

Braving The St. Lawrence River

*GazMétro Successfully
Completes Unique HDD
Crossing Method*

by Tonia Jurbin ■ Contributing Editor

When GazMétro, the largest natural gas distributor in Québec, planned a 9.3 mile pipeline expansion to bring gas from the Trans Québec and Maritimes transmission system on the north shore of the St. Lawrence River at Trois-Rivières, to the Industrial Park of Bécancour to the south, they knew it was going to be a challenge. This expansion was driven by the need to build redundancy into the system, to address the fact that the exiting 10-inch diameter crossing was operating at capacity and to meet commitments to supply a 550 MW co-generation plant at the Bécancour Industrial Park. The major portion of this project was clearly going to be crossing the St. Lawrence River with a 20-inch diameter pipe for a distance of 7,600 feet, a task never before accomplished using horizontal directional drilling.

Because of the long lead times needed to obtain environmental permits for alternative options, the project team carried out the environmental permitting, design and tender document preparation for the preferred HDD option as well as for their back-up plans – a shorter HDD run to cross the seaway and build the remaining crossing from a jetty, or conventional trenching. Conventional methods would also have proved difficult as the site crosses an active, deep shipping channel.

The project team knew they were facing risks in undertaking something that had never been done before. Gabriel Pop, technical advisor to the project manager explains, “We knew that we were pushing the limits of HDD technology for installing a 20-inch diameter pipe on a 2.3 kilometer crossing, so we pre-qualified our contractors, and our consultant chose an HDD specialist to as-

sist with the design.” The expansion including the crossing, two meter stations and the land based work, for an overall cost of \$50 million (Cdn), about \$20 million of which was related to the crossing itself.

Certainly the length of this crossing was going to make the job unique, but winter conditions, tides and historic flood levels, two islands and a bilingual and unionized environment added to the leg work.

To help GazMétro design the longest 20-inch HDD pull to date, their prime consultant, Pluritec/Johnston-Vermette of Trois-Rivières, Québec, hired Engineering Technology Inc. (Entec) of Calgary, Alberta. Entec specializes in planning, design, contract evaluation and construction inspection assistance for HDD projects. Grant Jameson, vice president of Entec puts the magnitude of this undertaking into perspective, “We see a large variety of HDD proposals on the market on a daily basis; but this project was unique in that it had all the elements of a great challenge including technical, social, operational and logistical elements.”

Tricky schedule

The schedule was completely driven on the premise that the HDD attempt could fail during the winter of 2004-05, and that conventional installation of the crossing would have to begin in May 2005. Pop continues, “We needed assurances that HDD would work by May 2005. We estimated that a traditional installation would take at least seven months so we back-calculated to the latest that we could start the dredging and still meet the supply commitments for



Top: One of the large downhole tools used on the project. **Middle:** Pipe is readied for the pullback. **Bottom:** The pipe string stretched beyond the shelter and dam.

September 2006 at Bécancour. We spent two years with the permitting process, preparing designs for both

the HDD and the dredging option. Tenderers prepared bids for all three options, and had to offer assurances that if HDD did not work they would be ready to complete the job with barges and other equipment and start dredging as soon as the ice was off the river.”

If the HDD worked, the contractor would install the land based portion of the expansion and provide assistance to the HDD contractor. Ganotec-Kiewit Partnership of Trois Rivières was the general contractor. Michels Corporation of Brownsville, WI, represented in Canada by Michels Directional Crossings Co. of Nisku, Alberta, was selected as the HDD contractor.

The crossing site was chosen at the narrowest point to cut 1,970 feet off the crossing length by taking advantage of two islands: L'Îles de la Point aux Roches on the south side, and Ile Carignan on the north. Access roads had to be built high enough to manage the spring run off and spring tides. About 54,900 yards of material was imported, about half of which was for 2,950 of access road, the rest for the 130 by 200 foot drilling pads built about a foot higher than the highest expected tide. The road could be elevated if necessary, but the drilling pad and shelter had to be high and dry for the duration.

The geotechnical investigation consisted of 13 boreholes, seven in-river (two of which straddled the shipping channel). The upper 66 feet of material on the north side of the crossing was predominantly sandy clay with traces of gravel in the deeper parts of the stratum close to the upper fractured shale. The depth of the drill path, 130 feet below the riverbed, was chosen to ensure they would be drilling deep into competent bedrock. At the north side of the crossing at Ile Carignan, a 42-inch, 197-foot casing was installed. A 36-inch casing was hammered inside of it from the surface to bedrock (308 feet). This would reduce the friction on the 36-inch pipe to facilitate eventual removal.

On the south side at L'Îles de la Point aux Roches, only about 92 feet of casing was required to get through the same overburden unit and into the rock. A final 16-inch casing that would guide the drill head was centered inside the larger pipe with spacers.

To decrease the length of the drill string for the 12¼-inch pilot hole, the drill run

was started at both ends and met two-thirds of the way from the south side. During the pilot hole drilling, the annular pressure was continually monitored to ensure that there was no loss of fluid indicating a possible frac-out, or release into the environment, nor any build-up of fluid indicating a possible cave in. By monitoring the pressures on both drill rigs, the crews were able to confirm the two drill strings had met.

Special drilling

Intersect drilling, well suited for long pulls, poor surface conditions or large differences in elevation, is not unique, but less than 15 have been successfully completed in North America. During the early planning of this project, that number was probably about two. The workhorse at the south (pulling) side of this project was a Michels-built Hercules 1200 rig with a push/pull capacity of 1.2 million pounds. Another Michel's built Atlas 840, with a capacity of 840,000 push/pull pounds, was used on the north side.

Floating ice on the river and an active shipping channel did not allow crews to lay down the typical tracking systems used to locate the pilot head. The riverbed is about 15-foot deep, except at the 650-foot wide shipping channel where it is dredged to 37 feet.

Helicopter attempts to position the tracking systems were ineffective as it simply could not be held still enough. Attempts using an ice-breaking tug boat also failed because the steel interfered with the tracking system. The best tool for the job turned out to be a coil system run from a fiberglass dingy. The pilot hole took 22 days to complete.

Once the drill heads intersected and effectively became one string, the entire string was pulled to the south side. The casing was removed to allow for adding a 31-inch reamer that would enlarge the hole on the descent part of the drill run. Once the descent path was enlarged, a smaller 29.5-inch reamer was used to enlarge the 4,153-foot run. Pressure at the mud pumps and other key variables were monitored throughout the drilling process; however, annular pressures were not monitored during the reaming phase. Many passes of the reamer were required to swab the wall of the drill path so as not to damage the double corrosion coatings on the pipe during the pull. The reaming took about 35 days; the product pull-back about 12 hours.

Waste disposal

Dealing with 3,000 cubic metres of cuttings and waste drill fluids proved difficult, Mike Prior vice president and general manager for Michels explained. “Long drills are not common in Québec and therefore the Department of Environment did not have a lot of experience in dealing with permitting for this kind of waste, so it took a lot of time to find acceptable sites. Authorizations for closer sites were granted once we were into the rock and had proven that the waste was benign.”

Prior continued, “We started with a disposal site about 80 miles away which was not too bad during the pilot hole drilling as there was not that much volume. By mid-February, we got approval to remove waste material closer to our sites. It was a difficult and time consuming process worth about 10 percent of our contract.”

Fortunately, acquiring 1.43 miles of lay down for 350 tons of assembled pipe on the north side was not a problem as most of the lots along the river are long and narrow. GazMétro had to negotiate with only three owners. Environmental permitting did require GazMétro to strip and store the topsoil along the right of way, replace it at the end of the project and monitor the restoration for three years.

It is much to the credit of Ganotec-Kiewit and Michels that there was no lost time for injuries, and communications was not an issue. “Construction in Québec is 100 percent unionized which is not really an issue for us as we are a union contractor,” Prior said. “However, we needed to find workers that were skilled in what we do and since there is not much drilling experience in this province we were able to demonstrate that we needed our own workers. The unions permitted eight members of our U.S. crew. It worked out really well as is evidenced by our excellent safety record on this project. The local workers got to have a close look at a unique HDD project and we got to work with very skilled Québec workers. Understanding between the French-speaking employees and U.S. workers was expected to be a concern but the unions provided enough bilingual workers to translate, and the U.S. workers quickly learned some basic French.”

FOR MORE INFORMATION:

HDD contractor:

Michels Directional Crossing, (920) 583-3132, michels.us