No More Muddy Waters

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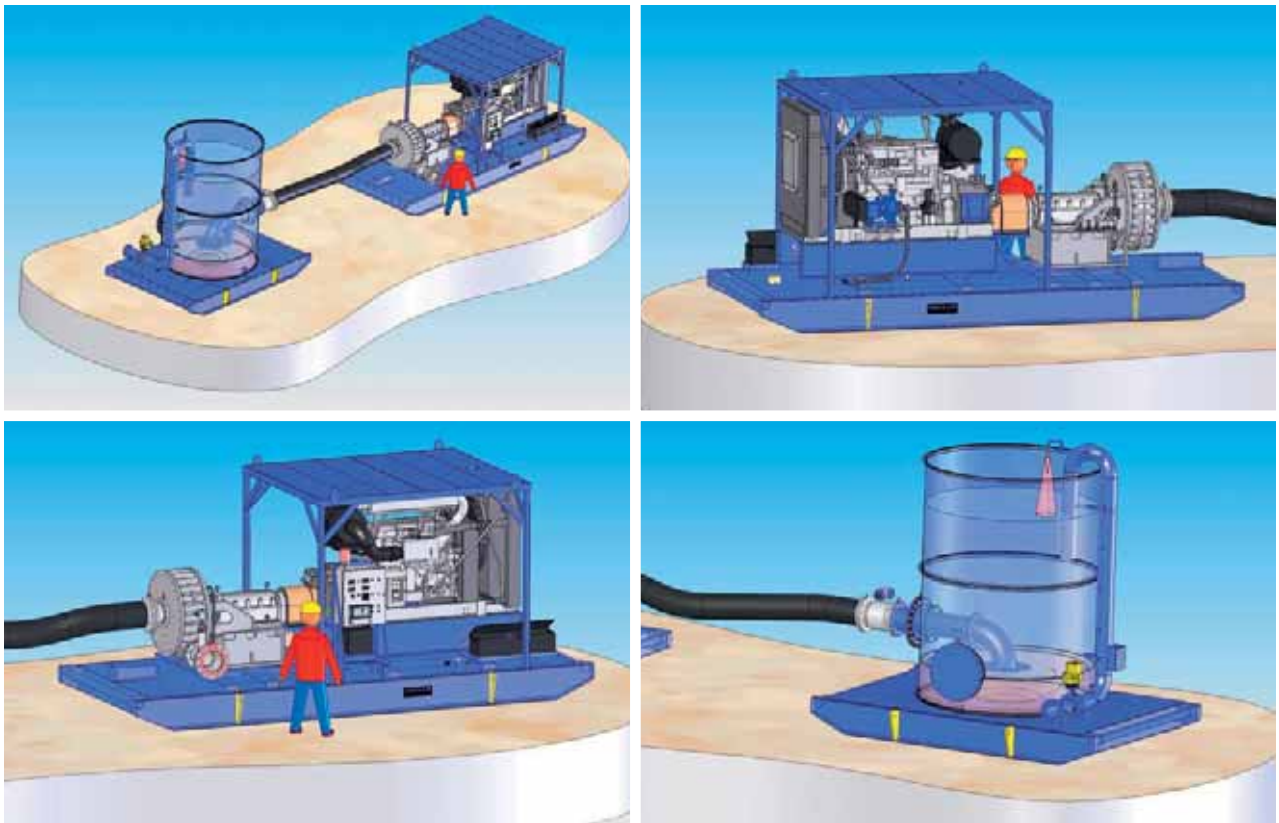
How electromagnetic flowmeters bring stability to a potentially rocky sand pumping application.

Though most flowmeters will deliver perfectly accurate results when pumping water, the addition of rocks or sand to the mix can figuratively muddy the waters and create noise that leads to instability and false readings. We've experienced this problem before in other projects that involved some sort of innovative booster design, cleanout, automated control system or other custom dredge and slurry solution.

When we were hired to improve sand dredging productivity for Carolina Sand (Johnsonville, SC), our evaluation flagged two primary changes that had to take place right away.

First, because of the trash in their ore body – material they could not see with the naked eye – Carolina Sand was only moving about 150 tons of sand per hour. This meant they could greatly reduce the unwanted materials in their ore body by switching to dry mining.

Second, the entire dredging process could be made more efficient, even self-sufficient, by monitoring the process with an accurate, stable flowmeter. A pipeline is just like a long freight train of water, and it's impossible to accelerate that train that quickly. A flowmeter actually controls the velocity of this train by sending a signal to the controller, then the controller speeds up or slows down the pump to maintain efficient set points.



Engineers used Solidworks 3D modeling software to design and package the dredge application. This ensured dimensional fit and accuracy to reduce the amount of change orders needed.

The booster station used in the new Carolina Sand system.

If the flowmeters are lying, the entire system responds to the lie and ends up with a mess. This particular application needed to use DC electromagnetic flowmeters, because AC magmeters would be adversely affected by the "noise" from the rocks and suffer from drift issues. The meter needed for this application would be similar to a precise speedometer that ensures the system will never go too slow or too fast.

Based upon our experience in the slurry mining and process control industry, we recommended that this particular application use strong slurry metering capabilities from a robust flow sensor. Also, due to the high costs associated with the severity of their productivity issue, Carolina Sand needed a custom solution that could be delivered when promised and within a reasonable timeframe.

After evaluating the abrasion, chemical and vacuum resistant properties of various flowmeters, we selected Optiflux 4300 custom electromagnetic flowmeters from KROHNE, Inc. (Peabody, MA) to meet the harsh slurries and difficult environment. These sensors could handle process temperatures up to 356-deg F (180-deg C) and non-water conductivity down to 1-µS/cm, while being chemically resistant to acids and alkalis.

The custom meters were delivered in twelve weeks. Though I've seen other flowmeters jump as much as 200-gpm in reaction to the noise of the slurry contents—not an actual increase in the flow, these meters were extremely stable—to within one-tenth of a gallon per minute, even when pumping rock-filled slurry.

We started with one 12-in flowmeter. The entire system involved ten custom flowmeters in different sizes that exactly match the interior dimensions of the pipeline, because the sand must not experience any change in the flow because of the meter. It must be smooth all the way through, or else the meter might wear out and reduce the accuracy.

We worked with the manufacturer's tech support to program and set the sensor parameters to ensure that the installation went smoothly and every meter set point along the line was completely understood.

The original system only moved about 150 tons of sand per hour, but the new system averages of over 300 tons an hour and no longer requires a crew of two to three people to operate the dredge. Now they simply operate the tank loaders and the transport system automatically pumps the material to the plant.

This application uses DC electromagnetic flowmeters, such as this one, that are not adversely affected by the "noise" from the rocks or suffer from drift issues.

The overall system uses ten custom flowmeters in different sizes with respective parameters that are programmed to exactly match the interior dimensions of the pipeline.

The pipeline is like a long freight train of water. The flowmeter controls the velocity of this train by sending a signal to the controller, then the controller speeds up or slows down the pump to maintain efficient set points.

Overall, Carolina Sand has been extremely pleased with the tangible results being achieved with the new system. The payoff is in the increased efficiency of the system. With the new system, Carolina Sand not only doubled their production to an average of over 300 tons an hour, but they also no longer need an entire crew of two to three people to operate the dredge. Now their personnel simply operate the tank loaders, and the transport system automatically pumps the material to the plant.

The key to achieving this dramatic improvement in efficiency was the use of electromagnetic flowmeters. In fact, the reduction in fuel cost, manpower costs and electrical costs pretty much pays for these meters.

Perhaps even more important than that is what Carolina Sand is not seeing: downtime. An unstable flowmeter can slow a pipeline to a crawl, or even choke a pipeline. Stoppage in a pipeline can lead to a shutdown for three days or more. In other words, when you choke 3,000-ft of pipeline with sand, it takes a long time to clean it out.

Fortunately, Carolina Sand doesn't have to worry about this problem. Their sand dredging application is moving along swimmingly, every single day.

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