UST detection GPR survey

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Introduction

Underground storage tanks (UST) are common and quite large man made storage utilities. The materials they store are very often dangerous and volatile (fuel, chemicals, waste water). This creates a reasonable need for periodic inspections of the tanks and the surrounding area. This is particularly important when planning for new infrastructures in the vicinity of the UST.

Using the GPR technology for these kind of surveys is perhaps one of the easiest, fastest and most information rich methods. The survey can be done extremely quick and easy which allows the use of the UST by its owners while the survey is taken place with only minor inconveniences. The survey results shows the position and depth of the tanks as well as the pipelines and other infrastructure related to the UST. At the same time the survey can show possible leakage from the tanks or some potential future danger – like the roots of nearby trees spreading.

When looking for utilities - try to keep the traces/unit reasonable high. Also, beware of the excessive use of stacking. Preferably collect the profiles with the minimum length of two depths you wish to achieve. If you are careless about these options, the data you collect will be hard to interpret or you might even miss targets.

Survey example

In this survey example we are going to use the FLB390 to locate three metal tanks. The tanks are used as the fuel storage at a nearby gas station. Each of the tanks is expected to be a laid down cylinder of approximately 2 meters in diameter and 8 meters in length.

Equipment for the job

Antenna name	Recommended settings			Size of target (m)	Recommended area of application
	HP(MHz)	LP(MHz)	Range (ns)		
FLB390	150	700	50-100	0.125	Medium to shallow depth stratigraphy and large utility survey, road assessment

The FLB390 is a full shielded air launched antenna with a narrow beam and excellent front to back ratio. These two facts allow the antenna to be less susceptible to crowded environment influences unlike any air launched antenna before. It is a good replacement for ground coupled antennas with similar frequency range on surveys where it is hard to keep in contact with the ground. Added as deep sub grade locator for road assessment surveys or used on a unique one wheel cart for extreme rough terrains it will make your survey more efficient.

Due to their different internal electrical design and principle of work, air launched antennas are always used raised from the ground. The minimum height can be roughly calculated as a 1/10 of central frequency wavelength of the antenna. The maximum height on the other hand is dependent on the size of the foot print of the antenna that one can allow for the survey. This is a result of the foot print being one of the correlating factors for the amount of environmental interference and horizontal resolution.

Being designed for specific types of survey, for this antenna we have created a group of specific carts.

Conducting the survey

We started our survey by making a quick free path “dummy” profile and marked the rough outline of the tanks and anomalies directly from the screen. With these marks on the ground we were able to make a sparse “grid” survey with 3 files in the X direction and 3 files in the Y direction.

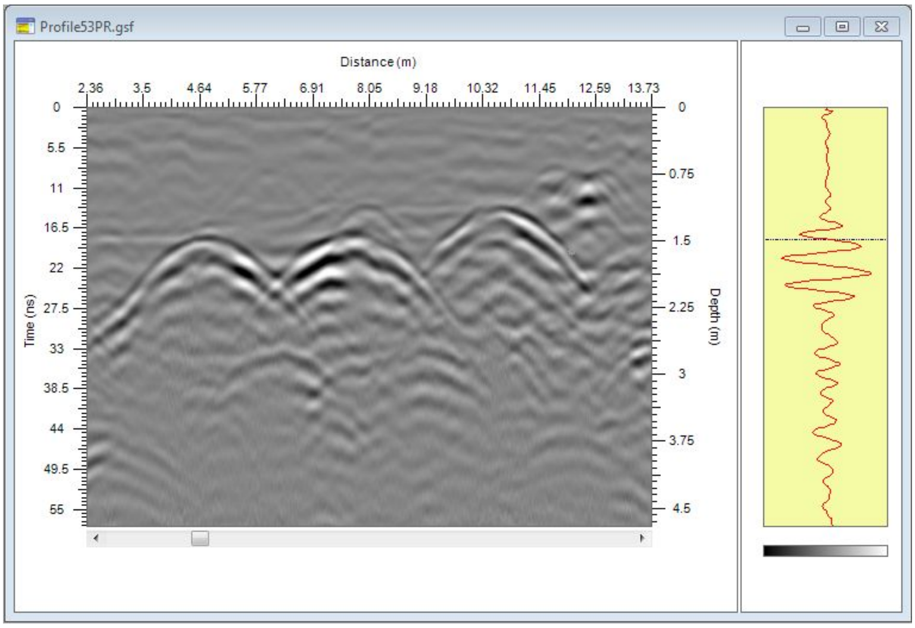
The X direction of the files is set perpendicular to the UST, and the Y direction is set to go parallel with the UST.

When doing a survey on a large area, one way of reducing time and effort for the survey is creating a “dummy profile”. The dummy profile is not used for final conclusions and interpretation – it might even be left out of the report entirely. You collect the dummy profile in a free path scheme – zigzagging, crossing back over your track at different angles and changing course freely. While you are collecting the profile, pay attention to your screen. Whenever you see an anomaly (hyperbola, sudden clutter, extreme attenuation/reflection) make a mark on the ground. Now you can allow yourself to make small grids or profiles over consecutive marks in order to collect just the relevant data. One might think of this procedure as narrowing the scope of survey to places of interest.

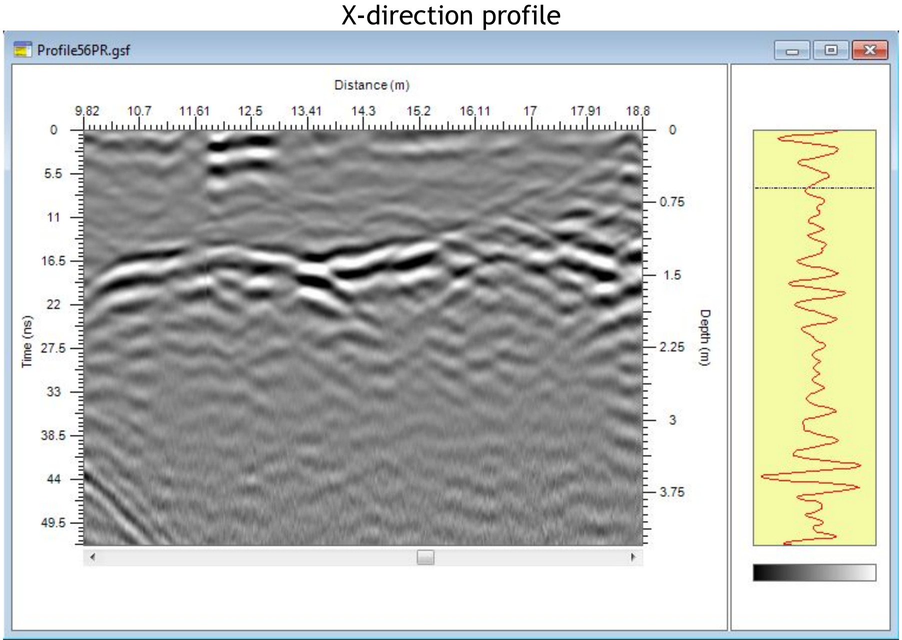
The files from this survey nicely depict the need to always cross the point objects (pipes, tunnels, tanks) as perpendicular as one can in order to see them and interpret them with ease. The files that were taken along the tanks are also showing the tanks nicely, but could be mistaken for a highly reflective layer contact.

Processing and Conclusions

Processing and interpreting this data was quite easy and left no room for speculation.
We used the files in X direction to determine depth and X position.
The files along the length of the tanks confirmed their depth and overall expected size.



X-direction profile



Y-direction profile