



wassara

# **WATER-POWERED DRILLING IN GROUND ENGINEERING**







**“When drilling in formation close to buildings and other constructions, it’s crucial that the drilling operation itself doesn’t undermine any buildings. We always use Wassaras water-powered DTH hammer in sensitive areas to ensure a benign drilling.”**

Björn Biller, [Drilling Manager for Ground Engineering at Veidekke, Sweden](#)

# STRAIGHT FORWARD DRILLING

The Wassara technology uses water to power the hammer. This makes it the ideal choice for most drilling applications in ground engineering – for drilling in sensitive areas as well as for drilling long straight holes. The water-powered DTH hammer is capable of penetrating any formation while maintaining speed and straightness. Hard rock, boulders, concrete, lime stone, granite, till, water rich formations and dense clay. The jet grouting hammer also enables jet grouting in one single pass.

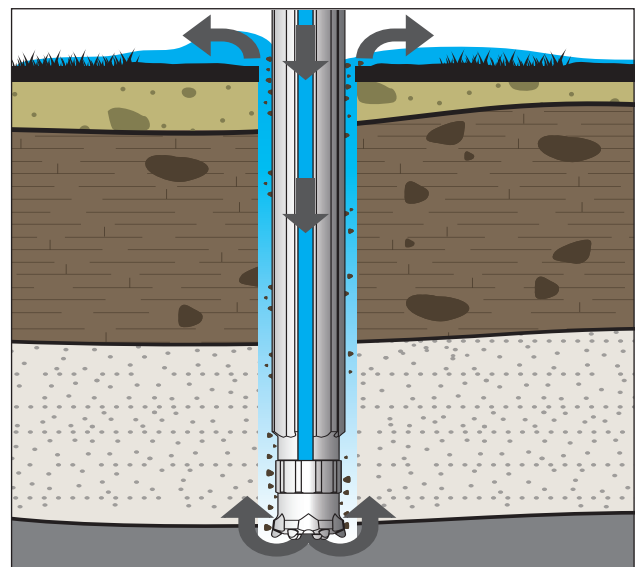
## Suitable for most ground engineering applications

When drilling in the ground, there are several aspects that affect the work: Type of formation (till, dense clay, water-rich formations, boulders, etc.), requirements on the borehole (length, accuracy, etc.) and environmental concerns (drilling in sensitive areas, noise restrictions). Wassaras drilling technique meets basically all the challenges that might arise due to these different aspects. Wassaras water-powered DTH hammer is developed to handle any formation, and is suitable in numerous applications:

- Drilling in sensitive areas
- Casing advancing
- Geo energy / geothermal drilling
- Jet grouting
- Maritime drilling

## How Wassara works

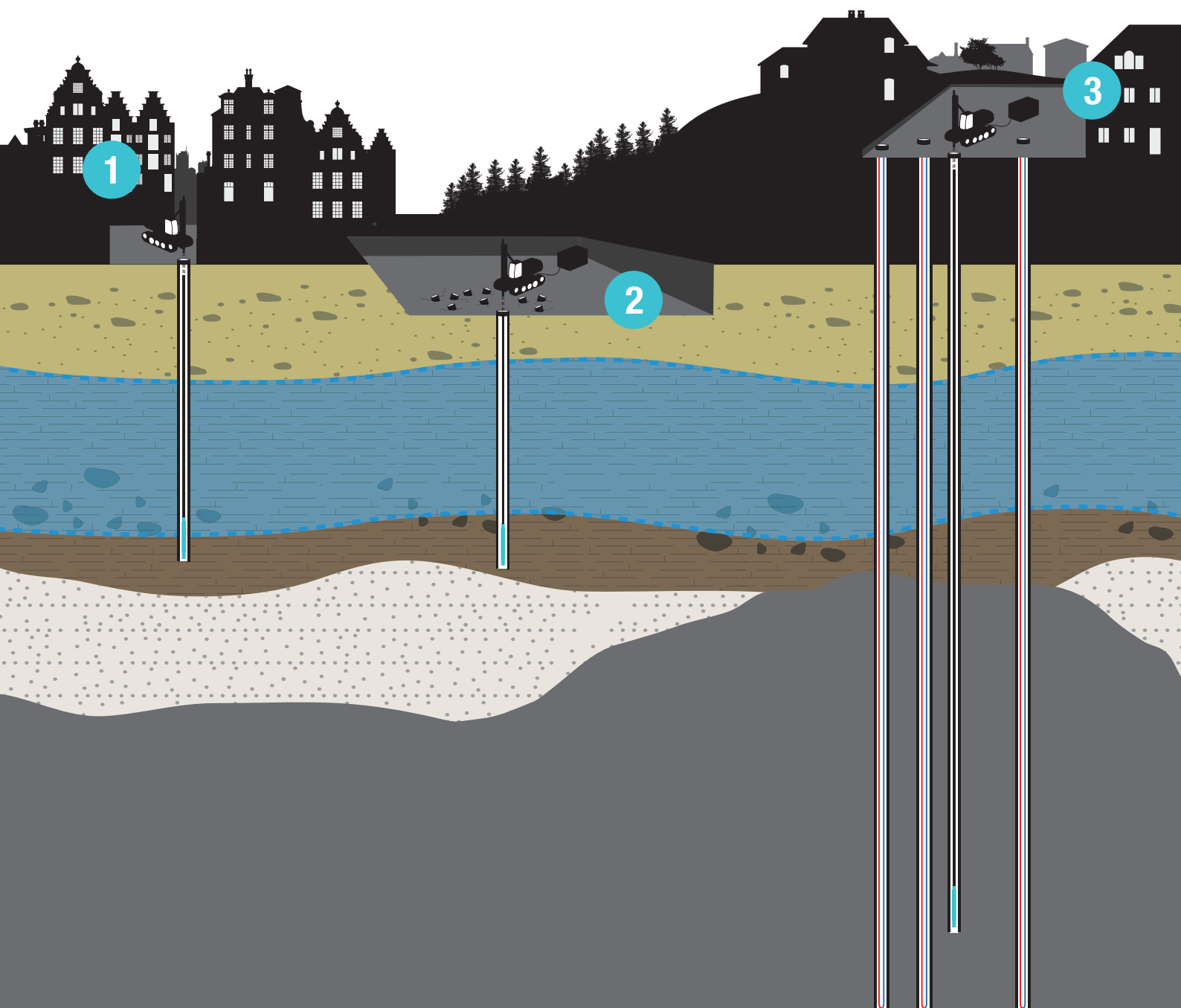
The Wassara technology uses high-pressure water to power the DTH hammer. Water enables a high frequency and high power output. When the water leaves the hammer it has a sufficient velocity to bring the cuttings and debris to the surface and clean the hole. Besides clean and straight holes with a minimum 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

# ACCURATE, BENIGN AND COST EFFECTIVE DRILLING

The water-powered DTH hammer from Wassara is the versatile choice for most drilling applications in ground engineering. It can handle any formation; hard rock, boulders, concrete, lime stone, granite, wood, till, dense clay and formations containing water.

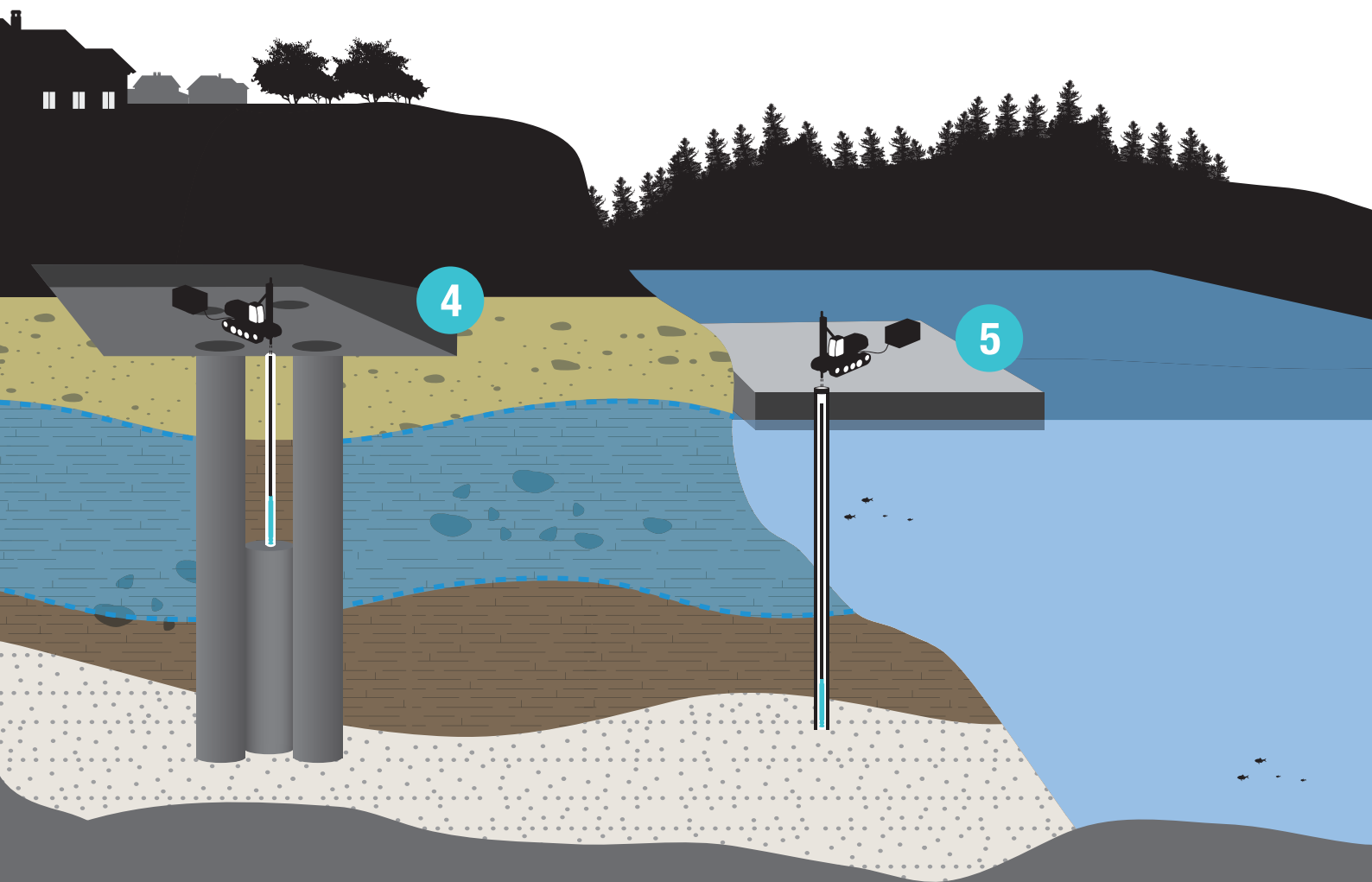


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# DRILLING IN SENSITIVE AREAS

## Foundation work and ground engineering with Wassara

### Minimal impact on ground water table

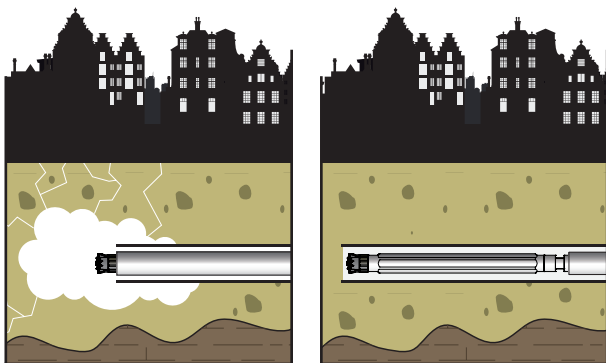
Urban areas are often considered as sensitive and must not be affected by side effects from a drilling operation. This means that no impact is allowed on the ground water level, or any injection of oil or air to the formation.

### No risk of harming buildings

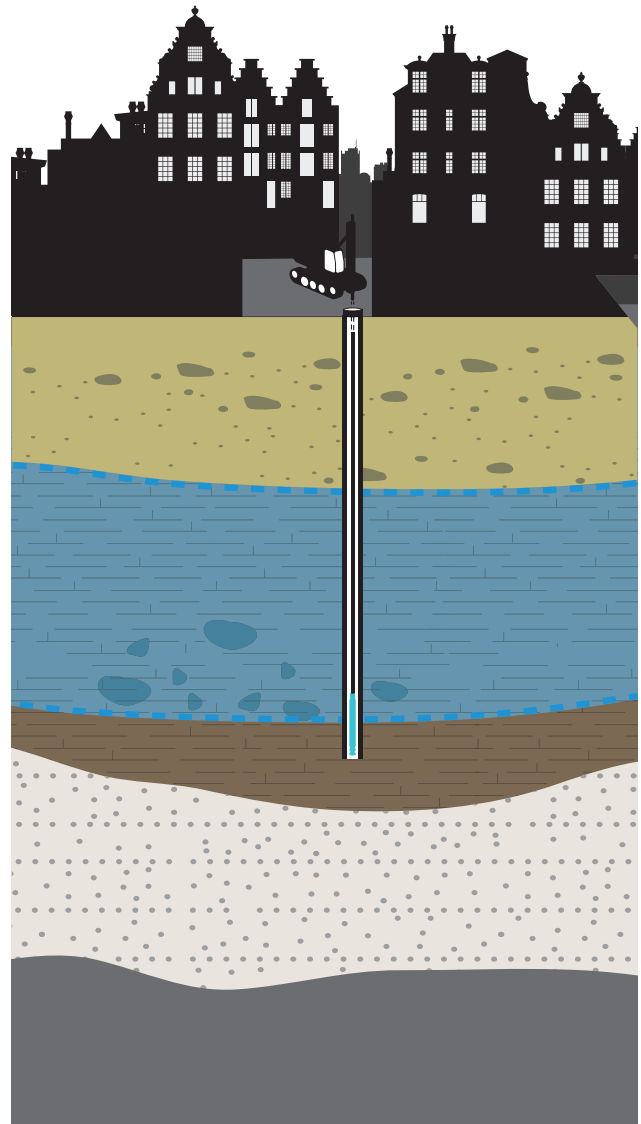
When drilling with Wassara, the risk of pressurising the formation is minimised as the water quickly lose pressure when leaving the hammer. When drilling with air-powered equipment, there is always a risk of pressurising the formation. If the formation is filled with cracks or cavities, the expanding air may cause hazard to adjacent structures.

### Better work environment

Air-powered drilling in urban areas often face environmental restrictions in terms of allowed noise level and injection of oil or dust to the air. Wassaras water-powered drilling gives no injection of oil or dust in the formation, and is far quieter than top hammers since the percussion takes place down in the borehole.



Wassara (right image) minimises the risk of pressurising the formation



### THE BANCO HOUSE IN OLD TOWN, STOCKHOLM, SWEDEN

**Mission:** Re-enforcing of a cultural monument in Stockholm, an old bank house from 1734. The house was once built on a formation comprised of old wooden piles, old filling material and clay. A total of 400 holes with casings were to be drilled.

**Result:** The benign drilling with Wassara proved a great success since the difficult formation didn't affect the drilling. Drilling indoors was no problem as the water could be discharged by a separate system.

# CASING ADVANCING

## Foundation and reinforcement work with Wassara

### High drilling performance

Wassara is proven to be a reliable method for casing advancing. The water lubricates the casing, which enables a smoother drilling operation. When casing advancing in longer holes, Wassara is often the only feasible method. Wassara offers drill bits and casing shoes developed for the water-powered drilling technique.

### Drills through any formation

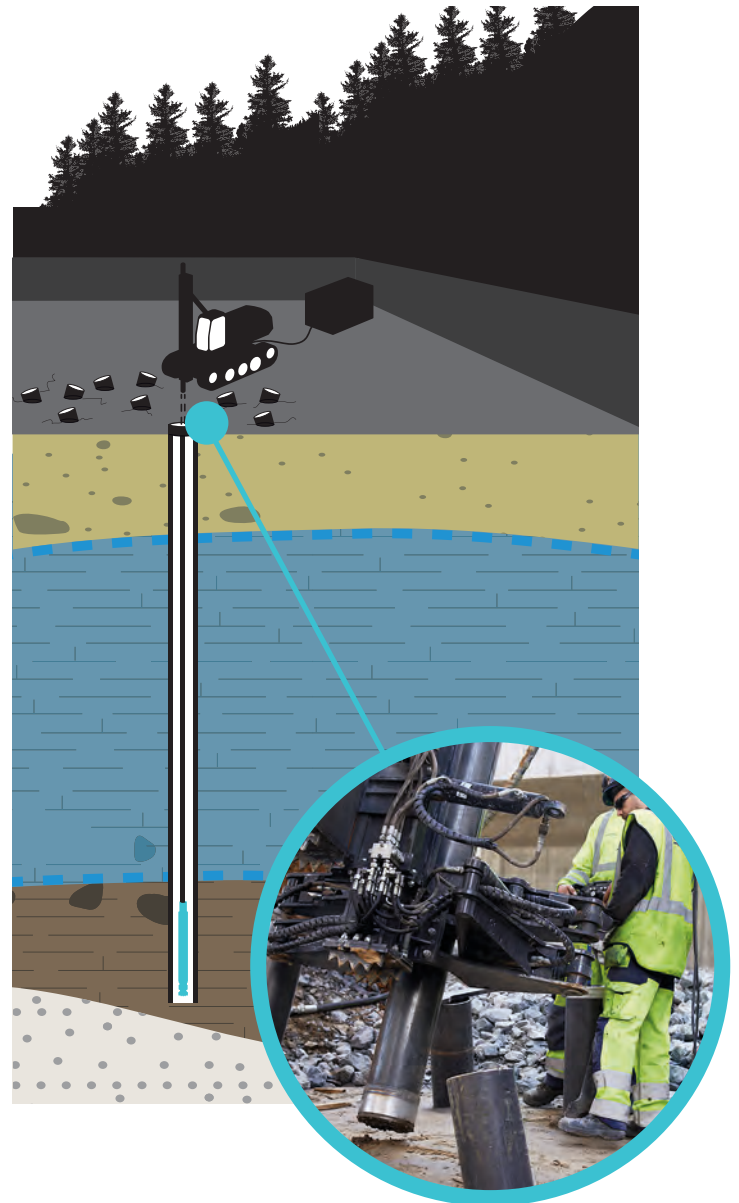
As Wassara is a water-powered percussion system, it's able to drill through complex formations, from soft clays and sands to harder rock, boulders and even through old wooden piles! The Wassara system is unaffected by water in the formation, even at high back pressure.

### Safer and more benign drilling

Because water is an incompressible medium, the risk of causing damage to the surrounding services or adjacent structures when drilling is minimised. Air-powered drilling always faces a much higher risk of pressurising the formation, leading to hazard for adjacent structures.

### More environmental-friendly

No dust or oil mist is created by the drilling operation, which leads to a safer, cleaner environment for both site personnel and the general public. When drilling with Wassara, it is possible to place the water pump well away from the drilling area, enabling a quieter and healthier workplace.



### THE CITYBANAN RAIL LINK PROJECT AT THE CENTRAL STATION IN STOCKHOLM, SWEDEN

**Mission:** Preparing the ground for building a work tunnel. As the main line was only five meters away, subsidence was strictly forbidden. The formation comprised a thin layer of till on top of soft clay, making drilling with air-powered equipment both impossible and forbidden.

**Result:** The whole drilling operation was smooth and easy. No subsidence was detected.



# GEO ENERGY AND GEOTHERMAL DRILLING

## Drilling long holes with Wassara

### Long straight holes

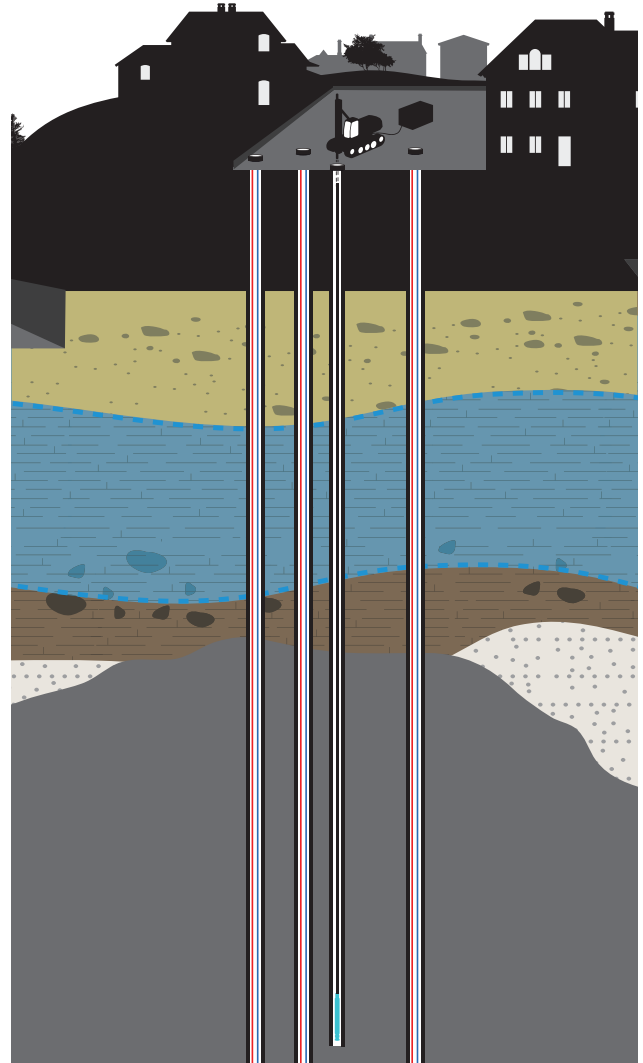
When drilling several long holes, minimised borehole deviation is crucial as the holes might collide otherwise. Wassara has proven its capability to drill long straight holes that are not affected by the water table. The ability to drill fewer holes to larger depths is also one of the advantages of the water-powered drilling technology – especially in restricted areas where space is limited.

### Drills through different formations

Drilling in areas with layers of different formations can be tricky. Dense clay is one of the more troublesome formations for conventional equipment to handle, while Wassara penetrates it with maintained speed and straightness. The water-powered DTH hammer is capable of penetrating any formation.

### Efficient and secure in water rich formations

To drill in water rich formations with air-powered equipment is hazardous; the air wants to push the water to the surface. This gives far reduced, if any, drilling efficiency. With Wassara, water in the formation is not a problem. The surrounding water will not affect the drilling at all. Nor does the drilling affect the water in the formation.



### GEO ENERGY STORAGE TO A LARGE CONFERENCE CENTRE IN MALMÖ, SWEDEN

**Mission:** Drilling 75 holes of 280 meters length in very water-rich formation. Maximum allowance of water fed to sedimentation system: 190 m<sup>3</sup> per day. Earlier drilling with air-powered DTH gave 100 m<sup>3</sup> every hour.

**Result:** Wassara kept the tight time schedule without exceeding the allowed amount of water fed to the sedimentation system.

# JET GROUTING

## Enabling single pass jet grouting

### Drills through any formation

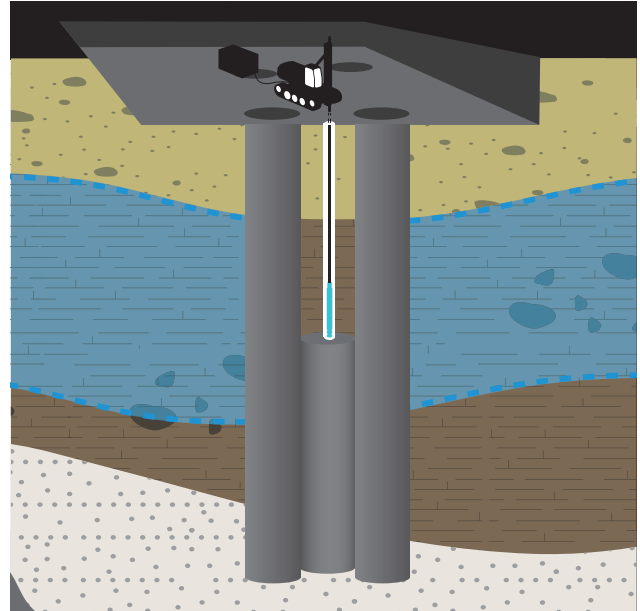
Wassara Jet grouting hammer enables single pass jet grouting in difficult formations. This eliminates the need for more than one drill rig and jet grouting equipment. As the hammer and jet monitor are powered by separate pumps, they can be controlled independently of each other.

### No changing of equipment

Where stones, boulders and other obstacles have made jet grouting complicated, Wassaras patented Jet grouting hammer makes the procedure easier. As the drill string is complete with all necessary tools, no changing of equipment is required during the whole operation.

### Performance

By pre-cutting with water or air through the nozzles during the drilling phase, it's possible to produce larger diameter columns than with conventional single fluid jet grouting systems.



# MARITIME DRILLING

## Foundation and reinforcement work under water with Wassara

### Highly efficient

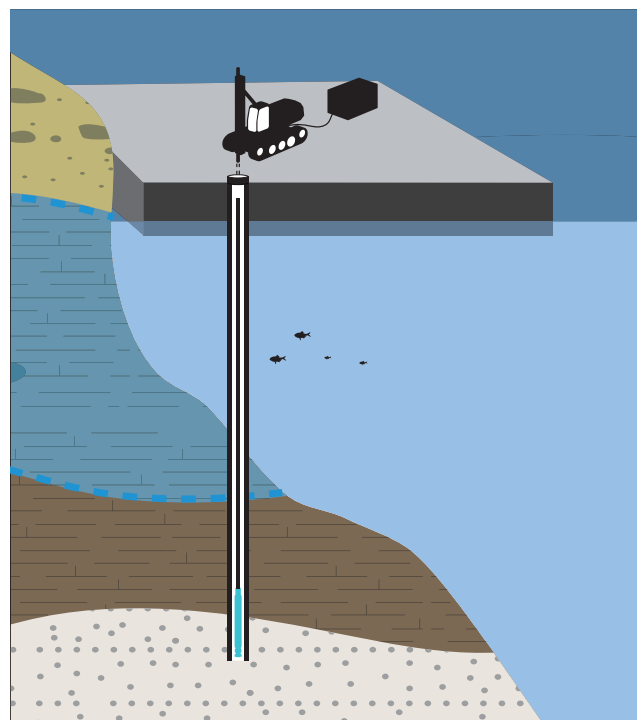
In maritime projects, like drilling in harbours, the Wassara technique offers superior efficiency compared to conventional drilling methods. The capacity is falling quickly when drilling with air-powered DTH hammer. With Wassara the capacity and speed is maintained during the whole operation, the surrounding water does not affect the drilling.

### No oil in the water

Another benefit with the Wassara technique is that it uses no oil, which eliminates the risk of any oil polluting the water. This is often a strict requirement when drilling in maritime areas.

### Minimised risk of pressurising the formation

The likelihood of pressurising the formation is very low with Wassara. This is always a risk when drilling with air-powered DTH equipment. Cracks and cavities in the formation will be at risk of expanding drastically with the expanding air.



# THE KEY BENEFITS WITH WASSARA

## Safer and more benign drilling

The Wassara drilling technique minimises the risk of pressurising the formation, which ensures a minimum of disturbance to the surrounding services and adjacent structures. The ground water table is not impacted – and neither does the ground water table impact the drilling work.

## Better borehole quality and accuracy

With Wassara you get straight and stable boreholes, thanks to the tight clearance between drill string and borehole. The stability is maintained by the water column's hydrostatic pressure. Also, the low up-hole velocity of the water prevents creation of cavities, which means cleaner and smoother holes.

## High and versatile performance

Since the Wassara technique itself uses water, it drills through water-rich formations without problems. The high penetration rate also provides very efficient and fast drilling through almost any material, from boulders and wood to dense clay and old foundations.

## Cost effective

The energy consumption with Wassara is normally 50–80% less than with air-powered drilling systems. Another cost saving factor is the minimum wear on the equipment, due to the low up-hole velocity of the water.

## Less environmental impact

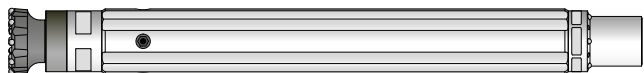
The water-powered technique gives no pollution as no oil is used to lubricate the hammer, only pure water is used. You get no injection of air or oil in the formation, no influence of oil in the ground water and no oil mist or dust distribution in the air – all important benefits, not least for the work environment.

### Hammer range



Hammer	Ø Drill bit	Water consumption	Max operating pressure
W50 (2")	60mm, 64mm (2 3/8", 2 1/2")	80-130 l/min (20-35 USgpm)	170 bar (2500 psi)
W70 (3")	82mm, 89mm (3 1/4", 3 1/2")	130-260 l/min (35-70 USgpm)	180 bar (2600 psi)
W80 (3.5")	95mm (3 3/4")	130-260 l/min (35-70 USgpm)	180 bar (2600 psi)
W100 (4")	115mm, 120mm (4 1/2", 4 3/4")	225-350 l/min (60-95 USgpm)	180 bar (2600 psi)
W120 (5")	130mm, 140mm (5 1/8", 5 1/2")	300-450 l/min (80-120 USgpm)	180 bar (2600 psi)
W150 (6")	165mm (6 1/2")	350-500 l/min (95-130 USgpm)	150 bar (2200 psi)
W200 (8")	216, 254mm (8 1/2", 10")	470-670 l/min (125-180 USgpm)	150 bar (2200 psi)

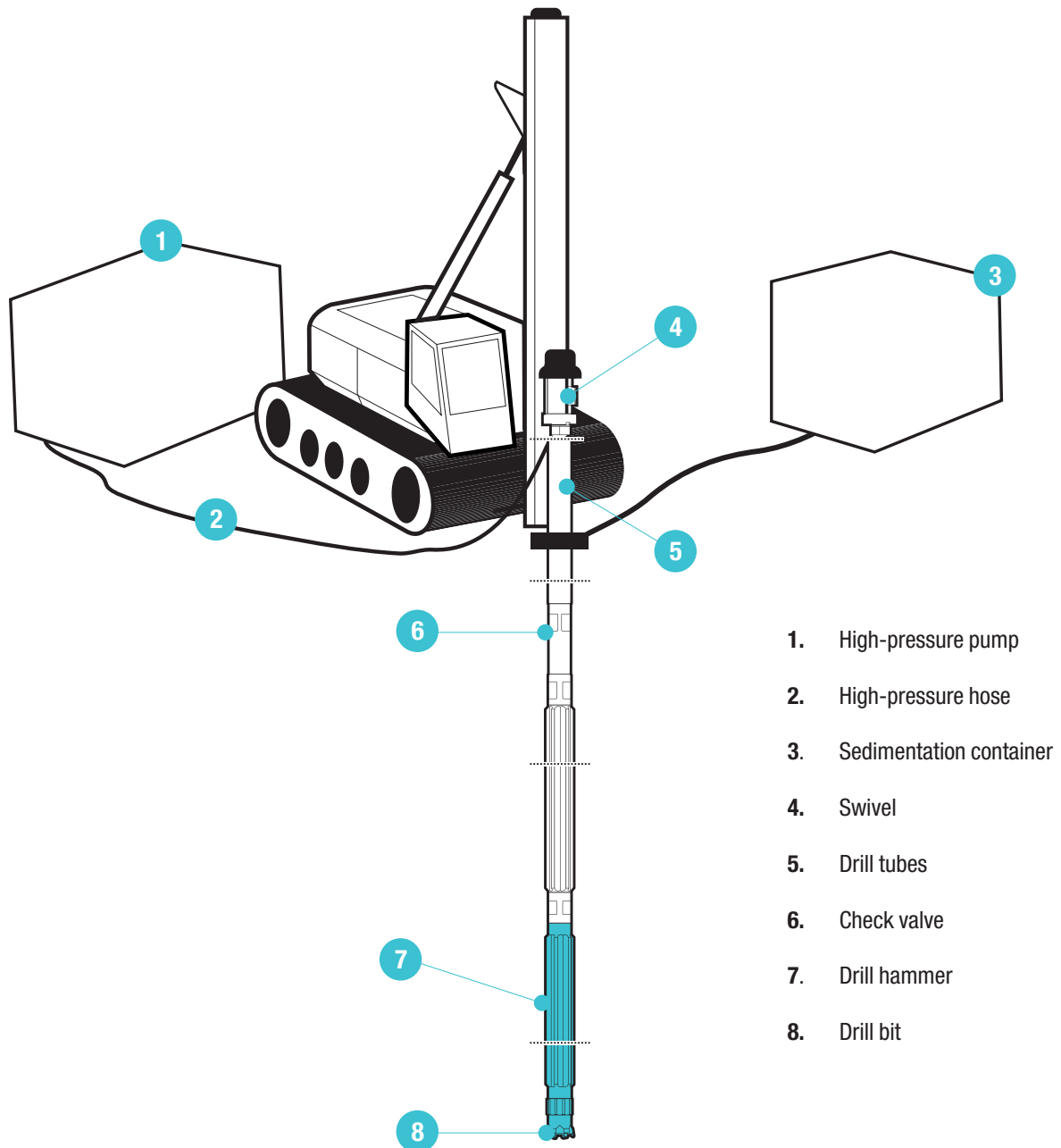
### Hammer range – Jet grouting



Hammer	Ø Drill bit	Water consumption	Recommended operating pressure	Max grout pressure
W100JG	153, 165 mm (6", 6 1/2")	200–350 l/min (52-93 USgpm)	170 bar (2500 psi)	500 bar (7250 psi)



# THE WASSARA SOLUTION





### **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](http://www.wassara.com)**