Pipe Bursting Installation of Watermains in Telkwa

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The Village of Telkwa is a small municipality located in northern British Columbia approximately half-way between Prince George and Prince Rupert. The Village straddles Highway 16, which is the only route west to Prince Rupert and north to the Yukon and Alaska via Highway 37.

The majority of the Village's water mains were installed in 1957. The Village has only schematic information about the existing water system and no detailed location information for the mains, valves, hydrants and services. Many of the valves on the mains have been buried over time and their locations are now unknown.

The north end of the Village (consisting of approx. 45 homes and 9 commercial and institutional properties) was fed by a single 150 mm diameter main running along the highway. The main was located under the shoulder of the road at a depth of 2.1 to 3.0m deep, with a long diagonal road crossing midway along the main.

The existing main ran under the shoulder.

This main had experienced several failures in recent years that required excavation of the highway road structure to repair. Because the location of many of the watermain valves is unknown, water supply to large areas of the community had to be shut down to make the repairs.

The Ministry of Transportation and Infrastructure (MoTI) has scheduled a highway improvement project in 2010 to widen and overlay the highway through Telkwa. Given the history of failure, and because a recent water system study showed that the main needed to be upsized to 300 mm diameter to provide adequate fire flows to the north end of the Village, Council wanted to replace the failing watermain prior to the highway upgrade.

The section of main to be replaced was in a very constrained location. The highway right-of-way is narrow and the road structure occupies most of the right-of-way. Existing water and sewer mains run along each side of the highway. The Bulkley River, containing a world renowned recreational fishery, flows on the west side of the highway, coming within 30 m at the closest point. On the opposite side of

the highway at this point, the terrain slopes up steeply from the road. In the 1960's, MoTI identified this as a slide area, raising concerns about increased risk of excavation in this area. Bedrock outcrops are visible adjacent to the site, indicating a high potential of encountering rock in any new trench excavations.

As this section of the highway is the only route west, the traffic flow is high and must be maintained. At a minimum, single lane traffic flow had to be maintained through the site for the duration of the work.

Pre-design engineering for the project explored three potential options for replacing the main; open cut installation of a new main along the existing main alignment, open cut installation of a new main along a new alignment, or pipe bursting the existing main.

Open cut installation of a new main on the existing alignment would require substantial excavation and disturbance to the highway structure. While this option would eliminate the potential for rock excavation, restoration and repaving would be costly and considered undesirable from MoTI's perspective. The large volume of soil from the excavations to be stockpiled would also make maintaining traffic flow through the site difficult and would require careful storm water management to avoid runoff carrying sediment to the Bulkley River. Another difficulty with this option is removal and disposal of the old AC pipe. Because it is considered a hazardous substance when exposed and disturbed, the handling and disposal requirements are onerous and the associated costs are high. This option would also require taking the existing main out of service for the duration of the work. A temporary bypass main to supply the north end of the village and a temporary supply main and services to the homes in the work area would be required.

Open cut installation along a new alignment would enable the existing main to remain in service, but would face the same MoTI approval, traffic control, and storm water management challenges as installation on the existing alignment. Excavation on a new alignment would likely encounter bedrock, which would increase installation costs significantly. The quantity of restoration and road reconstruction and repaving would also be large with this option.

The third installation option considered was pipe bursting. This method would also require the provision of temporary bypass mains and services, but it would create significantly less disturbance to the highway. The excavation required for pipe bursting is limited to a small number of entry and exit pits for the main line and tie-in pits for the service connections. The amount of disturbance to the highway would be reduced to a very small percentage of that required for open cut installation, facilitating traffic through the site and decreasing the potential for silt run off to the river.

Cost comparisons for the three options estimated that pipe bursting would provide a $775,000 cost saving over open cut installation. Pipe bursting was the favoured option and Council approved proceeding with detailed design and construction.

The final project scope included bursting the existing 150mm main along the highway with 220 m of 200 mm diameter HDPE and 640 m of 300 mm diameter HDPE plus bursting one existing 100 mm diameter highway crossing with 150mm HDPE. Also included were three new highway crossings installed by open cut, and six new hydrants and 21 services to be connected to new main (with new curb stops and pipe to main).

The successful tenderer, PW Trenchless Construction Inc. from Surrey, BC, started work on August 19, 2009. The bypass mains and services were installed and the main to be replaced disconnected from the water system.

The 150 mm diameter main along the highway was burst in eight sections of 60 to 140 m long. Entry and exit pits were excavated using trench shoring to minimise the size of the excavations. Pipe was butt fused into the appropriate length sections and staged behind the entry pit. A 200 mm burster with a 350 mm diameter rear expander were used and were powered through a 75 mm diameter air hose from a 13,000 CFM compressor. A "schnoze" adapter on the front of the burster was used to guide it along the existing pipe alignment. A 20 tonne trailer-mounted winch pulling on the "schnoze" was

The 200 mm burster with rear expander and "schnoze" adapter.

The new sections of HDPE main were joined using electro-fusion couplings.

used to assist the burster. Each section took approximately a day and a half to prepare and about four to six hours to burst. The existing valves, tees, and bends were burst as the new main was installed, saving the need to locate and remove them. The sections of new main were joined using electro-fusion couplings.

The last section was the longest at 140 m long of new 300 mm diameter pipe. This section of the old main had an existing bend, a valve,and two tees on it. This burst took about six hours. David O'Sullivan, President of PW Trenchless Construction Inc. was very happy with this particular burst given the length, number of existing fittings on the main, and the diameter upsize.

The existing 19 mm diameter copper service connections under the highway were replaced with 19mm polyethylene pipe using static bursting. A cone splitter towing the new pipe is pulled through the existing service using a steel cable pulled by a backhoe. In most instances, the existing copper pipe was pulled out ahead of the new pipe and was able to be recycled.

The service laterals were connected to the new HDPE main using electro-fusion saddles with the main being accessed by 1.5m x 1.5m shored pits.

The project was successful, with both the Village and MoTI satisfied with the execution and the end result. Traffic delays during construction were minimal (typically only 3-4 minute waits), the disturbance to the Village was minimal and the cost savings realised were substantial. More local pipe bursting work is anticipated in the future now that MoTI and others are aware of the method and have seen successful implementation on the Telkwa watermain project.

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Service connections under the highway were replaced using a static burster.