

**Everything Leaks -
Leak Detection Methods and
Technologies for Geomembrane
Lined Systems, Storage Tanks and
Pipelines**

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A Fact to live with

The Truth About Leakage –

All storage systems leak...

...eventually

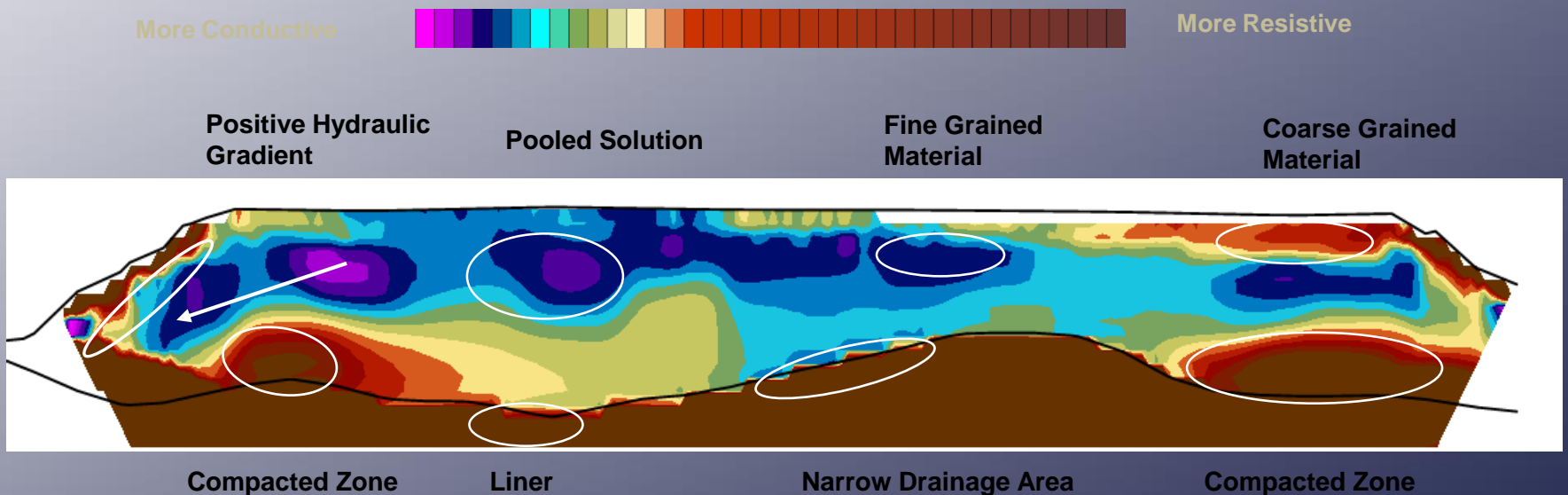
Three Main Focus Areas for Leak Detection

1.Fluid Filled Ponds

2.Pipelines

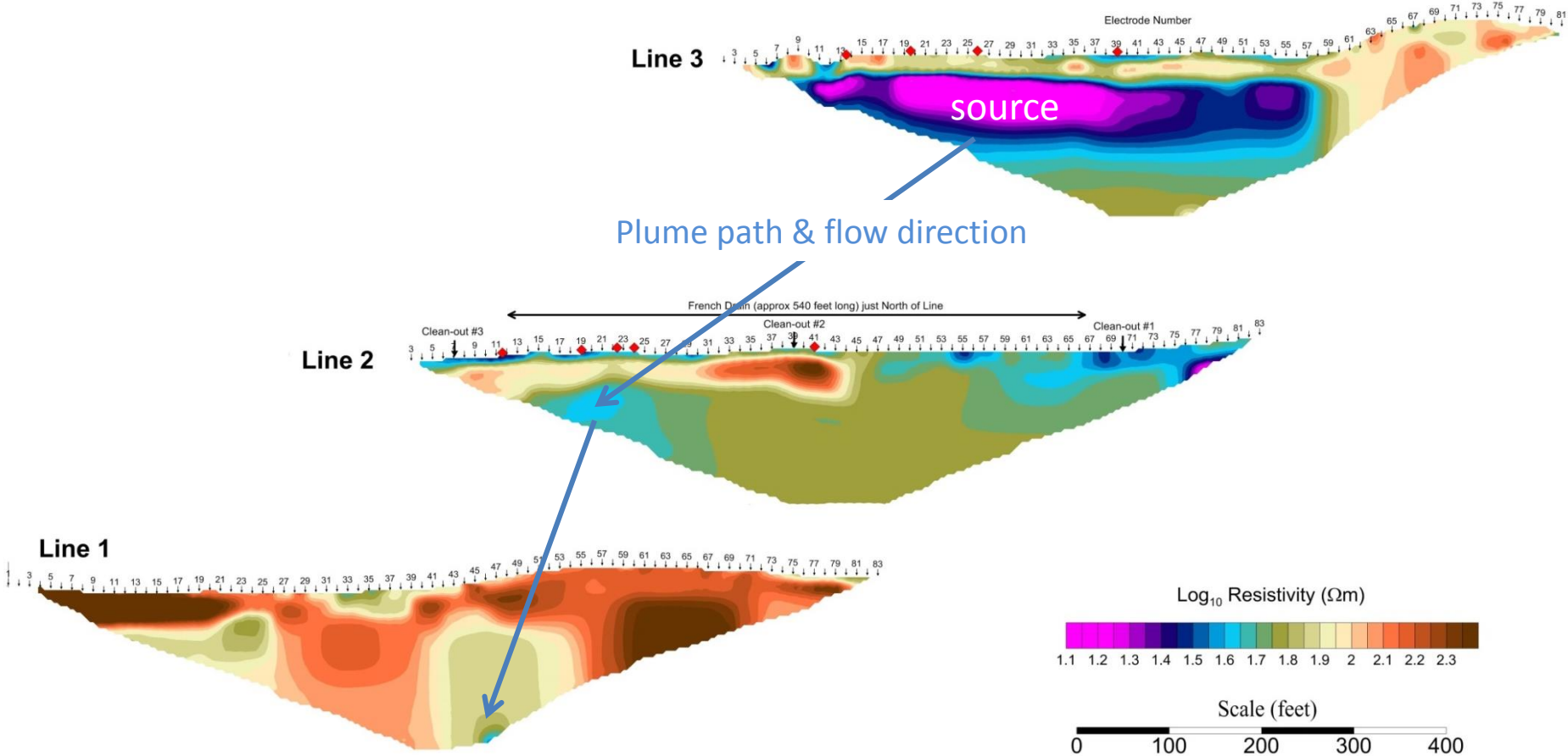
3.Tanks

- We use geophysical methods to create visual interpretations of the surface and subsurface of the earth.
- Succinctly, we see geophysics as a tool for any industry working directly with the earth's surface and subsurface. We work with environmental, engineering, ground water, mining, oil & gas, and chemical industries.

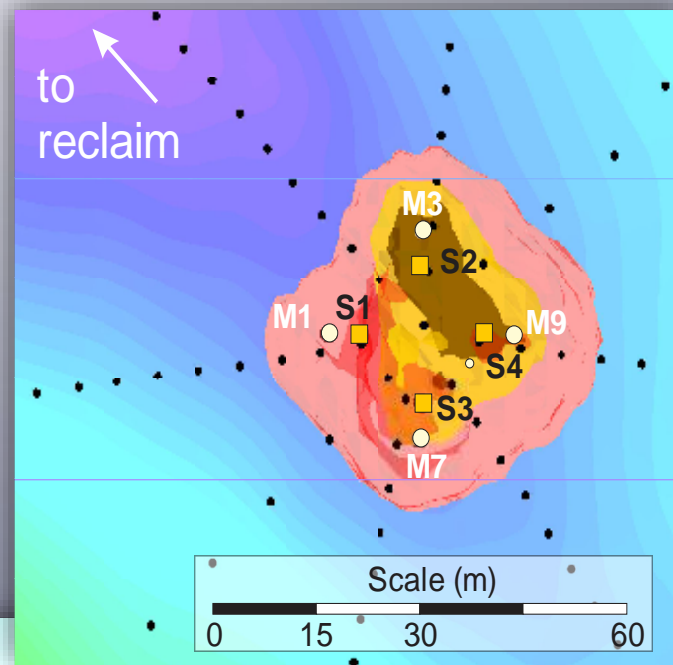
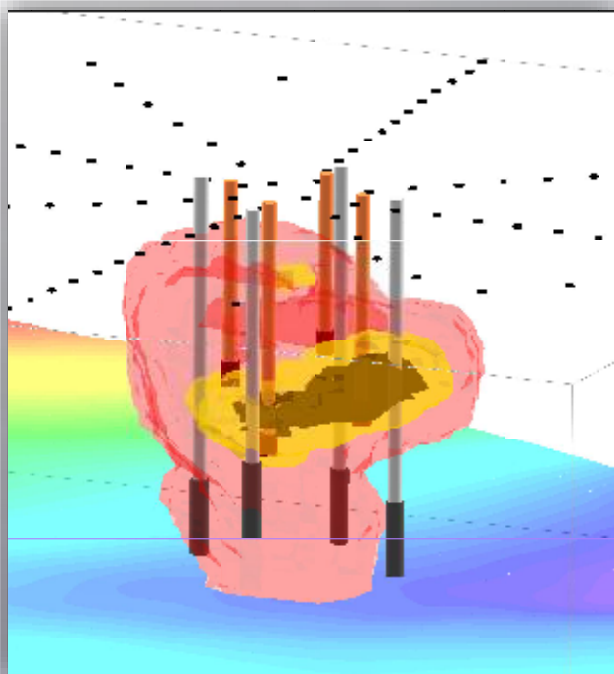


Plume Mapping

Cumulative 2D Resistivity Profiles



Injection Monitoring





Fluid Filled Ponds

Pond leak detection is not just for new construction or empty ponds. There is no need to drain the structure to use electrical methods.

We start with ASTM standards as a guideline and modify the survey based on our experience and technology to create a leak detection survey tailored to fit each site.

HGI utilizes a cabling approach, which allows us to archive and post-process the data and present easy to understand maps that show the anomalous readings over the leak locations.

HGI's methods take some of the human error out of the leak detection equation and we have an extremely high success rate in leaking pond surveys.

Fundamentally

Electric leak location is governed by:

- The inverse relationship between the conductive nature of the solution and the highly resistive nature of most geosynthetics.

A hole:

- Breaches the liners resistive nature
- Creates a local region of high conductivity

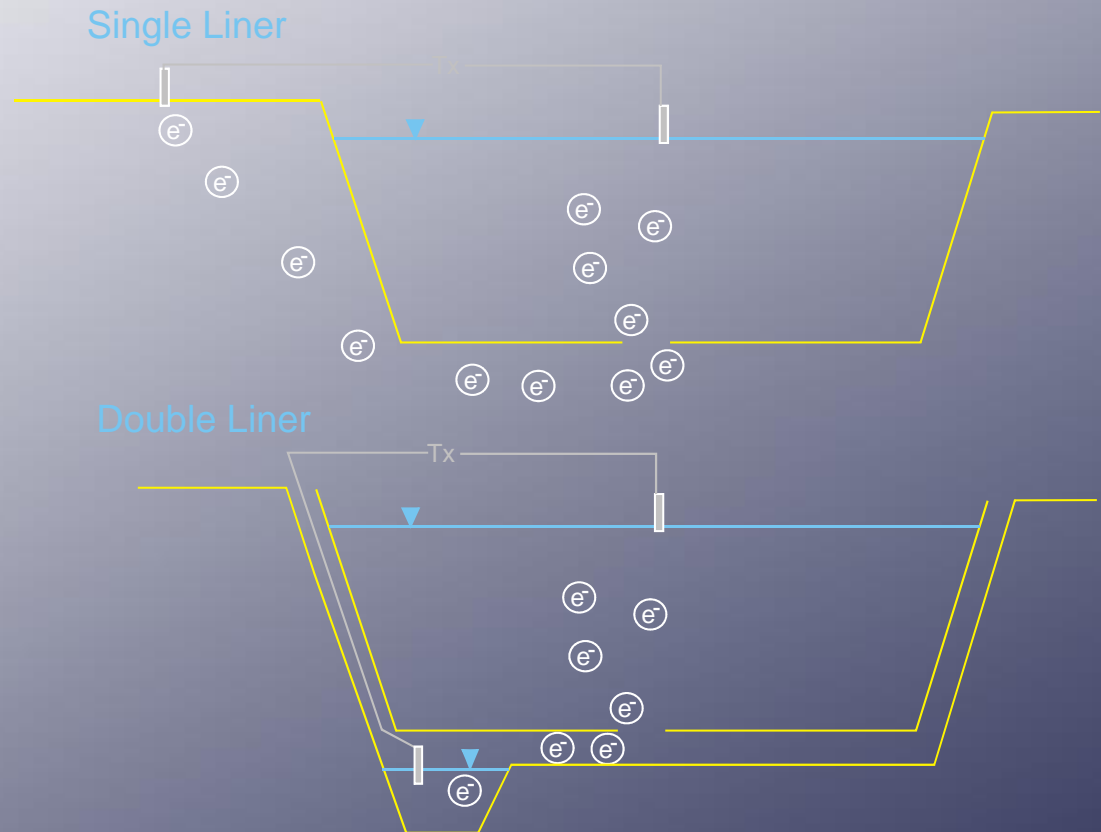
Therefore:

- The electric potential relative to a hole in the liner is significant and measurable
- Current levels remain low and uniform across intact and undamaged liner.

Electrical Leak Detection Basics

An electric current is induced within the containment structure.

In the presence of leaks, the current flows more readily, resulting in a larger magnitude response near a leak location.



Images From The Field

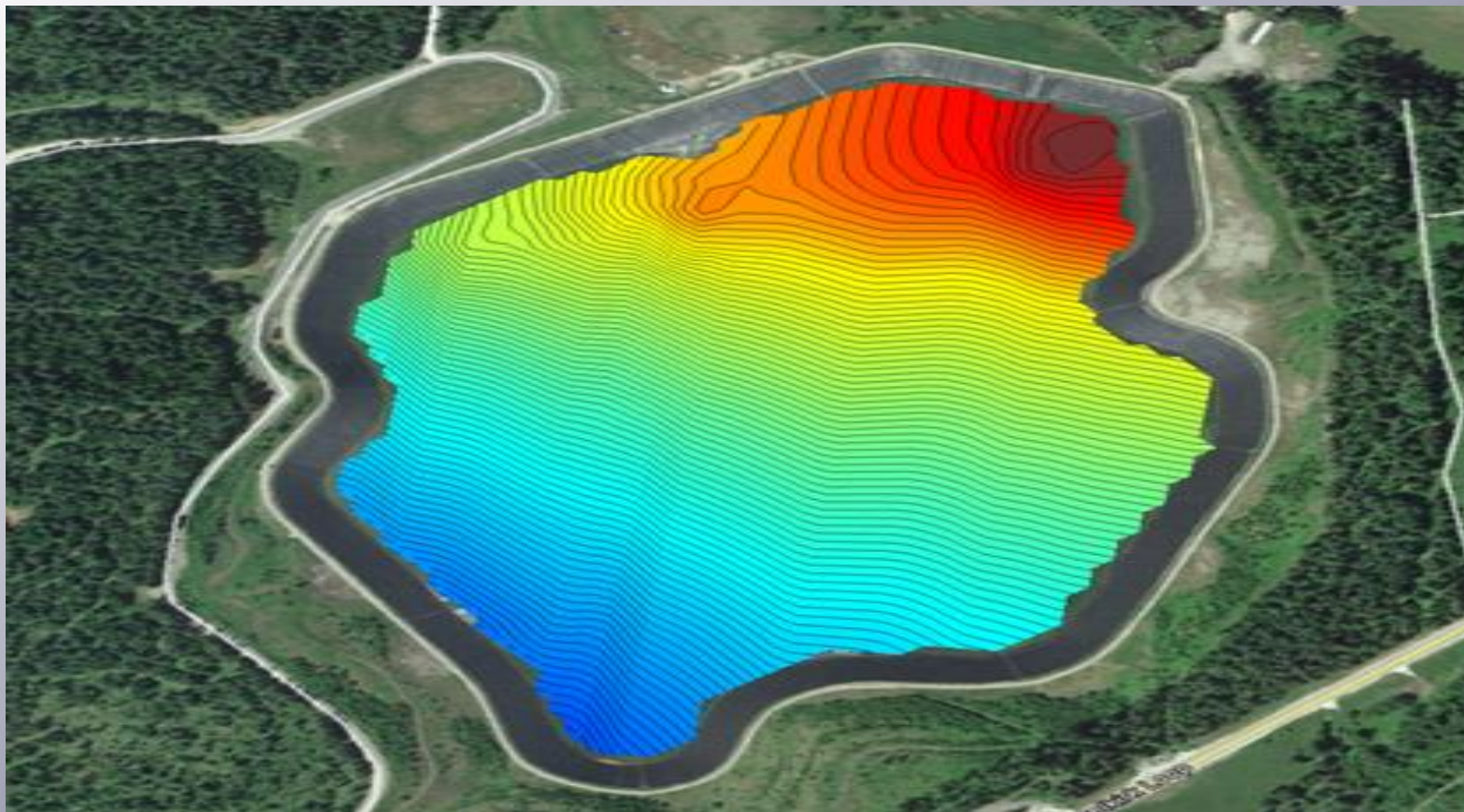
Leak Location and Integrity Testing In Lined Ponds



Images From The Field

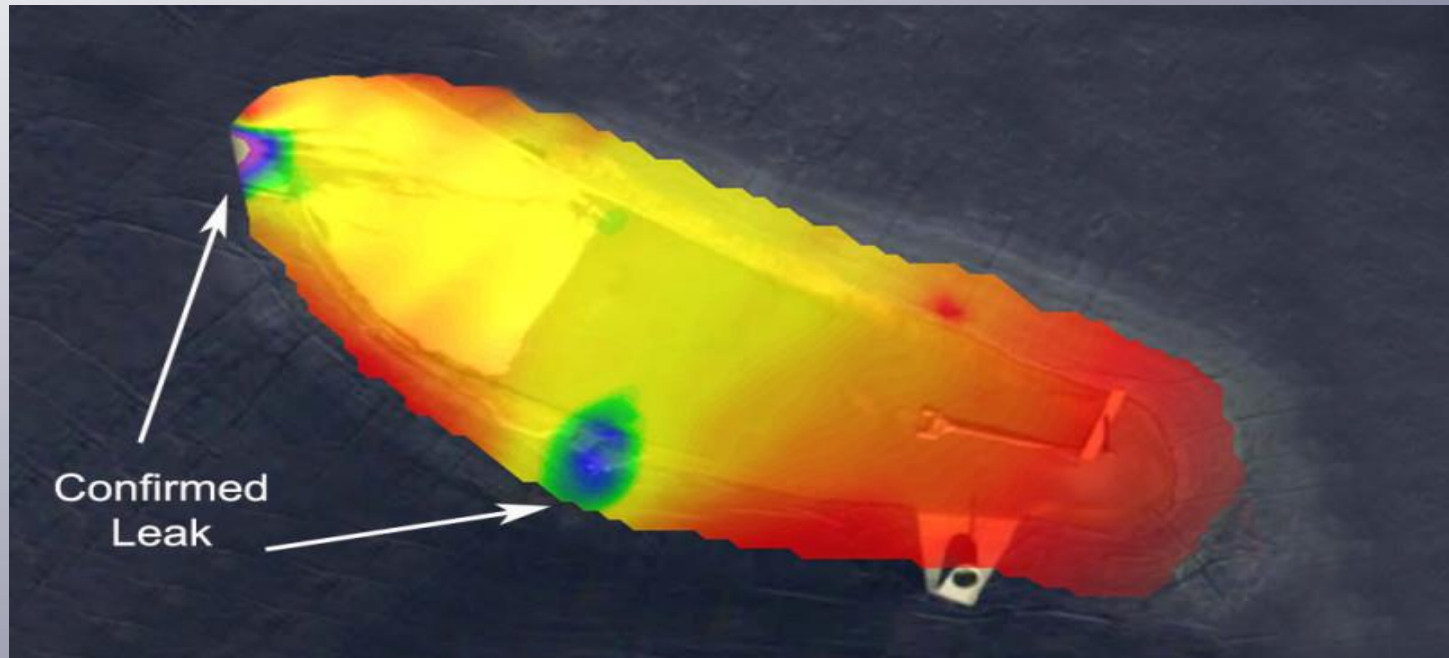
Leak Location In Canals & Tunnels





Colored Countour Maps

This image shows electrical responses in a plan view map which helps visualize the location and magnitude of leak responses.





Limitations

Every geophysical method has its strengths and weaknesses.

One limitation is not being able to detect smaller tears in liners in the presence of much larger ones. The subtle electrical responses from a small leak can be dwarfed by the responses from larger tears. Sometimes, the bigger holes need to be fixed before being able to find the smaller holes.

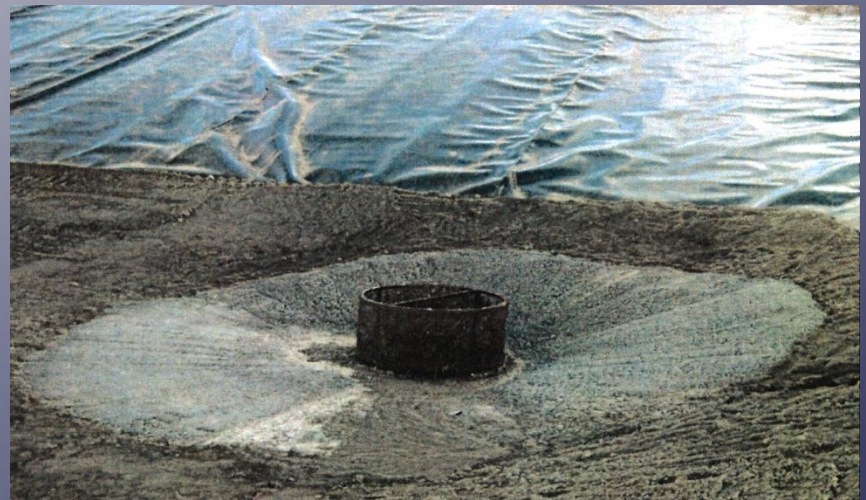
In our experience it is uncommon to have more than 2 or 3 major leak responses in a single pond. HGI can typically find all leaks in a single survey.

There are exceptions, for example one pond had over 40 leak responses, which took 3 surveys to determine the extent of the leak responses.

Reducing Human Error

Boundary Conditions and Ground Objects

Current will always flow to the path of least resistance. It is common in pond to have grounded infrastructure that can divert current. These conditions can lead to false leak responses in surveying if not properly accounted for.





Future for Fluid Filled Ponds

Using technology to help solve problems

Continue to invest in new hardware to increase efficiency in the field.

Remote controlled data acquisition systems that can handle very large ponds

Permanent leak location grids under bottom liners

Buried Tank Detection





Hanford Nuclear Site

1945 - 149 single-shell tanks were built - 94 million gallons of storage capacity.

Tanks size ranged up to 1 million gallons.

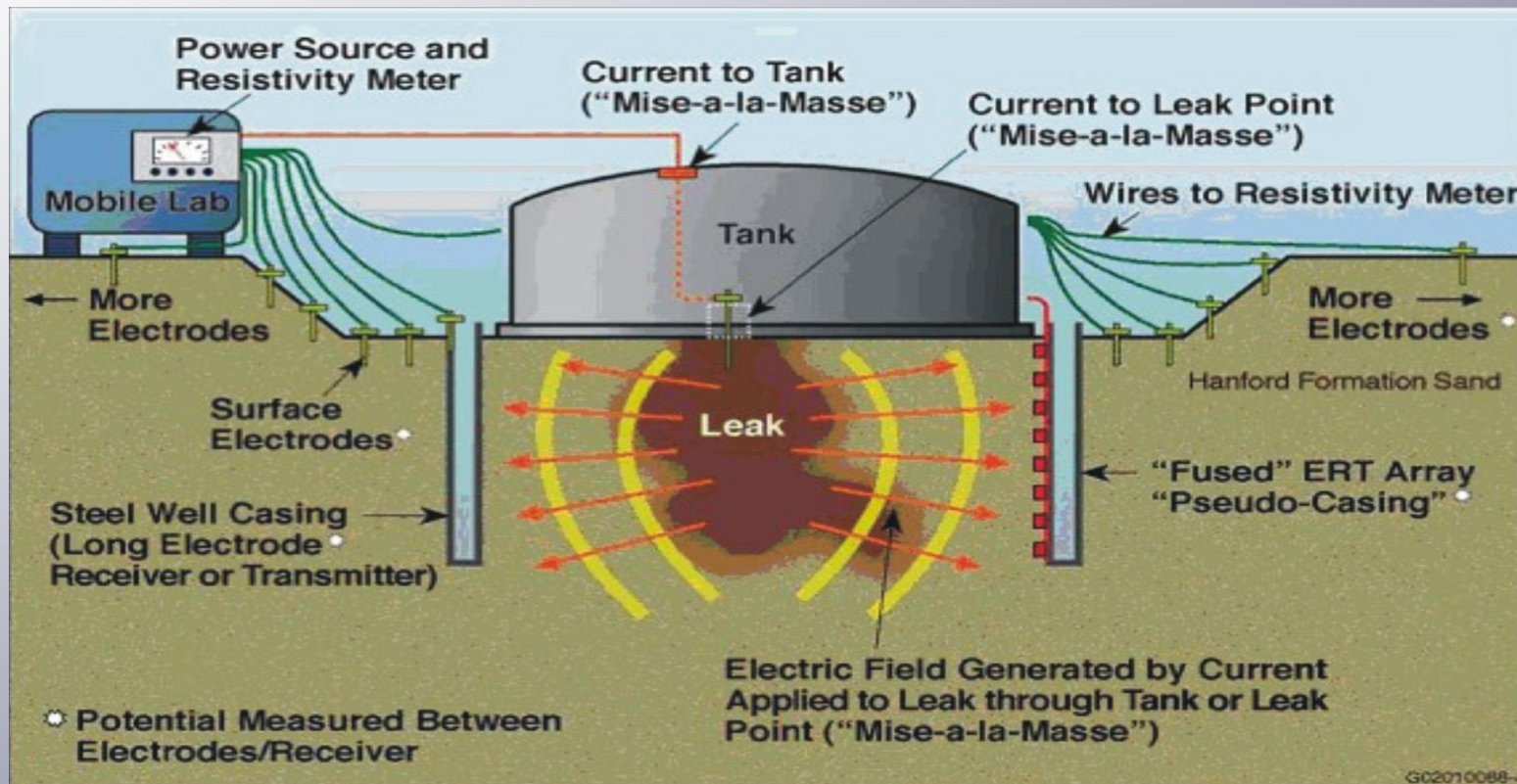
1968 – 1986 - 28 newer double-shell tanks were constructed.

Total of 18 Tank Farms

Retrieve the waste and transfer it into the more secure DSTs for temporary storage before treatment



Geophysical Leak Detection Monitoring



The Monitoring Program Takes Advantage Of Changes In Contact Resistance That Will Occur If Conductive Tank Liquid Leaks Into The Soil.

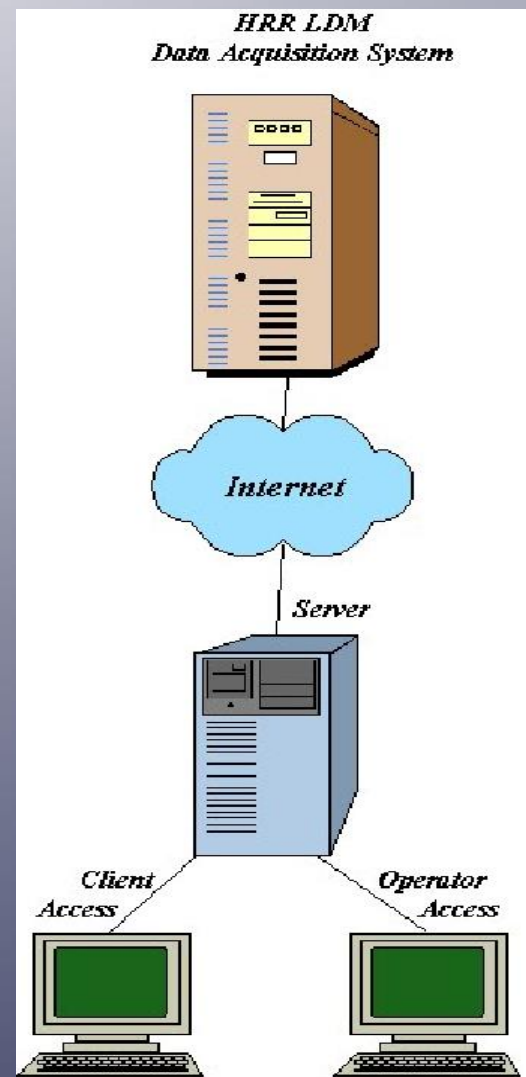
Long-Term Leak Detection Monitoring

LDM technology consists of a data acquisition system (DAS) housed in a small trailer sited adjacent to the tank farm.

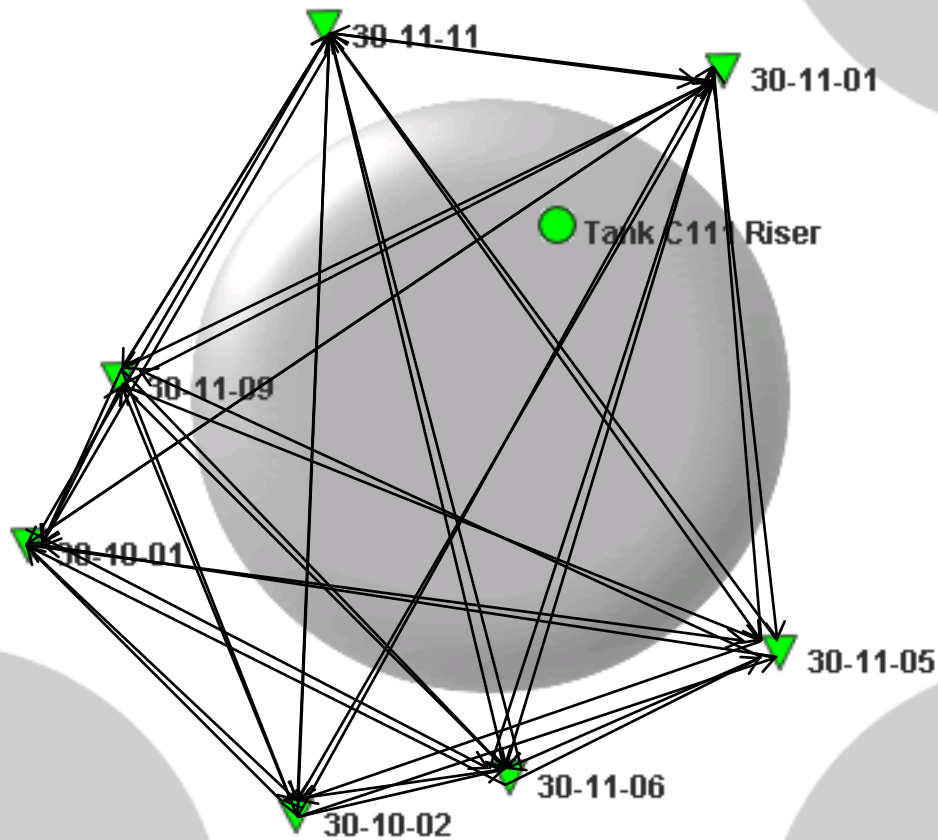
Cables run from the DAS to wells around the target waste tank and to a tank riser.

The DAS controls switching for the various transmitting and receiving electrode pairs.

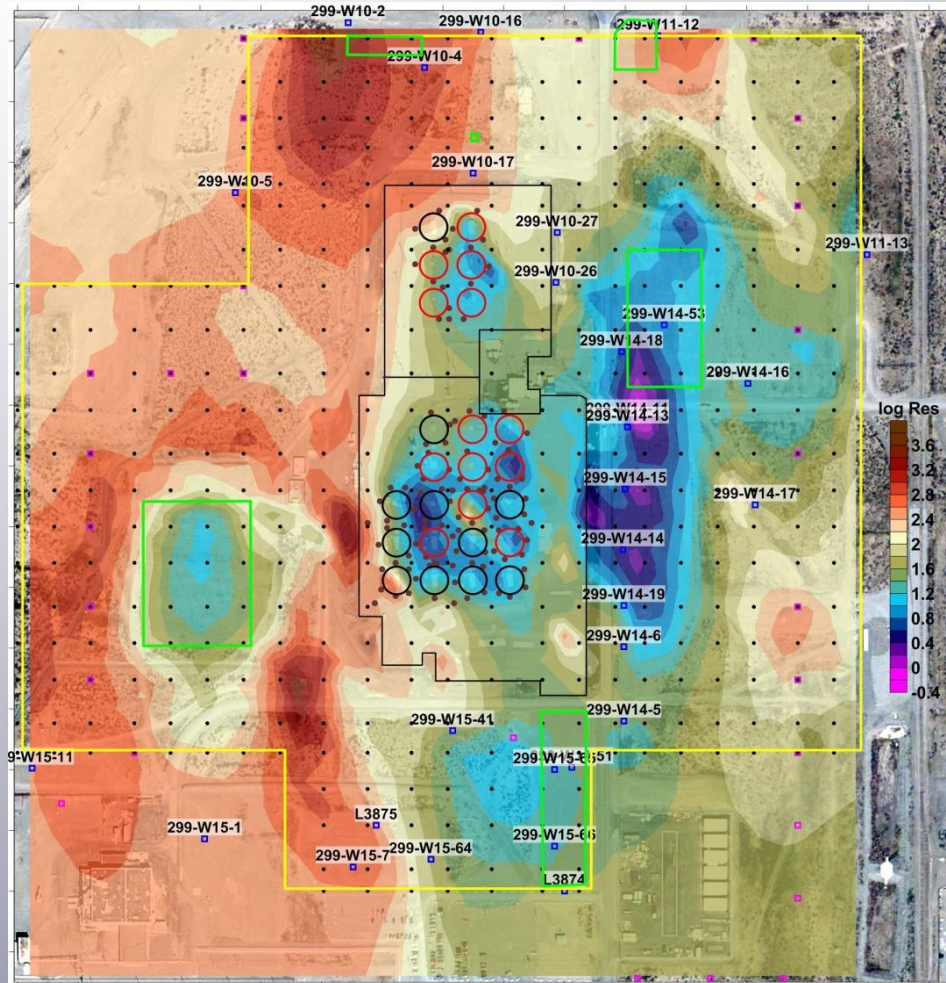
Data From Multiple Paired Electrode Types Provide Critical Information On Resistivity Changes Occurring Around Hanford Waste Tanks



Geophysical Leak Detection Monitoring

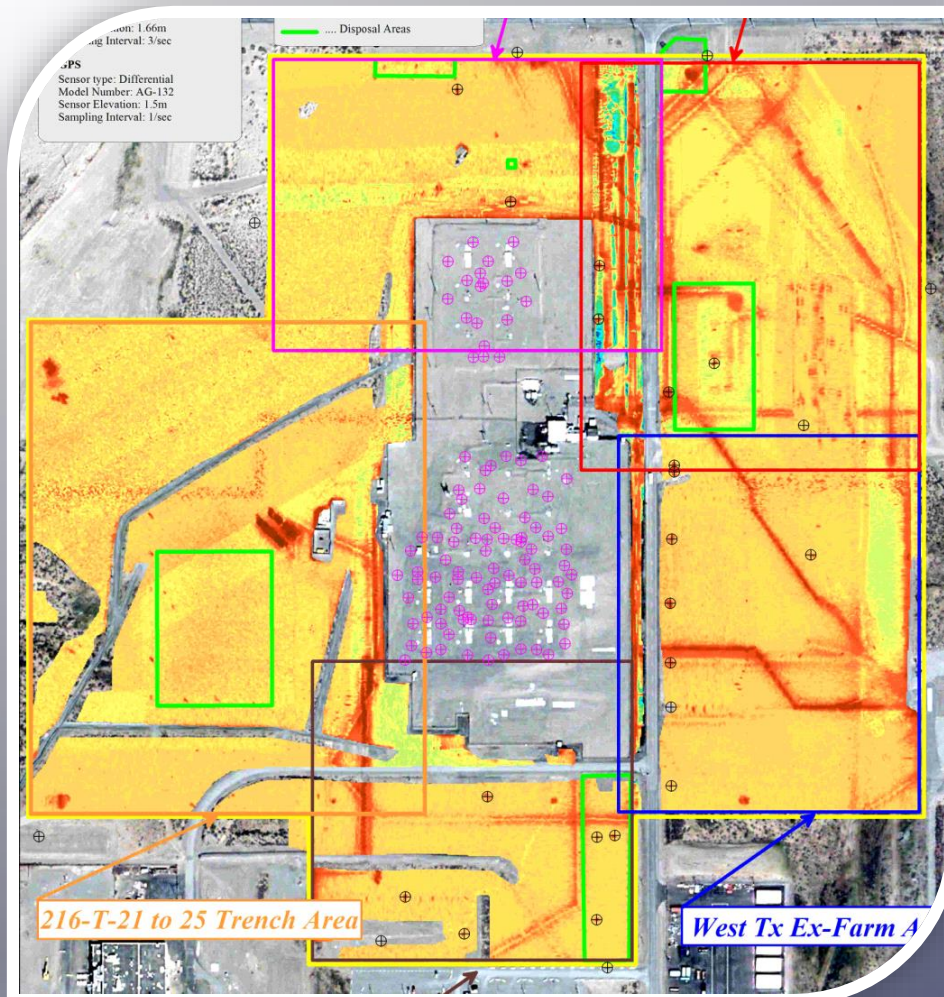


Tank Leak Detection



- Electrical Resistivity Results – non invasive
- 150 ac coverage
- Tank farm and disposal waste sites
- Wells and surface electrodes
- Features match known targets

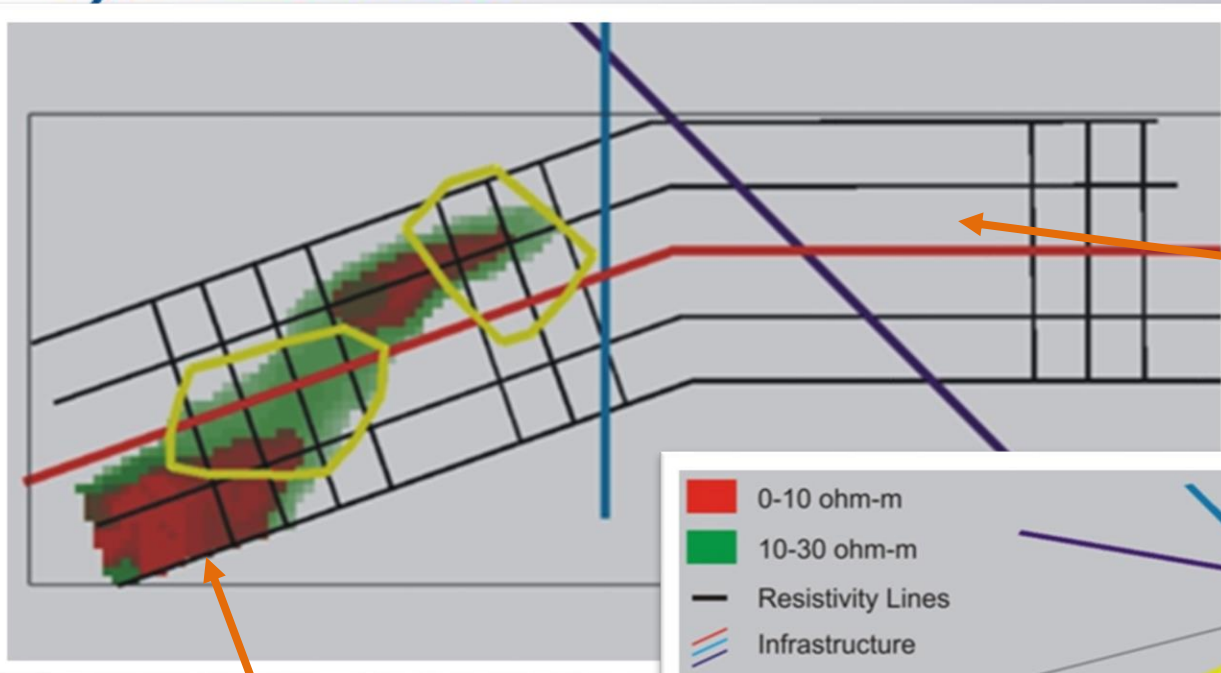
Pipeline Detection



- As-built drawings not reflective of current conditions
- Electromagnetics can locate metal pipes
- Metals have strong physical property contrasts with soil
- Typically not used to find leak from metal pipeline

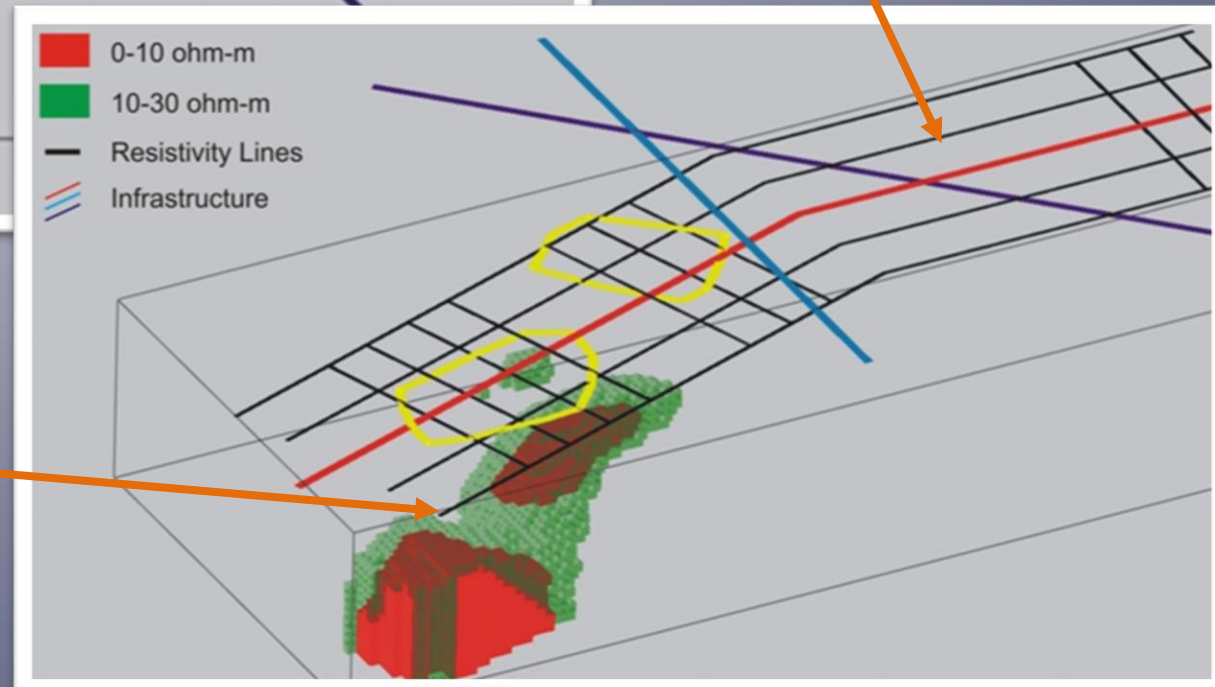
** Map not for leak detection*

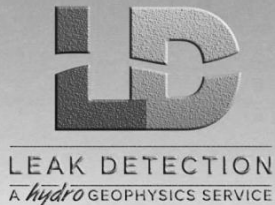
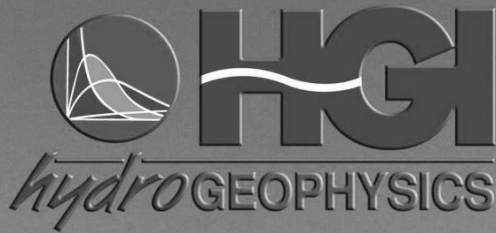
Pipeline Leak Detection



No response over background area

Large response over leak areas





- Website Resources:
- General: hgiworld.com
- Mining: heapsolutions.com
- Leak Detection: hgileakdetection.com

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