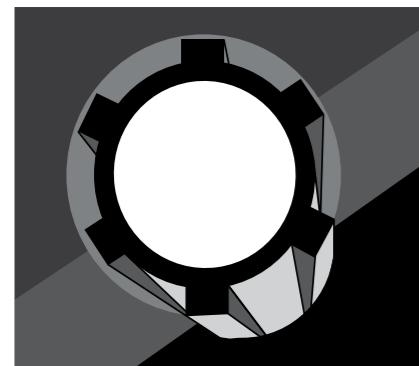
Accuracy is the most crucial factor for the profitability since it dictates borehole length and scale of the operation. In this respect Wassara is outstanding, with a borehole deviation of normally less than 1%, compared to 10–20% with other technologies. Wassara also drills smaller diameter holes efficiently.

Lower costs and higher productivity

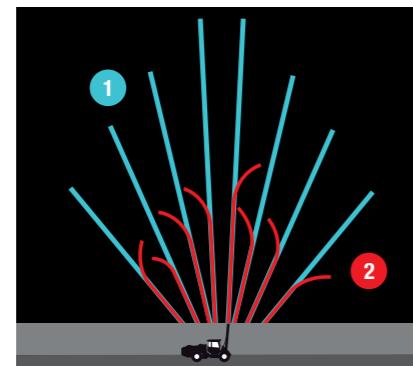
When comparing costs for drilling systems, it is the actual cost per ton ore on the ground that matters. So, when comparing Wassara with other systems, these parameters should be taken into account.

This is where Wassara clearly shows its benefits:

- Scale – the drilling accuracy means less development and more tonnes per round.
- Drill metres – you get more tonnes per drilled metre. The drilling depth can be extended, without need to take any extra actions.
- Fragmentation – controlled due to drilling accuracy.
- Energy consumption – Up to 80% less due to system efficiency. The energy consumption is about 1/5 compared to air compressor, and 1/3 compared to top hammer.
- Lifetime of equipment – extensive due to minimum component wear.



The low velocity of the return water minimizes the wear on the hammer guide ribs, enabling a tight clearance between the hammer and the wall – giving the drill string optimal stability.



The main challenge is drilling accuracy. Wassara normally keeps the holes within 1% deviation!

- Consistent fragmentation and dilution for optimal flow and processing.
- Drifting reduced by 70%
- Volume per drilled metre increased by 500%
- Safer mining thanks to outstanding accuracy even for the longer holes.

1. With Wassara 2. With other solutions

Safer and more benign drilling

The low up-hole velocity of the water (0.5–1.0 m/s) minimizes the disturbance to the surrounding formation. The water also flushes the cuttings to the surface safely, in contrast to air ITH that blasts cuttings and gravel both in the bore-hole and into the air at 40–80 m/s.

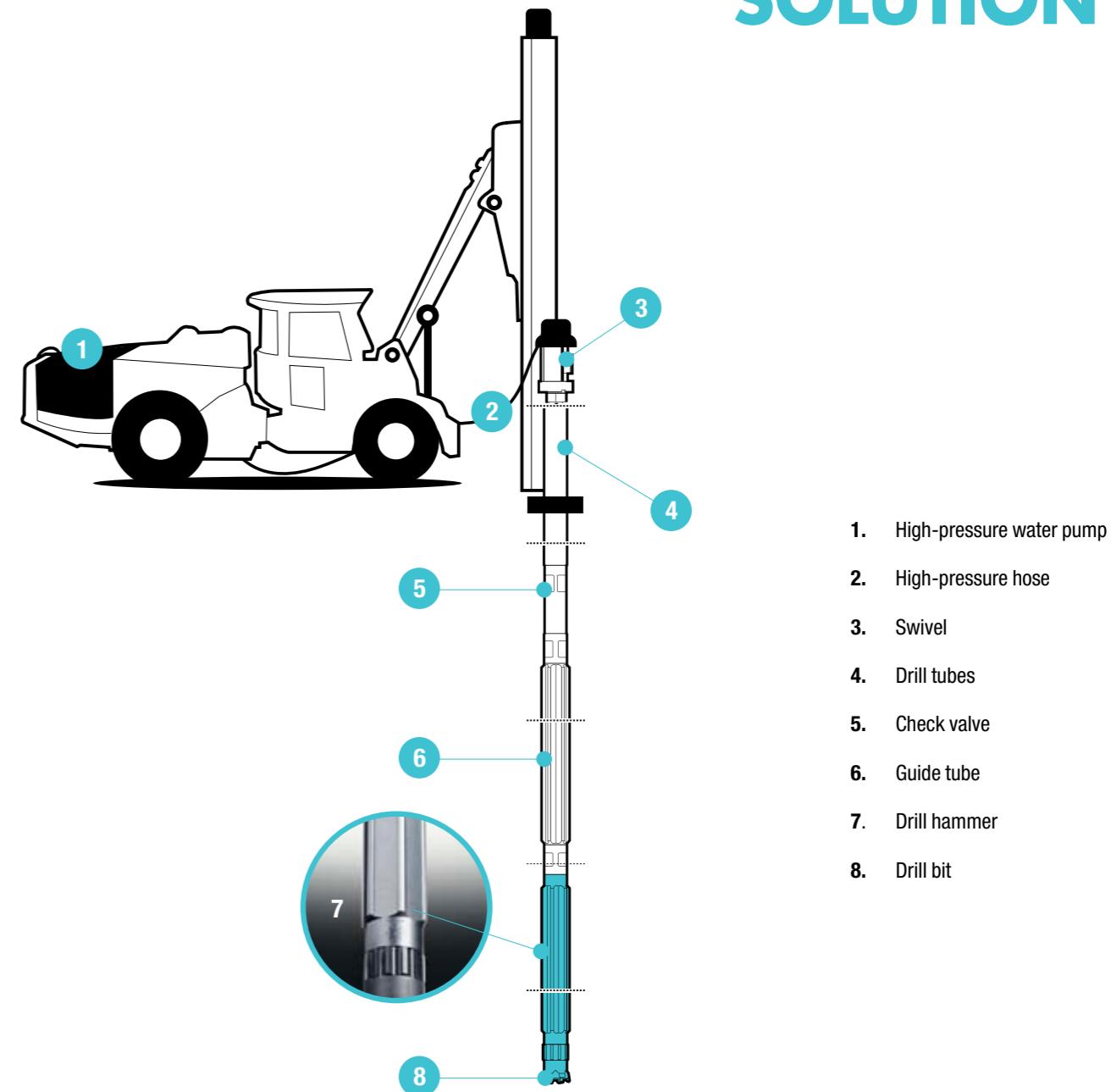
High and versatile performance

Wassara is faster than diamond core drilling and faster than air ITH and top hammer for long holes, due to the system efficiency, higher frequency (3 600 blows per minute compared to 2 000 – 2 700 with air ITH) and constant percussive force. No impact power is lost through the drill string; the penetration rate is maintained even at significant depths since the hammer is always at the bottom of the hole.

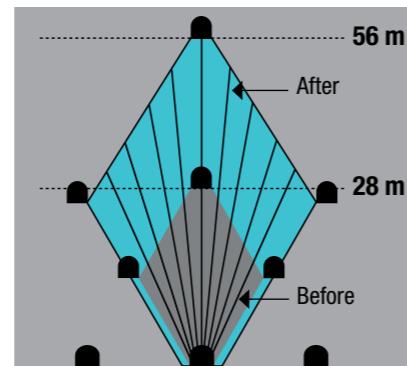
Less environmental impact

The water-powered technique gives far less pollution as no oil is used to lubricate the hammer – you get no injection of air or oil in the formation, no influence of oil in the water table, and no oil mist or dust distribution in the air. These benefits also heavily improve the work environment.

THE WASSARA SOLUTION



1. High-pressure water pump
2. High-pressure hose
3. Swivel
4. Drill tubes
5. Check valve
6. Guide tube
7. Drill hammer
8. Drill bit



Scaling up from 12 to 28 metres between levels and drifts:

- Drifting reduced by 70%
- Volume per drilled metre increased by 500%
- Reduced costs in all steps from planning to operation

Hammer range

Hammer	Ø Drill bit	Water consumption	Max operating pressure
W50 (2")	60mm, 64mm (2 ½", 2 ½")	80-130 l/min (20-35 USgpm)	170 bar (2500 psi)
W70 (3")	82mm, 89mm (3 ¼", 3 ½")	130-260 l/min (35-70 USgpm)	180 bar (2600 psi)
W80 (3.5")	95mm (3 ¾")	130-260 l/min (35-70 USgpm)	180 bar (2600 psi)
W100 (4")	115mm, 120mm (4 ½", 4 ¾")	225-350 l/min (60-95 USgpm)	180 bar (2600 psi)
W120 (5")	130mm, 140mm (5 ⅛", 5 ½")	300-450 l/min (80-120 USgpm)	180 bar (2600 psi)
W150 (6")	165mm (6 ½")	350-500 l/min (95-130 USgpm)	150 bar (2200 psi)
W200 (8")	216, 254mm (8 ½", 10")	470-670 l/min (125-180 USgpm)	150 bar (2200 psi)



Wassara – cost-efficient and environmentally friendly drilling

LKAB Wassara is a Swedish company developing and manufacturing unique water-powered drilling systems for high performance in surface- as well as underground drilling operations. The heart of the Wassara drilling system is the world patented water-powered down-the-hole hammer.

The drilling systems have been used for more than 20 years in various applications within many industries; mining, exploration, ground engineering, dams, geothermal, marine, oil & gas storage. Our experience covers more than 25 million drilled metres working in different locations around the world. Reference studies can be found on our website.

LKAB Wassara was founded in 1988 and is owned by LKAB. LKAB is an international high-tech minerals group that produces iron ore products for the steel industry and other mineral products for many other industries and applications.

Explore more at www.wassara.com