

PHREACAM® – an automated well inspection system

With the increasing use of and growing pressure on groundwater resources, groundwater investigation and development are receiving increasing attention. In this context, optical borehole inspections have gained importance as an essential prerequisite for ensuring the proper functioning of water wells and groundwater monitoring wells. This development is also reflected in recent German technical standards and regulations. For example, the DVGW Code of Practice W 127 recommends regular video inspections of production wells in order to ensure reliable and uninterrupted groundwater abstraction. Similar recommendations can also be found in European regulations and guidelines, including the EU Water Framework Directive.

Groundwater monitoring wells provide the only direct insight into groundwater bodies and their hydraulic systems. To use monitoring wells as sources of information, they must be in proper condition and maintain a sound hydraulic connection to the aquifer. This is essential for obtaining reliable data from hydraulic testing and groundwater sampling.

Borehole camera inspections are used to verify well construction, to locate and inspect casing joints, and to identify structural defects. Incompletely threaded casing connections and damaged sections may indicate the ingress of external water. Camera inspections are also used to detect floating LNAPL (Light Non-Aqueous Phase Liquid), identify foreign objects, assess sediment accumulation, and evaluate the need for cleaning or regeneration of the well prior to use.

With this broad range of information, borehole camera inspections support the planning of measurement and sampling depths as well as the installation of monitoring instruments and pumps. Borehole camera inspections supply quality assurance to monitoring well use by documenting their proper condition and should be carried out prior to the use of the well.

To obtain inspection videos with high image resolution to allow a detailed inspection, low logging speeds are required, resulting in increased inspection and operational times. Conventionally, camera inspections are performed using cable-guided systems while simultaneously viewing the video feed, which ties up operating personnel and increases costs.

In case of the short distance between object and image plane, low logging speeds are required to avoid motion blur and to capture borehole wall images with sufficient detail. Higher logging speeds at increased frame rates require significantly higher data transfer rates and cable-guided systems using copper conductors quickly reach their limits, as signal attenuation over long cable lengths restricts the achievable image resolution and consequently the desired level of detail. Fibre-optic systems, on the other hand, can provide higher data transmission rates but are significantly more expensive and their cables and connectors are generally more susceptible to damage and more difficult to repair.



PHREACAM® was developed to provide a fully automated, cable-free borehole camera inspection system delivering high-resolution video recordings. The use of this system reduces operating time, does not require dedicated personnel during the inspection, provides a consistent and highly detailed recording over the entire inspection interval, and makes the subsequent evaluation significantly more efficient. Since no personnel are required to operate the system, this time can be used to prepare groundwater sampling programmes or hydraulic testing activities.



Since PHREACAM® operates fully autonomously without a cable connection, the system is highly reliable in operation and requires significantly less maintenance than conventional cable-guided camera systems. In addition, cable-related failures and repair requirements are eliminated.

The camera probe operates independently and records HD-quality videos at all deployment depths. The camera probe, weighing less than 2 kg, is automatically lowered into the well by means of a deployment unit and a 2 mm steel cable at a constant, pre-set speed. The descent speed remains constant despite changing loads, such as when passing through the groundwater table or as the cable weight increases with depth. The current operating depth is limited by an external water pressure of 25 bar (2,5 MPa/360 PSI), corresponding to a water depth of approximately 250 m. The camera probe can be operated in monitoring wells with minimum diameters of 2 inches (DN50) and larger. The risk of the tool getting stuck is low and is reduced through the use of flexible centralizing elements.

The illumination intensity is pre-set on the camera probe according to the diameter of the well. For wells larger than DN250, a high-intensity light attachment can be installed to provide enhanced illumination.

The inspection video is stored directly within the probe on a USB flash drive. Upon reaching the target depth, the descent stops automatically and an acoustic signal indicates that the inspection has been completed. The camera probe is then retrieved and the USB drive removed.

The recorded video can be viewed on a computer or mobile phone. By using fast-forward playback, important information can be identified quickly while maintaining a high level of detail. Date and time are continuously recorded in the video.

The display of the deployment depth relative to the top of the well casing and the compass orientation of the video image is currently under development.



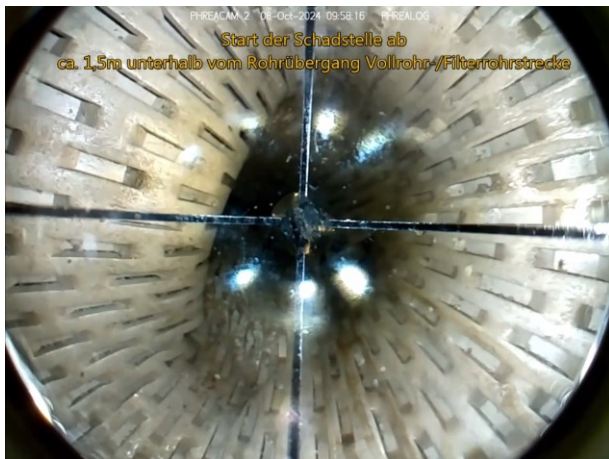
Picture gallery



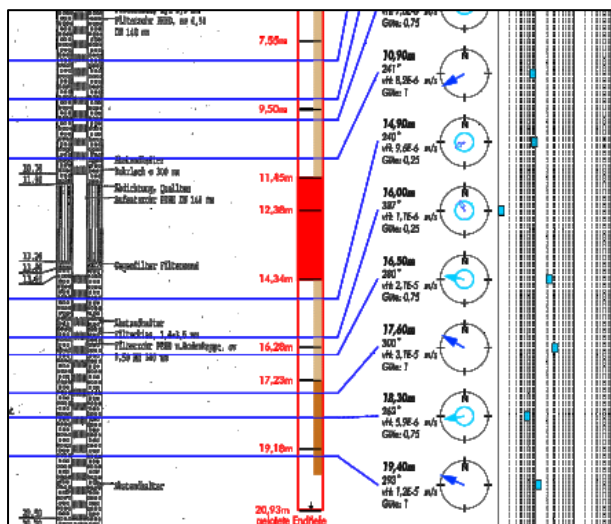
removal of the USB flash drive



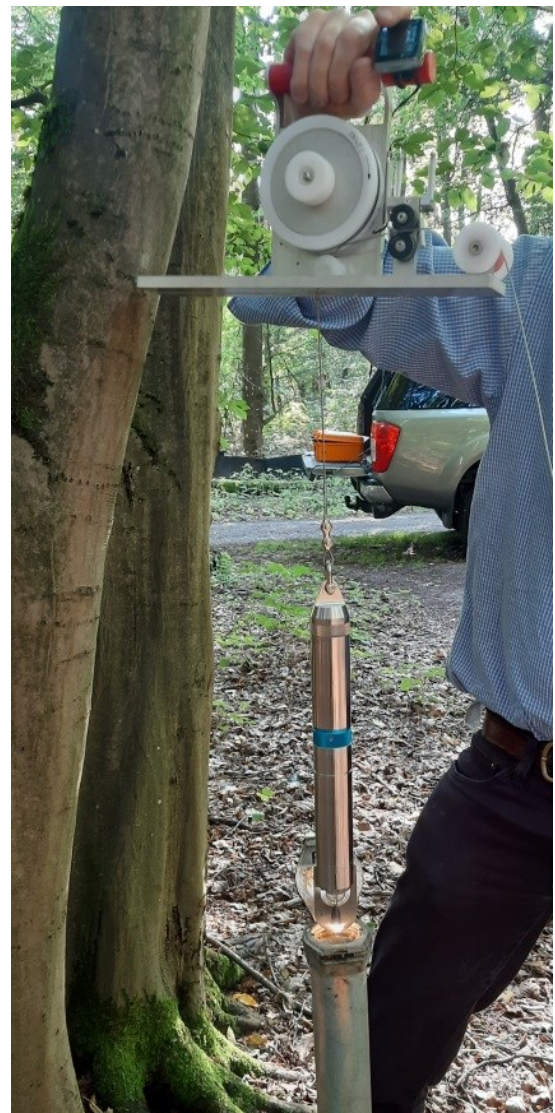
High-resolution viewing of borehole siltation



PREACAM- Detailed detection of damaged areas



Horizontal Flow measurement positions determined by the camera inspection



Deployment of the PHREACAM into a 2-inch monitoring well using a cable reel device





*Auxiliary light head for
wells exceeding 10 inches
(DN250)*



Transport case

Further information on the PHREACAM can be found here:

