# Case Study: How Wire-Wrapped Screen Contributed to a Fishing Job

## Introduction

Selecting a type of well screen for any water well (e.g., industrial, agricultural, municipal, or domestic) should involve more than simply deciding that one wants a certain amount of open area per unit length. It is easy to forget that there are other implications to choosing a well screen beyond its potential entrance velocity and unit cost. While those considerations are obviously important, this case study describes why one should keep in mind that a well screen's durability and strength are (not may be) important during construction and throughout the lifetime of a water well.

## Background

Ground water is a vital source of water supply in Sub-Saharan Africa where many communities and cities rely upon wells (locally referred to as boreholes) for potable water. In 2007, RMC worked with a national water utility in Sub-Saharan Africa where, over the years, the utility had constructed numerous production wells using a variety of types of screens and perforated casings. It was during the routine rehabilitation of one of these wells where the importance of strength and durability of well screen was clearly demonstrated. This case study describes how an otherwise common incident escalated into a major problem that had major implications for the utility.

## The Setting

The utility's rehabilitation crew had begun cleaning a well constructed in 1994 to a depth of 735 feet (224 m). The uppermost 525 feet (160 m) consisted of 10-inch diameter (254 mm) blank casing that connected to a 20-foot long (6 m) reducer. Beneath the reducer were 20 feet of 8-inch diameter (203 mm) Ful Flo louvered screen that connected to 151 feet (46 m) of wire-wrapped well screen. The top of the wire-wrapped screen was at a depth of 564 feet (172 m).

After mechanically cleaning the wire-wrapped screen with a nylon brush, the crew lowered into the well a 4-inch diameter (102 mm) pipe connected to a 3-meter long dual swab. When a total of 205 m of pipe and dual swab were in the well, the crew began to repeatedly raise and lower the string to clean and airlift the screen. It was during that cleaning procedure, as the crew was lifting the string, that one of the couplings separated and twenty-three 6-meter lengths (452 feet) of pipe and swab suddenly dropped into the well.

It is not an uncommon event in either well drilling or rehabilitation work to drop pipe or other objects into uncased holes or wells. It shouldn't happen; but it does. In this case, when the tools were dropped, the crew made preparations to retrieve it and expected a straightforward exercise. Using a simple fishing tool, the crew successfully grabbed onto the top of the pipe and attempted to lift it out. However, the pipe and swab were firmly stuck.

Prior to beginning the rehabilitation, the well was inspected with a downhole video camera and the as-built design records were checked. Therefore, the as-built design was well documented and confirmed. The question then became, what was holding the pipe/swab in the well? The answer was found in the as-built design.

## The Source of the Problem

Going back to the as-built well design, the top of the wire-wrapped screen was at 172 m. When the length of the pipe in the hole was checked, it showed that the bottom of the tool (i.e., the 3-meter long swab) was within the wire-wrapped screen. In Sub-Saharan Africa, most well drilling contractors do not conduct deviation surveys so there were no data showing how much deviation existed in this well. However, it is reasonable to assume that it was not plumb and that it probably drifted several degrees from vertical. The well was drilled through hard sandstone so some vertical deviation was likely. Even a small deviation would have caused some curve in the well. So, when the falling pipe and swab impacted the interior of the wire-wrapped screen, it would have easily penetrated it.

Wire-wrapped well screen has some very useful attributes; however, durability and strength are not two of them. Wire-wrapped screen offers considerable open area per unit length which comes about through its construction. Thin, delicate wire is wrapped around and welded to an array of small-diameter internal rods. Its tensile strength and collapse strength are much lower than louvered screen. Louvered screen is manufactured from blank, steel casing, which actually gains strength when it is perforated due to the corrugating effect of the louvers. By comparison, wire-wrapped screen is fragile and requires particular care during installation and rehabilitation.

In the scenario described above, it is easy to accept that when the wire-wrapped screen was impacted by the falling pipe and swab, it was simply torn open. It was no match for the tremendous downward force of the falling pipe and dual swab. Then, when the crew reconnected to the pipe and began tugging on it, the wire around to the rods simply detached and became entangled around the swab. That explains why the pipe and swab could not be removed even with great upward force exerted by the service rig.

## The Result

After about 3 weeks of intense fishing, the crew was only able to retrieve one 6 meter length of pipe. Finally, recovery work was discontinued. This particular well had been functional, productive, and important to the utility; its loss was disappointing and had serious operational implications. A new replacement well will probably have to be drilled.

## Summary

Well designers should keep in mind that durability and strength are valuable assets that can be built into a well. The scenario described above would have been avoided had the well been constructed with louvered screen. The downward force of the dropped pipe would not have destroyed louvered well screen. Most likely, the crew would have simply lowered the fishing tool, reconnected to the pipe, and pulled it out.

## References

Roscoe Moss Company, 1990, *Handbook of Ground Water Development*, John Wiley and Sons, New York, NY.