

Sub-Bottom Profiling Investigations

Key Words: ground-penetrating radar, sub-bottom profiling, dredging, pipeline

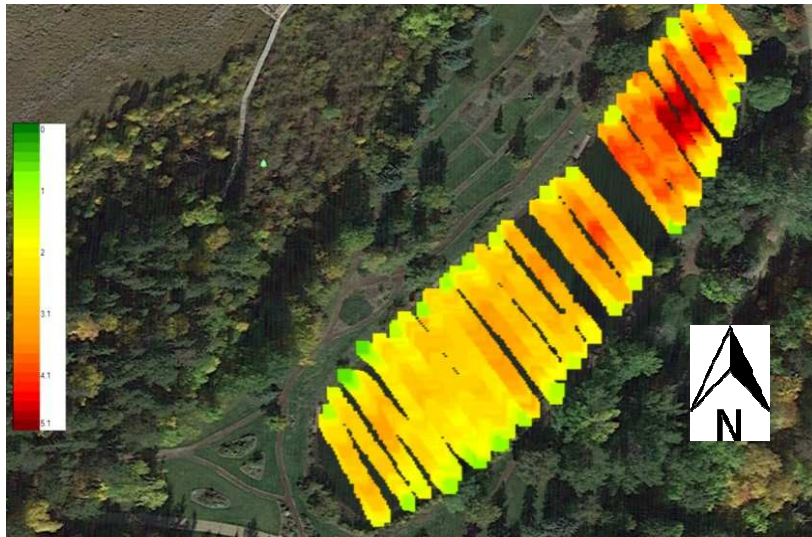


FIGURE 1: Map of survey area with depth to the bottom of the sediment layer indicated by color intensity. Survey lines across the lake spaced 5 meters apart.

There is often a need to identify features below the bottom of a water layer in a number of industries, for a variety of applications. Such applications include determining thickness of sediment layers, searching for objects at the bottom of water bodies, or determining position and depth to sub-bottom pipelines.

The best way to tackle this kind of investigation is to use Ground-penetrating Radar (GPR). This technology sends a radar signal into the ground, and the time it

takes to travel back to the sensor is related to the material in the subsurface. Maverick Inspection collects, processes, and interprets GPR data to provide a client with estimates of layer thickness, identification of the presence of anomalies, and depths to objects in the subsurface (such as pipelines or storage tanks).

CASE STUDY: In March of 2016, Maverick Inspection conducted a sub-bottom profile investigation of a lake bed using Ground-penetrating Radar (GPR). The purpose of this study was to investigate any presence of a sediment/mud layer at the bottom of the lake, and if present, determine the thickness of that layer. The client was interested in dredging the lake bottom, and determining the thickness of the sediment layer would assist in planning the project. GPR was selected for this survey for its ability to work well on ice and snow, and for the ease of the results to be interpreted in the case of a lithology study. One of the major obstacles on this project was that the lake was partially frozen, and was therefore unsafe to traverse. Maverick rose to the challenge, and deployed the GPR system using a small water craft maneuvered across the ice using ropes affixed to either side of the lake. 1100 meters of data were collected this way.

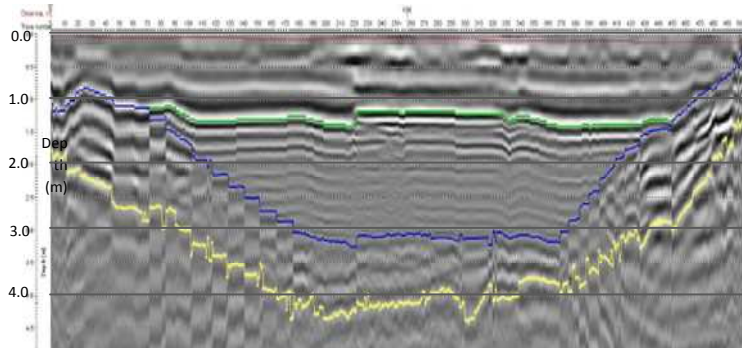


FIGURE 2: Radargram converted to depth, with each separate layer picked: red to green is ice, green to blue is water, blue to yellow is sediment/mud.

To produce a final image of the data, called a radargram, the data must be carefully cleaned and processed to remove any unwanted signal, and converted into true depth. The analysis team at Maverick has a wealth of experience in GPR data processing and the latest industry leading analytic tools, so it does not take long to produce an accurate radargram.

CONCLUSION: Figure 2 is the final image produced after all data processing, and it clearly depicts 3 distinct layers in the raw data profile: the ice layer, the water layer, and the sediment layer overlying the bottom of the lake. It also depicts the depths to all layers identified in the subsurface. The GPR wave velocities of these layers were estimated using industry accepted values. These velocities were used to calculate the approximate depth to the identified layers. Using this information, the client was able to determine whether or not the lake needed to be dredged.

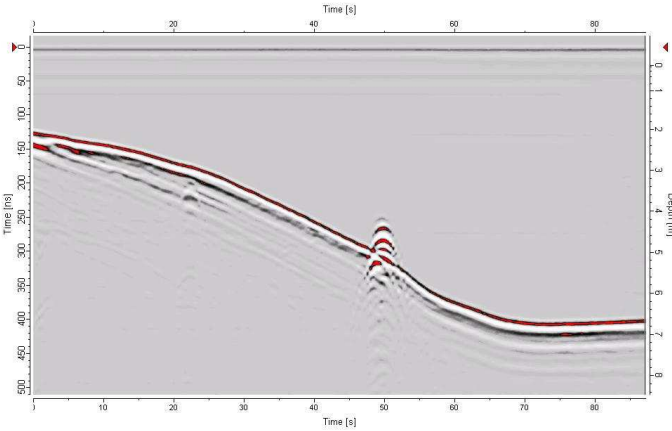


FIGURE 3: Typical radargram of an object in the subsurface, depicted by the hyperbola near the center of the image

APPLICATIONS: There are many reasons to conduct a sub-bottom profiling survey. Among these is to determine the position of and depth to subsurface objects, such as pipelines. Figure 3 is a radargram clearly depicting an object resting at the bottom of a body of water, manifested as the hyperbola in the center of the image. This is typically how objects appear in GPR data, with the top of the hyperbola denoting the shallowest portion of the buried object. Pipelines appear in radar data in much the same way, and are detectable in most radargrams.

Due to our range of experience and available technologies, Maverick Inspection is well equipped to tackle any scope of sub-bottom profile investigation. Maverick Inspection houses one of the widest ranges of subsurface inspection technologies available in the country, which means we can accommodate a larger variety of subsurface conditions and depth-to-target requirements. With the full force of services that Maverick provides, we can find a solution to any of your subsurface investigation needs.



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