A sewer outfall project in Oregon called for the use of horizontal directional drilling from the outset to install a pipeline that connected it to a new sequencing batch reactor (SBR) wastewater treatment plant and a diffuser near the heavily trafficked Columbia River ship channel. However, a different twist was added to make the project more cost-effective for the owner, as well as less risky for the contractor to complete.

The twist in the project came when the HDD contractor — The HDD Co.Inc. of Cameron Park, Calif., — decided it would be better to push, rather than pull, the product pipe through the pilot hole using steel pipe with Permalok connections and a specially designed pipe clamp. The contractor also redesigned the bore to be done as an inverted siphon instead of drilling it on grade.

The end result was an HDD installation of a 4,400-ft, 18-in., steel-coated pipeline for the City of Warrenton, Ore., that will bring treated effluent from the new plant into the Columbia River just inland from where it empties into the Pacific Ocean. A cathodic protection system utilizing a rectifier and anodes was installed with the steel pipe due to the salty content of the water to inhibit corrosion.

**Project History**

The reason for the project was that the City of Warrenton, Ore., was under a state moratorium due to its wastewater treatment plant being over capacity. The original treatment facility was on two 12-acre, non-aerated, facultative lagoons located along the Columbia River. The effluent was discharged to a drainage ditch that flowed to a tide gate and then out to the river during low tides.

When conducting a feasibility plan for the new treatment plant, the City decided that the best way to discharge the treated effluent was to allow the greatest opportunity for mixing, which would be in the Columbia River shipping channel — 4,400 ft from the bank of the river and 5,800 ft from the location of the new treatment plant, according to Eric Sharpsteen, wastewater operations consultant with Ecology Associate Advocate, which was involved with construction management of the project and contracts, operates and maintains the new SBR wastewater treatment plant and outfall.

“The City originally hired Cosmopolitan Engineering Group of Tacoma, Wash., to design the outfall, and the original design stipulated that a hole be bored to the river at the location of the intended diffuser, [and] then an HDPE pipe be pulled back through the bored hole from the river toward the entry hole on land. A section of cut-and-fill pipe would [then] be installed to interconnect with the new wastewater treatment plant,” Sharpsteen said.

“After the City hired The HDD Co.Inc., the contractor proposed an alternative method that would result in a huge savings to the city for the cost of constructing the outfall;” he added. “Essentially the project became a design-build [project], but the original design engineer oversaw the installation of the new design and was responsible for reviewing and approving materials and technique.”

The HDD Co.Inc. was brought into the project by the engineering firm HLB, which had worked with the contractor on past projects. After reviewing the plans and taking into consideration what was involved, Neil Swope, owner of the HDD Co.Inc., said he had a different idea on how to make this project work. Two of the obstacles the contractor faced involved the extensive traffic entering and exiting the ship channel — which is located on the lower Columbia River and serves as a link for national and international commerce — and the strong current during the winter months, during which the project had to be completed for environmental reasons.

**The Plan**

The HDD Co. Inc. proposed drilling an inverted siphon rather than on grade, and instead of pulling the HDPE pipe 4,400 ft from the middle of Columbia River inland, the crew would forward ream the bore and then push the pipe through.
it and attach it to the diffuser. Pushing the pipe kept the HDPE pipeline out of the ship traffic’s way during pullback and allowed a majority of the project to be done from shore. The exit hole was about 100 ft from the ship channel.

By allowing The HDD Co. Inc. to install the coated pipeline by pushing it, the overall cost and risk was substantially reduced. “When the tide is going out, the water is moving incredibly fast and when the tide comes in, it’s coming in just as fast in the other direction. The pipeline would be like a big noodle out there, going in 10 different directions... It allowed us to do a majority of the work on shore rather than having so much marine support,” Swope said.

“By eliminating much of the marine support, we were able to offer a lower price and a project that didn’t have as much risk. We accomplished the same thing [as the original plan]. They still got their pipeline put where they wanted it.”

The HDD Co. Inc. started construction in November 2005, with construction of an access road and pad for the rig setup. Crews then drove 120 ft of 30-in. steel conductor pipe to stabilize the formation underneath the levee near the Columbia River. Drilling of the pilot hole commenced in mid-November, taking about 10 days and going smoothly.

“Then we pulled our drillstring and 12-in. casing out of the hole,” Swope said. “We forward reamed the hole using a 7 3/4-in. mud motor, attaching a 28-in. fly cutter-style reamer to the end of the mud motor. We forward reamed it all the way to the exit.”

Because the pipe delivery was delayed from Permalok and wasn’t delivered until after Christmas, crews continually swabbed the borehole in preparation for pipe installation. It took about two days to complete the pipe installation.

“For connecting the Permalok, we designed a special pipe clamp,” Swope said. “The clamp was attached to the section of pipe that was already in the borehole and once the clamp was installed, we would pick up another joint of the product pipe and put it on our machine. The clamp was tightened and the hydraulic force of the rig was used to press fit the connection. The specially designed connection has two O rings that are used to help seal it.”

Once the 18-in. steel pipe exited the bore on the river bottom, a 40-ft long diffuser had to be installed. Global Diving and Salvage Inc. of Seattle, Wash., was hired to complete the installation. The diffuser was anchored to the river bottom by divers using helical anchors and concrete weights and was partially covered with quarry spoils. This part of the project took about a month to complete due to severe weather conditions.

A pig launcher also needed to be installed on land so that a pig could be run through the line if the pipe needed to be cleaned in the future. Swope said this required significant excavation and shoring due to the wet conditions.

“The diffuser and pig launcher were two of the more challenging aspects of the project for us only because it’s not what we normally do,” Swope said. “The drilling part went well, with almost no problems. We maintained circulation for almost 4,300 ft, which is difficult to do in our business. We designed the bore a lot deeper than previously planned, giving...
Challenges

The HDD Co. Inc. crew faced numerous challenges in completing this project, including being confined to a small setup area for its 400,000-lb American Augers rig and other drilling equipment. Before they could begin drilling, an access road and pad had to be constructed. "We were basically set up on the corner of a little lagoon on the south side of the levee," Swope said. "We hauled rock in for a week to build the pad. We were basically filling in part of the lagoon. We also had to build a narrow rock road alongside the levee, which was very environmentally sensitive."

A great deal of pre-planning was involved in this project, such as avoiding the ship channel and the severe weather conditions. At the time of year the project took place, gale force storms are not uncommon. "We were set up near the mouth of the Columbia River and that area gets hit with some really bad storms. The rain was relentless," Swope said. "There was a period there when it rained for almost 30 days straight with the wind blowing as hard as 60 to 70 mph.

"The current and the tides out in the Columbia River are incredible. When you are out near the ship channel during the winter months, the amount of water coming down the Columbia River is incredible. We couldn’t come up with a way to handle 4,400 ft of HDPE pipe out in that and stay out of the ship traffic’s way. We have handled HDPE pipe in the ocean before and we’ve done it successfully but we also didn’t have 500-ton vessels coming up and down the ship channel. I can just picture it. Here’s this big, long pipe out there like a snake and here comes a ship and there goes your pipeline."

Swope said what made this project unique in some ways is the fact that there is not a big call these days for HDD and outfalls. More are being done than in past years but it’s still not a normal project. "We are seeing them more and more, but I would say 95 percent of the work we do are typical crossings, where we’re either drilling under a river, road, wetlands or things of that nature," he said.

Sharon M. Bueno is managing editor of Trenchless Technology.