

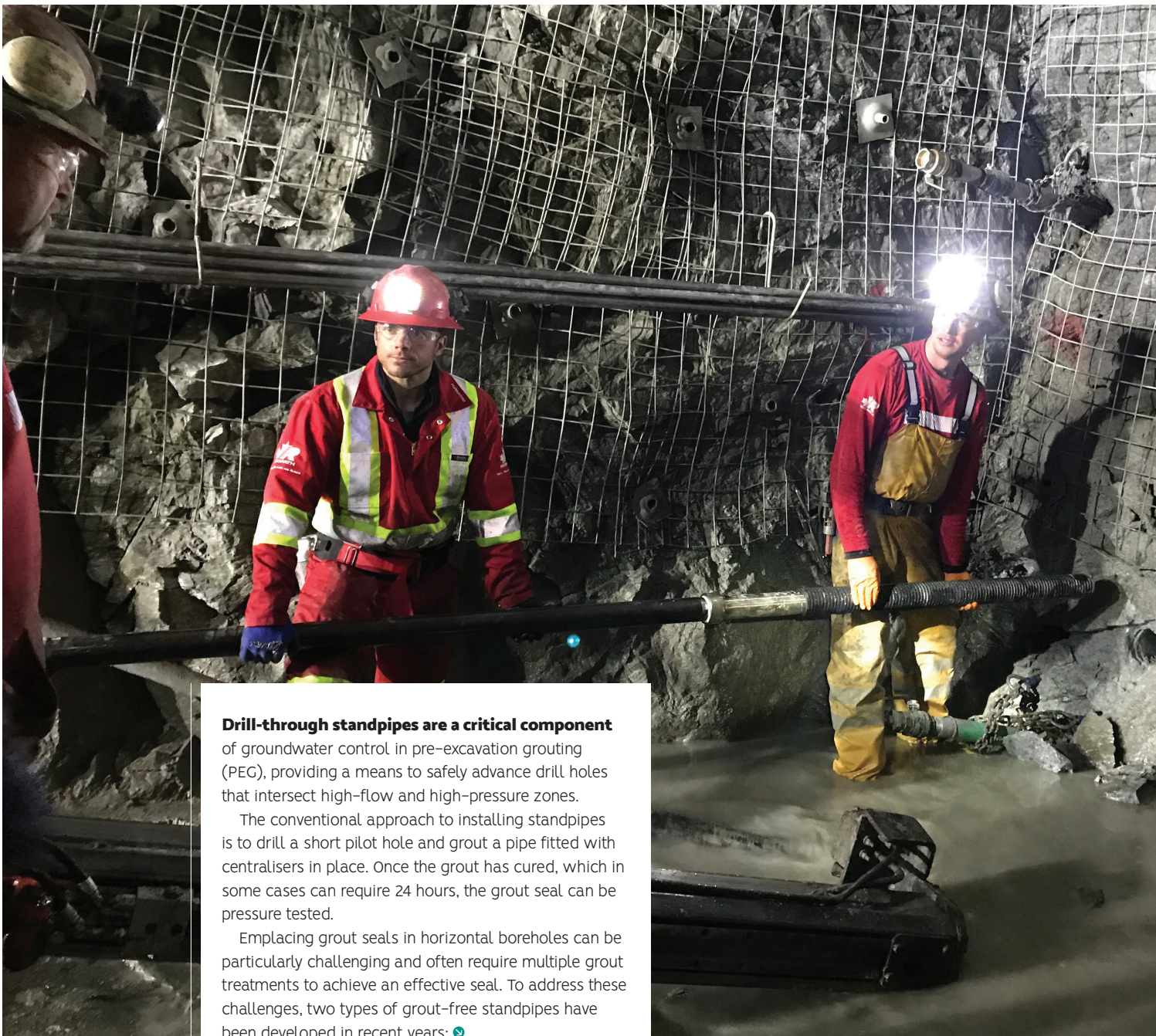
# PEG SAVINGS FROM NEW STANDPIPE SOLUTIONS

## Below:

Photo of Standpipe Installation

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IPI PACKERS

Two types of high-pressure, grout-free standpipes developed for pre-excitation grouting (PEG) in recent years are discussed by **Joel Adams**, Director (Mine, Water, Geotech) with IPI Packers

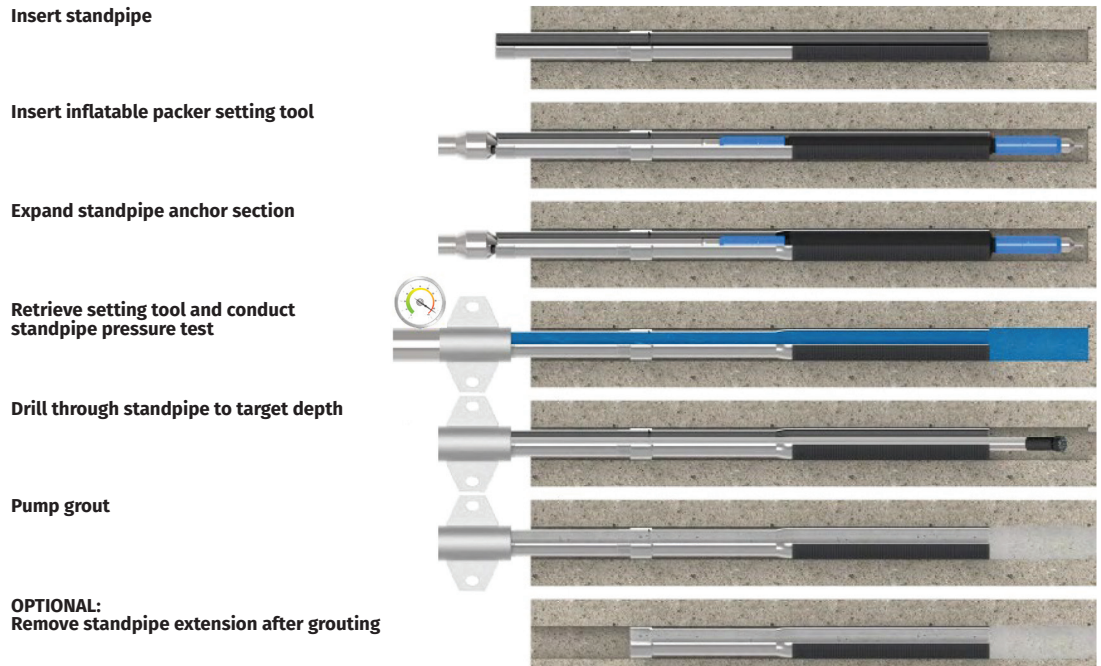


**Drill-through standpipes are a critical component** of groundwater control in pre-excitation grouting (PEG), providing a means to safely advance drill holes that intersect high-flow and high-pressure zones.

The conventional approach to installing standpipes is to drill a short pilot hole and grout a pipe fitted with centralisers in place. Once the grout has cured, which in some cases can require 24 hours, the grout seal can be pressure tested.

Emplacing grout seals in horizontal boreholes can be particularly challenging and often require multiple grout treatments to achieve an effective seal. To address these challenges, two types of grout-free standpipes have been developed in recent years: [▶](#)

**Right:**  
Grout-free expandable  
standpipe installation



- **Drill-through Expandable Standpipes** – an elastomer-covered standpipe that is installed using an in-situ hydroforming technique and utilises a high-pressure inflatable packer to expand and press the standpipe directly to the borehole wall.
- **Drill-through Temporary Standpipes** – utilises an inflatable packer to create a seal during drilling and grouting activities, and can be removed to be re-used in another location. These systems are also particularly effective in tunnel boring machine (TBM) operations because no steel is left in the probe/grout holes once activities are completed.

**DRILL-THROUGH EXPANDABLE STANDPIPES**

The grout-free expandable standpipe was developed for a drill and blast mining operation that required extensive PEG to control groundwater ingress. Initially, the operator was using conventional standpipes with centralisers and cementitious grout to withstand grouting pressures exceeding 70 bar (~1000psi). The operator experienced a high rate of failure with the conventional approach that required a 24hr grout cure time and thus experienced significant costly down time.

High pressure inflatable packers have been used for setting expandable casing patches in water wells for many years. This same technology is now being applied for installing elastomer-covered standpipes in rock holes. The expanded standpipe conforms to the borehole wall and acts as an anchor and sealing component, eliminating the need to grout. The expansion process is completed in a matter of minutes, after which the sealing and anchoring integrity of the standpipe can be tested immediately.

Typical standpipe dimensions are 73mm o.d. (2.875-in) and 3m-long (10-ft). Length and diameter can be adjusted to suit project needs. Installation is achieved by first drilling a pilot hole slightly longer than the standpipe length. After the pilot hole is flushed to remove cuttings and debris, the standpipe is inserted leaving the desired length of stick-out at the face.

The expansion tool is then inserted into the standpipe and energised to approximately 480 bar (~7,000 psi) to expand the standpipe and compress the elastomer cover against the borehole wall. It is energised using either an air-driven liquid pump (water inflation), or a battery-powered hydraulic pump (oil inflation). Under no circumstances should gas be used as an inflation medium for this process.

The expansion process takes approximately 200 seconds from initiating packer inflation to completing the expansion. The pressure-vs-time plot demonstrates the distinct phases of the expansion process:

- a) packer inflation within the standpipe
- b) increasing packer pressure in the elastic range of the standpipe
- c) standpipe yield and expansion, and
- d) standpipe coming in contact with the borehole wall and compression of the elastomer cover.

Once the standpipe is fully expanded, the inflatable packer is removed, and the standpipe can be pressure tested. The minimum length of the expanded portion of the standpipe is approximately 1m. The seal length can be extended simply by moving the expansion tool to a new location and re-energising the expansion tool. The length of expanded standpipe required to achieve adequate sealing will be dependent on-site geologic conditions.

The equipment required to expand the standpipes comprises a high-pressure inflatable packer, O-ring sealed installation rods, and a high-pressure pump. The system is compact and easy to transport underground. All seals and the inflatable packer element are easily replaced on site, however a redundant expansion tool set up is recommended to minimise downtime should any of the components fail or become damaged.

**DRILL-THROUGH TEMPORARY STANDPIPES**

An inflatable packer-based standpipe was used for the Rondout Bypass Tunnel Project in 2019.

A packer with modular dual-wall standpipe extensions is connected to the drill fitted with a BOP inside the TBM head. The inflatable packer is installed in a 104mm pilot hole in the tunnel face and energised with 20 bar (290 psi) water pressure via the annular space between the inner and outer extension rods using a simple hand pump. When the packer is in contact with the borehole wall and inflated with water, any pressure applied from within the borehole will boost the packer pressure to maintain a competent seal.

The packer is designed to withstand up to 70 bar (~1000psi) differential pressure. The inflated packer and BOP create a closed system that allows operators to control groundwater inflow during drilling and provide pressure control during grouting. When drilling and grouting procedures are complete, the packer is deflated, the assembly is disconnected from the BOP and removed from the borehole, after which the system can be redeployed at a separate location.

The inflatable packer element is designed to withstand multiple cycles of inflation and deflation. However, if the element sustains damage during operations, the packer system is designed such that the packer element can be replaced on-site with minimal effort and tooling. Spare parts required for tool maintenance include packer elements and seal kits for redressing the packer and the dual-wall extension rods.

Field experience has shown that the packer-based standpipes perform well in TBM applications where the drilling machine is mounted rigidly in the machine. However, these systems have been less successful when used in conjunction with jumbo drills in drill and blast applications due to excessive boom movement while the drill hole is advanced. The expandable standpipe solution, discussed earlier, may be a better option for use in conjunction with jumbo drilling due to the lack of parts that can be damaged or fail when subjected to excessive boom movement.

**CONCLUSION**

Use of grout-free standpipes minimise down time in PEG activities for tunnelling projects. Expandable standpipes are effective when they can be installed outside the cutting face in TBM projects and in drill-and-blast operations utilising jumbo drilling. Temporary standpipes using inflatable packers are advantageous in TBM projects because no steel is left in the cutting face of the tunnel, and they can be reused multiple times. ■



**Above:** Photo of Standpipe and Installation Equipment

**Below:** Plot of Pressure-vs-Time for Standpipe Expansion, and Photo of Post-installation Pressure Test

