

Hydroexcavation: Making a Splash in the Construction and Utility Industries

Today's concept of hydroexcavation dates back to the mid-1800s when California's 49ers, anxious for more gold, blasted water under high pressure directly onto the surrounding hillsides.

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By Peter Hildebrandt

Back then the technique was called hydraulic mining. This method created more material to sift through for gold but also much more environmental degradation, which is still being dealt with today. But the water and the use of pressure might be the only things in common between yesterday's hydraulic mining and today's hydroexcavation, which is now more like laparoscopic surgery. It allows for quick, clean, and precise evacuations, which require less backfill, less labor force, less restoration, and less environmental impact than conventional digging methods.



Photo: Doetsch Environmental Services

Hydroexcavation has also taken off because of the increasing number of fiber-optic lines and natural gas pipelines throughout the country. The owners of such lines are leery of equipment digging around their lines, so a whole new type of hydroexcavation called “pot-holing” has developed. This technique ensures that when horizontal boring is done, lines will not be disrupted.

How Hydroexcavation Works

Hydroexcavation is also known as hydrodigging, hydrotrenching, vacuum evacuation, or soft digging. The non-mechanical and non-destructive processes of this method combine pressurized water and a high flow of moving air to simultaneously excavate and evacuate native soils at a controlled rate. During the course of a typical hydroexcavation operation, the soil and water slurry is conveyed via an 8-inch tube to a truck-mounted debris tank. The control of the flow water stream permits a remarkable amount of accuracy in operations. Because only material necessary for repair or inspection needs to be removed, hydroexcavation may be a perfect fit—especially when compared with the large, less-than-accurate excavator or backhoe buckets traditionally used.

Hydroblasters Inc., a central Wisconsin contractor, uses a vacuum truck and a water blaster for its work. “Basically all we do is use water to cut through the soil, and then we just vacuum up the soil,” says Rod Marquette, operations manager.

Hydroblasters has no problem cutting through clay, sand, and even concrete. Solid rock, due to lack of porosity, is impossible to cut. Ninety percent of the company's accounts are with the paper and pulp mill industry. Getting a lot of machinery into the middle of the paper mill is difficult, but Hydroblasters can bring its hose in and suck out an area where footings for machinery need to be poured. This type of excavation is especially useful in any kind of work where an existing floor must be cut through. It has done work exposing natural gas lines or fiber-optic cables for cities, places where accuracy is critical.



Photo: Doetsch Environmental Services



Photo: D.F.S. Markers Inc.

Kemp Ritter, manager/owner of Ritter and Ritter Inc. in Aitkin, MN, uses his Vactor for hydroexcavation and for cleaning sewer lines. The company employs equipment manufactured by Vactor using a combo unit because it can do more than one style of work. “We keep one truck busier than having two \$300,000 rigs sitting in the shop,” says Ritter.

He does what is known as “cured in place” lateral liners, which are especially useful in places with a lot of utilities in areas with flowerbeds, sidewalks, and other features that cannot be disturbed. “We hydro a smaller hole down, crib it, get down to the line, and invert a liner down into the sewer line to fix it without digging up the whole line,” says Ritter. “Prior to using hydroexcavation equipment we used backhoes and shovels.”

The liner Ritter utilizes is especially effective in keeping roots from growing into the clay sewer pipes. “The cured-in-place liner is inverted inside the pipe with a resin-impregnated liner and then ambient cured with pressure for two-and-a-half hours cures out as structurally sound as standard PVC piping,” says Ritter. “This creates a seamless, one-piece pipe that eliminates any problems with tree roots.”

Despite being in Minnesota, Ritter is able to use his equipment in winter and has no problem cutting through frozen ground. They use cold water under high pressure, 1,500 to 2,000 psi, with a hand-controlled earth-breaker nozzle that has three jets to it. Eight-inch suction is used to suck all the debris, water, and mud out of the area. In addition to excavation work, Ritter does a number of other operations, including service work for residential, municipality, and industrial wastewater and hauling of liquids.

Doetsch Industrial Inc., a Michigan company with a 107-year history in excavation work, has been doing hydroexcavation for 10 years. In 2001, it dedicated Vactor equipment for hydroexcavation only. Doetsch now has that machine and three additional for this type of work. “We are an environmental contractor. We do sanitary sewer cleaning,” says Joe Schotthoefer, operations manager. “We work in the auto plants based here in Detroit, and we are very strict about avoiding any cross-contamination. When we go out and hydroexcavate on these sites, when we leave earth behind—that is all we leave behind. We are quite proud of the fact that what we are doing with our trucks is exactly what they were meant for, excavation.”

Because Detroit is a tough market, Doetsch does a variety of work, including utility verification, hydroexcavation in the large pits at the transmission or distribution stations for the utility companies, and consulting on how to position digging in building and basements or in places where using conventional digging equipment is not feasible. Last year Doetsch was heavily involved in large pit work where multiple lines were being uncovered. “One of these pits was nearly a 900-yard pit around natural gas pipeline,” says Schotthoefer. “We opened it up so the owners could have corrosion protection put in place on their pipes.”



Photo: D.F.S. Markers Inc.

Whenever holes are going to be dug in the ground, there will always be adjoining utilities conflicts, according to Ransom M. (Randy) McElroy, senior vice president of McElroy Inc. in Meridian, MS. His company has been in business since 1930 and in the late 1990s, after extensive research, decided hydroexcavation would be especially useful in cases where there was not time to locate utilities, such as a sudden water leak or sewer backup that had to be fixed.

After first learning about hydroexcavation/hydotunneling from some of the pioneers in the field in New Orleans, McElroy is now a trenchless technology contractor. As with many of the other contractors involved with hydroexcavation, he often works around numerous fiber-optic cables. He does pipe bursting and various types of boring applications that include hydroexcavation. In pipe bursting, an entrance and an exit hole are made to keep surface disruption at a minimum. Steel bursting heads are actually pulled through the pipe to burst the existing pipe into the surrounding soil, while simultaneously new pipe of equal size or greater is pulled into place. It is a utility contracting method of pipe replacement originally developed in the UK, according to McElroy.



Photo: D.F.S. Markers Inc.

Containing the disruption

McElroy's company opted to invest in heavy-duty equipment (including some 3,000-gallon debris trucks) due to the volume of dirt they have to move. "I can suck a lot of dirt before I have to dump. We use hydroexcavation weekly in our mechanical, municipal, and environmental applications," says McElroy. "We use Keith Huber Equipment. They do the Air Spade and Air Shovel and are big-time hydroexcavators. They work well for us. Huber is also the vacuum truck company of choice in the New Orleans area.

"I do several things that make me a very exclusive contractor. Basically, I get a lot of work because no one else wants to do it or thinks it's impossible to do—and it's not. They're just ill equipped and ill informed," says McElroy. Spencer Fielder and Debi Sagucio of D.F.S. Markers Inc. get contracts through BellSouth. Fielder has done hydroexcavation for the past year exclusively in a housing development called Palm Coast on the Atlantic Coast of Florida. Before this he worked for 18 years as a locator for utilities. In his new work he has to be within inches of the equipment he locates—not feet as when he worked before. His main objective is damage prevention. "I visit every property that's under construction and verify that the drops to the underground splices on the cables are good to go for BellSouth," says Fielder. "After being in the

ground for 20 years, these ends have been cut off at the ground level or have been destroyed by other underground construction. I use the Vac-Tron to dig down and pull the cables to the surface, put a marker on them, and then place a sod box over them so that they know exactly where they are."

Fielder tows his Vac-Tron equipment with a Ford 350 truck. The Vac-Tron is equipped with a 550-gallon container. He uses both his best judgment and electronic equipment—the metal detector he uses even picks up copper—to find coils of phone cable buried, sometimes up to 3 feet deep. Then he punches down with his equipment, cuts the trench line with the water jet, and is able to go up and down the cable without damaging it at all. He can pinpoint equipment to within inches. "This is a new concept in doing this type of work," says Fielder. "We actually get things done before a work order is produced or a technician has to go out to the site."

Challenges in Hydroexcavation Work

Hydroblasters finds that its biggest challenge comes when its crews must work around rocks. "We only use an 8-inch or a 6-inch hose, so if we come in contact with a large rock this can be a problem," says Marquette. "We can pull up a 40- or 50-pound rock with the vacuum, but if the rocks get any heavier or larger, say a boulder, usually we will just move over and drop another hole and try again. This really slows us down. In northern Wisconsin there are a lot of boulders that we have to work around."

Ritter finds that because the holes involved are so much smaller than usual, things have to be shored up well before workers can go down. To prevent cave-ins, the four-to-one or three-to-one slopes on the holes must be dug back for the sake of worker safety.

He also finds that education about hydroexcavation is a challenge. "It's been hard to get people to understand that this is a safe way to dig, especially in the US," says Ritter. "Every other guy out there has a backhoe and a dump truck. They look at it as 'Gee, I can do that with my trackhoe. Then I'm making the money.' They look at the hiring of an excavating company as money lost to them. But still hydroexcavation is a safe way to dig. We can go around telephone lines, power lines, whatever you might have. If you know what you are doing, it is no problem. We work very hard at not creating any problems or damaging anything that we are hired to protect by digging."

McElroy feels that individuals just getting into hydroexcavation need to be careful when selecting equipment. “If you go too light on your equipment’s output, it can be like using BBs to slay elephants. I have a quarter of a million dollars of equipment because I need the production. That’s just the style of work I do. I require the heavy artillery.”

Fielder finds that digging down and finding that everything is already waterlogged is a hurdle to overcome working in coastal Florida. He is required to put up a barricade between swells to keep water from flowing into a hole before he’s finished excavating it. This cuts the excess water from flowing into the holes he’s digging.

Ivan Fox, P.E., president of AirX Utility Surveyors Inc. in San Diego, CA, says disposal of the wet material created by hydroexcavation is a challenge. “We dump our trucks into settling basins,” says Fox. “Here the water is able to percolate the ground, and then the residual soil can be used for backfill. Hydroexcavators generally cannot empty their wet material into a landfill because of the water content involved.”

Fox also finds challenges with different soil types. When working in the Palm Springs area, air excavation is effective, as the soil there is virtually all sand. In the San Diego area, there is significant clay, which is difficult to remove with air alone, and water excavation is required. There is also a formation known as the Stadium Conglomerate. “This is a mixture of variably sized cobblestones in a clay matrix,” says Fox. “The larger rocks are continually clogging our vacuum hoses, and work often goes much slower.

“But overall, I think air- and hydroexcavation have tremendous potential and a great future ahead as methods. It’s just a question of getting the word out to the many who still know very little about this option in earthmoving.”

AirX’s Keith Huber equipment is fully self-contained with a vacuum, dump tank, and high-pressure water pump on the truck used to break up the soil. AirX vacuums what is being broken up into the dump tank for offsite disposal in the settling basins. Its F350 or F450 Ford trucks carry about a yard of imported material, which can be compacted back into an excavated hole to replace the removed wet material.

That same truck also contains an air compressor for breaking up the soil with air. There is a separate dump tank for sucking up dry material, which can then be placed directly back into the hole. AirX’s F350 Ford truck carries about a yard of imported material, which can be placed back into an excavated hole when things are about to be completed.

Fox also modified his Vactor truck for hydroexcavation. It was putting out 65 gallons per minute—too much water for his purposes. Instead he installed an additional pump with an output of 18 gallons per minute, at a pressure of 2,000 psi. Depending on the difficulty of the soil he will decrease or increase the pressure of the water.



Photo: D.F.S. Markers Inc.

“I think it’s a tremendous entrepreneurial opportunity for anyone getting into various facets of hydroexcavation,” says Fox. “There is a great need for various types of specialized equipment, such as grabbers that go down and get rocks out of an excavation. The more I look at the industry, the more I realize that the opportunities are there for those who might want to explore all the avenues. We really saw a surge after the trenchless technology came about in the early ’90s. Through trenchless technology and the locating of utilities, the need has escalated. I get a lot of general engineering contractors telling me, ‘How could I not have heard about this?’ I tell them, ‘Well, I’ve been doing it for five years.’ I’ve spoken to the American Public Works Association, American General Contractors, and the American Society of Civil Engineers about it, and we are really pushing that this has the components of a professional service. The professional aspect is known as Subsurface Utility Engineering—because locating utilities and having to interpret what we are seeing needs to happen by someone with an education and professional experience to make those determinations.”

Benefits of Hydroexcavation

“Compared to the older methods, this is a much more effective way of pinpointing the exact location you are working on,” says Ritter. “You can also work on a much smaller area because you control your dig area—much more so than with a backhoe. With a backhoe, to get down 6 or 7 feet, you have to have a pretty big hole on top.”

Ritter points out that utility, gas, and phone companies are pushing more and more for the use of hydroexcavation. It means fewer repairs for them and often less major disasters. “When a contractor hooks on a natural gas line, that can create a big problem,” says Ritter. “It is simply a much safer way to dig. Another advantage, which I’ve heard about from one of the sales reps for the machinery we use, is that places like Chicago find it especially useful in preserving large boulevard trees from root damage. Anything within a certain distance from the trees must now be hydroexcavated around the roots. Pipes can be installed below the roots without damage to the trees, and there is no canopy loss to communities that want to preserve these trees.”



Photo: Doetsch Environmental Services

Schotthoefer contends that both accuracy and worker safety involved with hydroexcavation are among the greatest benefits of using this method. “The big thing with the safety is that you can keep your labor force and your operators up on the surface—not down in a pit,” says Schotthoefer. “Also, the law states that for 18 inches on either side of the known utility line you are supposed to hand-dig to expose. That’s very labor-intensive. But no one’s really doing that. Backhoe operators are saying they have a great feel with their equipment, digging a little bit more and a little bit more, and people are getting hurt because of it. Hydroexcavators can work together with other equipment operators to reach a common goal—just as with other types of equipment they can’t do it all.”

Schotthoefer has developed an information Web site, which contains a hydroexcavation benefits worksheet for those interested in comparing hydro with traditional excavation methods, at www.safeshovel.com.

Fielder finds that the beauty of his Vac-Tron water jet is that it will cut through virtually anything organic. “But when it reaches phone cables, TV cables, or water mains, it doesn’t even put a dent or scratch in those things. That’s what this is really good for. It’s not meant for pulling a lot of dirt out and trench building for 10 or 15 feet. But if you’re just punching down for a viewing hole and then going out in a little 3-inch trench 8 to 10 feet on either side of the hole, it’s perfect.”

McElroy feels that more can be torn up with a backhoe in 15 minutes than can be repaired within one week. “If you get ahold of a fiber-optic cable, it could cost you dearly. It could put you out of business. I just did a job involving extensive use of the pipe-bursting method where we hydroexcavated all of our pits and service re-connects—all of that up under a fiber optics line. I was the only person with the guts to bid the job and made it specify pipe bursting and hydroexcavation for the engineering firm. Then I came in as low bidder and did the job in record time, and it made us look like a million dollars. It also advanced both pipe-bursting and hydroexcavation technology all at the same time.

“People who get into this are the pioneers and innovators. They are looking for that new tool in their toolbox that will make them exclusive. Then we’re all salesmen out here trying to sell a better wheel or better service, and this is a wonderful service to have. It will catch on as more and more engineers, project managers, and customers are made aware of it. Of course, the more people that get involved in it, the more manufacturers will get involved and the price will go down—though it’s still cost-effective even now.”