



**An Overview of
Electric Leak Detection & Leak Location
Methodson Geosynthetic Liners**

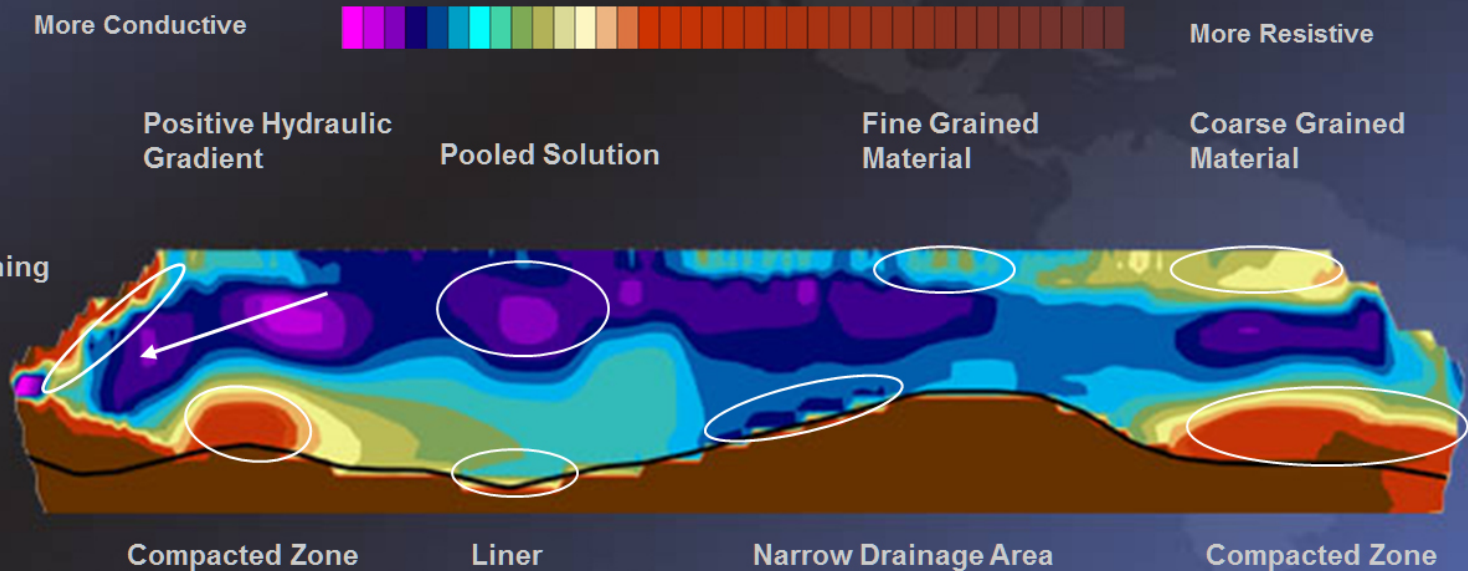
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Hyatt Regency San Antonio Riverwalk

We use electrical 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.





Liner Leak Location Methods

Bare Liner

- **Water Puddle - ASTM D7002**
- **Water Lance - ASTM D7703**
- **Spark Testing - ASTM D7240**
- **Arc Testing - ASTM D7953**

Water Covered & Soil Covered

ASTM D7007



A Fact to live with

**The Truth About Leakage –
All liners leak...**

...eventually

**Liner Integrity depends on construction quality and
maintenance through end of life.**



A Story You Know!



Groundwater Contamination In Hinkley, CA

Unlined ponds leached Chromium-6 into the groundwater causing cancer and autoimmune disease.

Leakage occurred between 1952 – 1966

From 1996 to 2008 settlement costs reached \$448 Million

Cleanup cost \$700 Million.

Total cost is upwards of \$1.1 billion and counting.

Electrical Leak Detection Basics

Electric leak location is governed by:

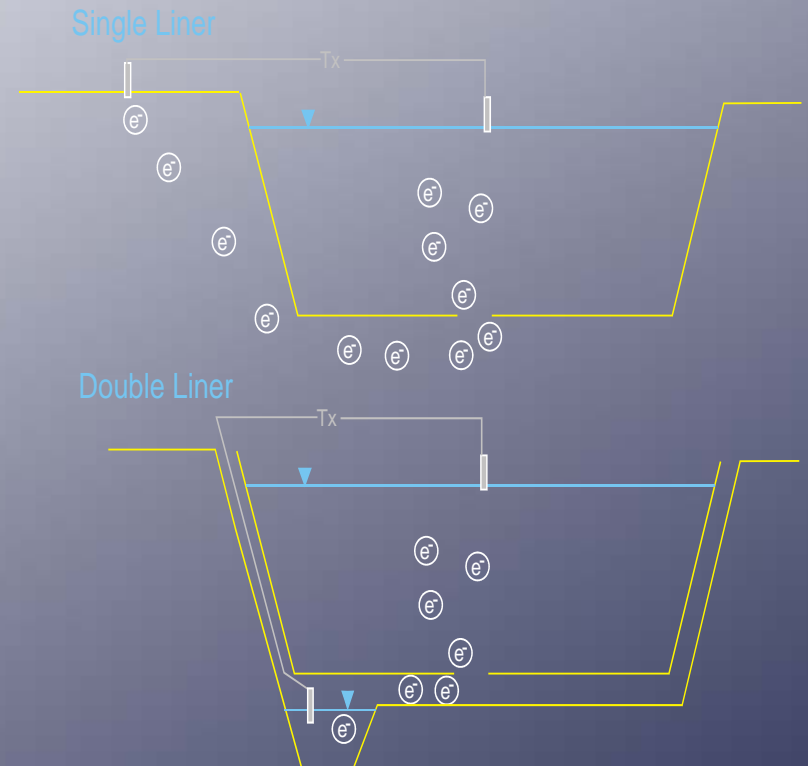
- The inverse relationship between the conductive nature of boundary materials and the highly resistive nature of most geosynthetics.

A hole:

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

Therefore:

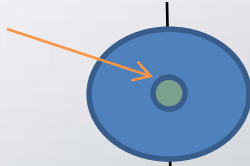
- The electric potential relative to a hole in the liner is significant and measurable
- Current levels remain low and uniform across intact and undamaged liner.



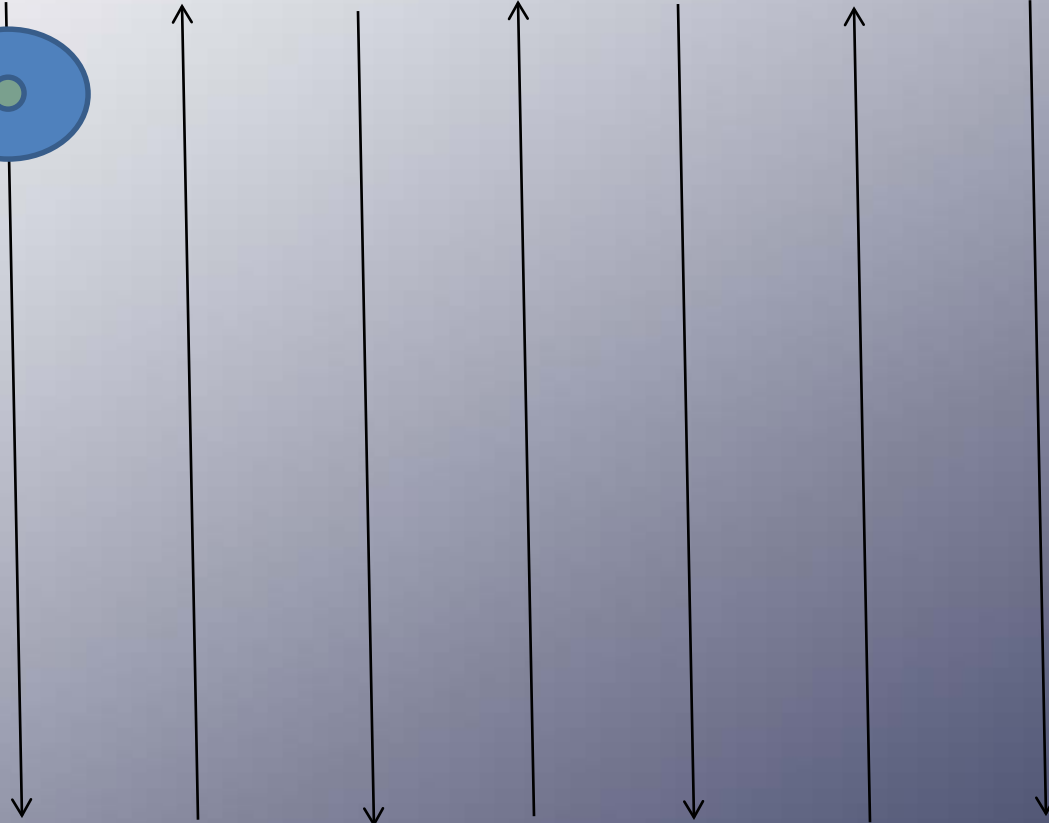


Survey Setup

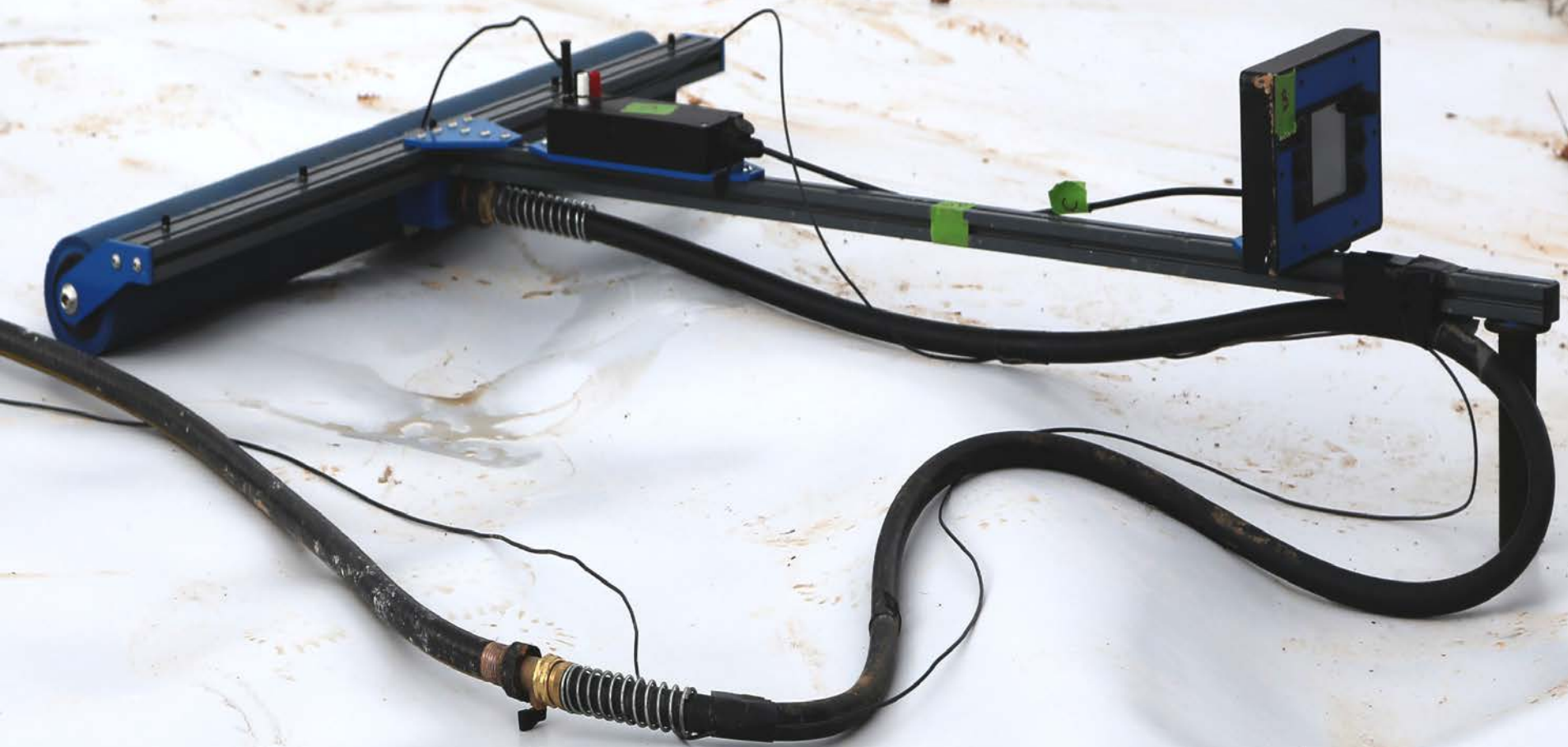
Receiver



Transmitter









B

MSA





GENEVA

SCOTT
POLYMER
KST
SCOTT

CHRYZ

Cabela's



Transmitter & Transmitting Electrode Setup



Transmitter Setup











Challenges With Leak location

Challenges with leak location surveys fall into two main categories

- Human Error
- Equipment Limitations

Boundary Conditions

Operators must consider:

- All the elements in contact with the margins of the geosynthetics in a lined system
- How well the substrates below and above the liner can carry current
- The quality of electrical isolation in the area to be surveyed







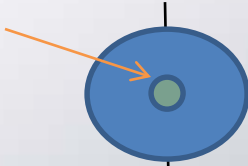
Human Error

- **Geometry not considered.**
- **Maximum distance between survey lines determined incorrectly**
- **Lack of routine following sensitivity test throughout survey**
- **Survey electrical array set up incorrectly - liners have caught on fire from improper transmitter setup**
- **Suspected leaks marked incorrectly**

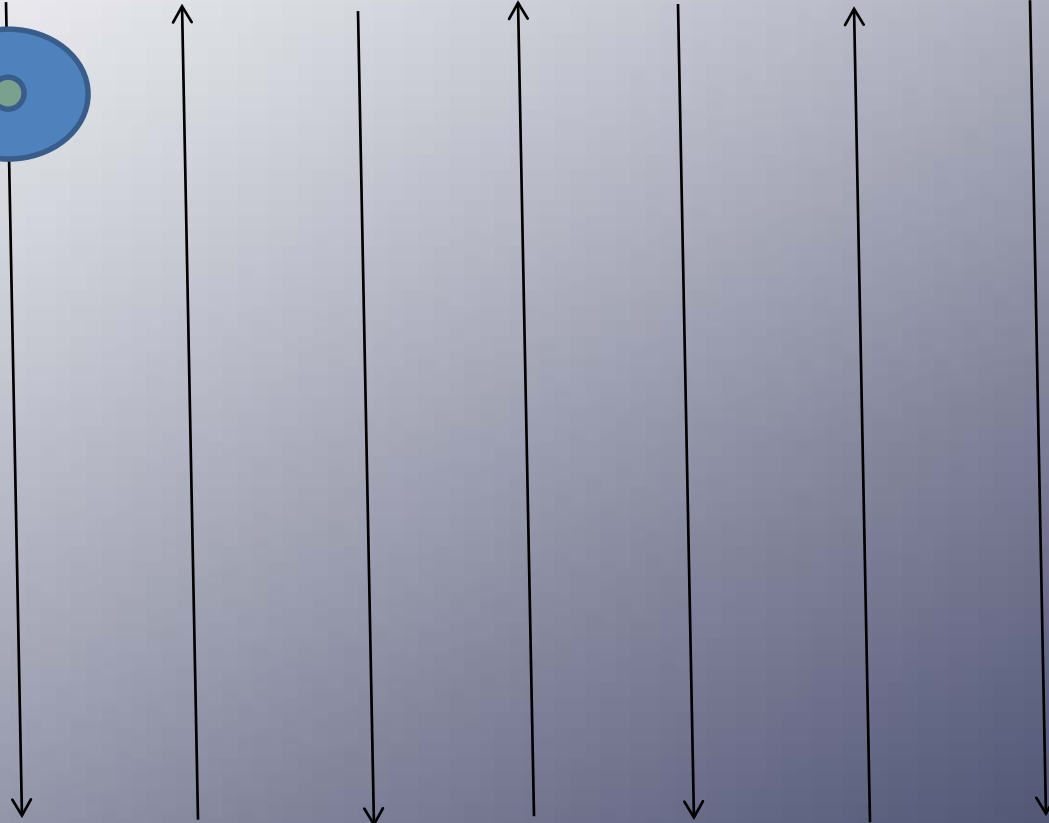


Geometry Matters...

Receiver



Transmitter



Human Error

*Exhaustion & Complacency During Physical
Data Acquisition*



Equipment Limitations

Low Level Automation

Contemporary leak location equipment for covered systems is typically divided into two separate components:

A current injector (transmitter)
A current detector (receiver).

This lack of connectivity means that system checks are operator-dependent rather than system-dependent.



Survey Area Limitations

Fluid depths need to be lowered to levels that an operator can operate in easily.

Total survey area is reduced to the water level of the pond.





Equipment Limitations

Survey Area Limitations

For material covered liners in mining, leak location equipment is limited by the depth of the material.

The injected current will decrease with increasing depth - at some depth the resulting signal cannot be distinguished from background noise.





Equipment Limitations

Resolution in Conductive Substrates

- Conventional leak location systems break down in highly conductive solutions or substrates.
- Current leaking through a hole is attenuated to such an extent that the signal falls below the detector's ability to resolve it.

Signal Shadowing

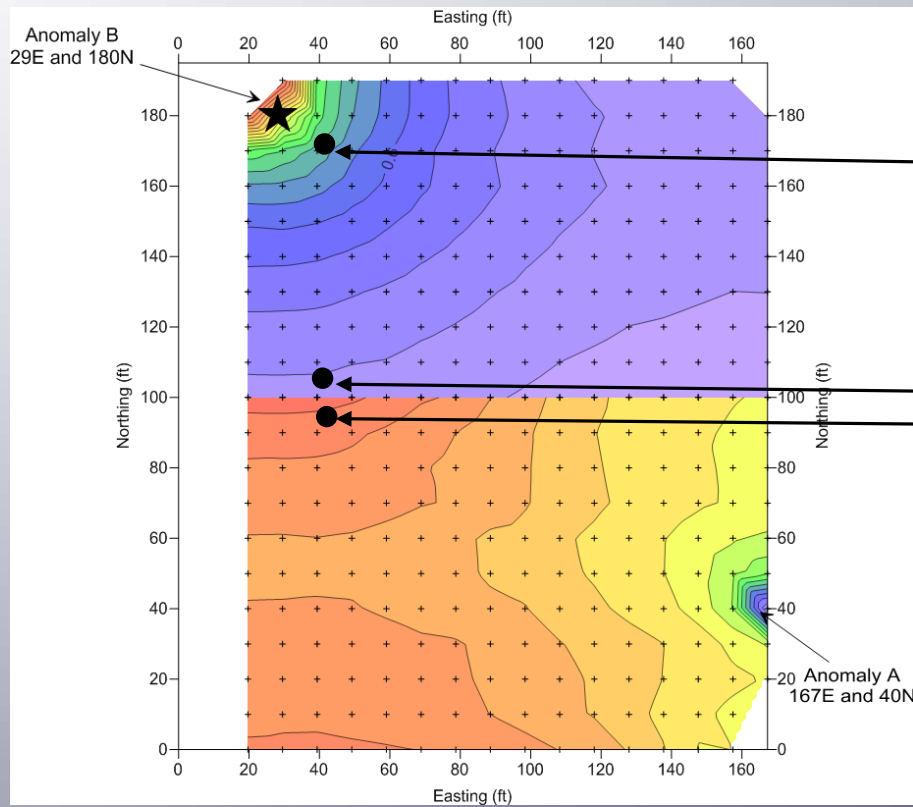
- It is extremely difficult to resolve smaller holes in close proximity to larger ones.
- Large tears or punctures creates a much larger signal pathway. High current flow floods the immediate area, shadowing or obscuring the location of smaller holes nearby.



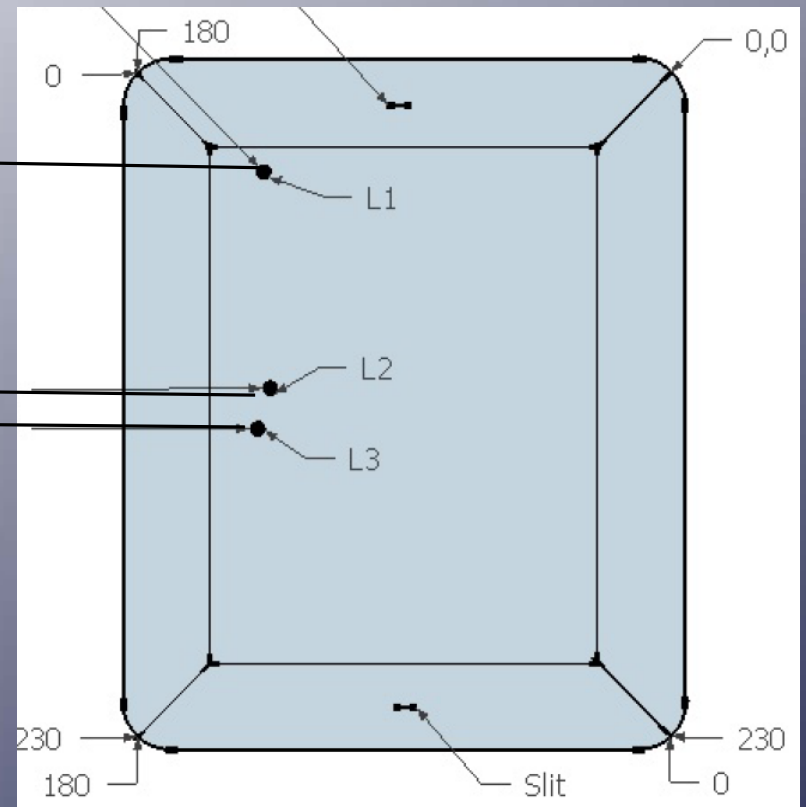
The Future of Electric Leak Location

- 1) **Equipment that houses both the transmitter and receivers in a single system.**
While transmitting and receiving electrodes are in the pond the actual transmitting, receiving, and data logging occurs in a single device.
- 2) **Numerous independent sensors at discrete intervals in the pond.**
- 3) **Data is collected and stored for analysis –**
reduces subjectivity and increases objectivity.
- 4) **Hardware has checks and balances to assure system is functioning properly**
- 5) **Highly trained personnel**
- 6) **Color contoured maps**
- 7) **Large patches**

New Way



Old Way



Excel Data Analysis

