

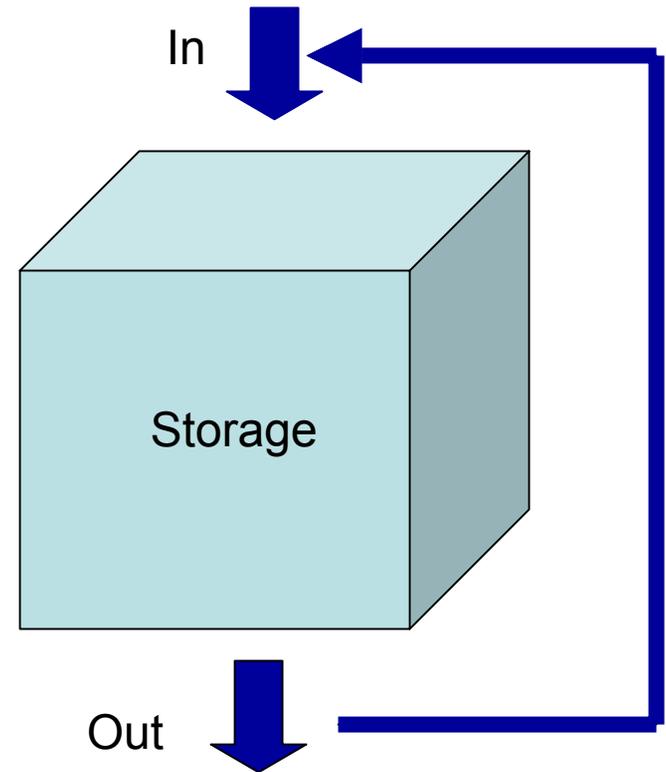
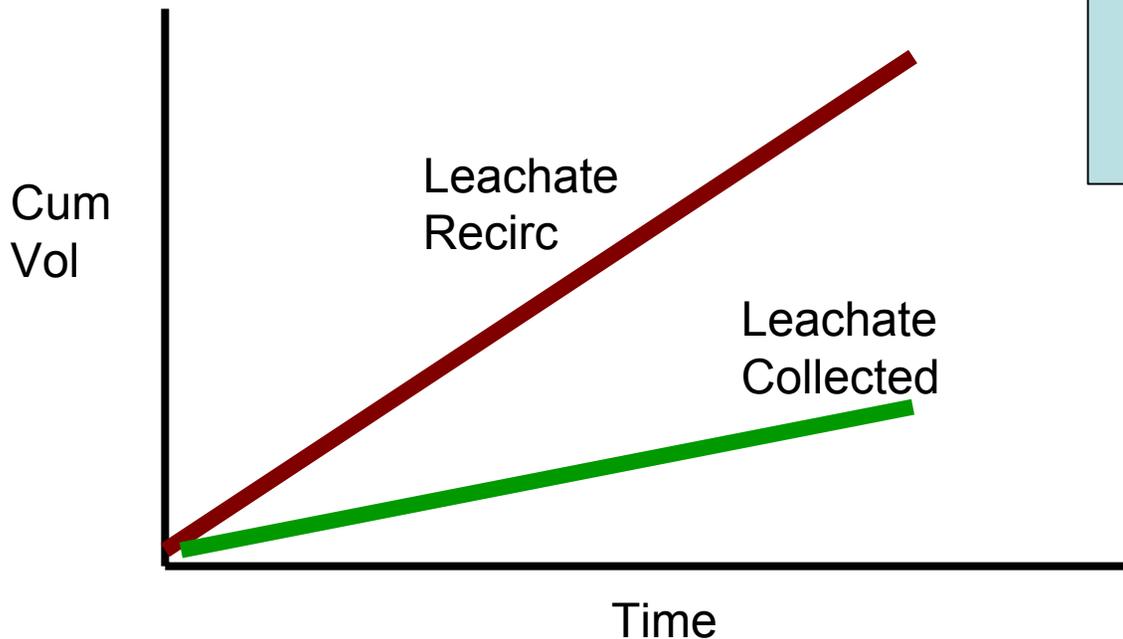
US EPA ARCHIVE DOCUMENT

# Measurement of Moisture

- Water balance
- Collect waste samples and measure gravimetrically
- *In situ* methods

# Water Balance

- Track moisture into and out of landfill



# Collection of Waste Samples

- Great data
- Expensive
- Infrequent



# *In Situ* Devices

- Adapted from devices used for soil irrigation purposes
- Examples:
  - Neutron probes
  - Time domain reflectometry (TDR)
  - Resistance devices

# Neutron Probes

- Neutrons emitted by the probe travel through adjacent medium; neutrons get thermalized by other atoms, especially hydrogen ( $H_2O$ ).
- Can measure thermalized neutrons using a device like a Geiger counter.
- Relate this measurement to moisture content.
- Probe lowered into pipes in landfill.

# TDR Devices

- An electromagnetic pulse is emitted.
- The propagation time of the pulse is a function of the dielectric constant of the surrounding medium.
- The dielectric constant is also a function of the moisture content.

# Resistivity Devices

- Measures the electrical resistance of between two electrodes inserted into a medium.
- The greater the moisture content, the lower the resistance.
- A function of liquid specific conductance.
- Example: Gypsum block

# Challenges

- How to install: TDR and resistivity are permanent; Neutron probe requires borehole
- Direct contact with the waste: Desired for TDR and resistivity.
- Calibration (what is actual moisture content?)
- Neutron probe required radioactive source

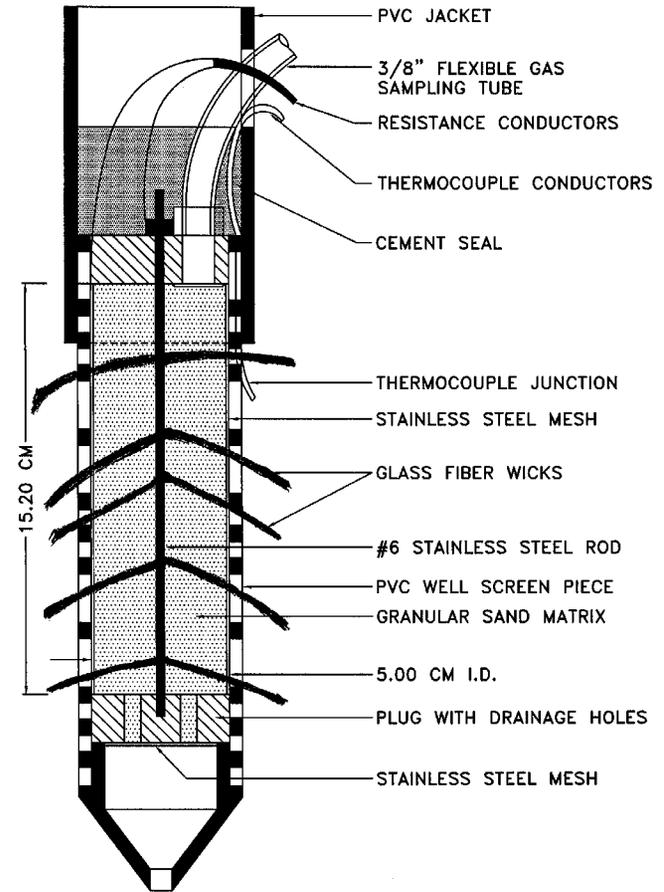
# TDR Device Used in Florida



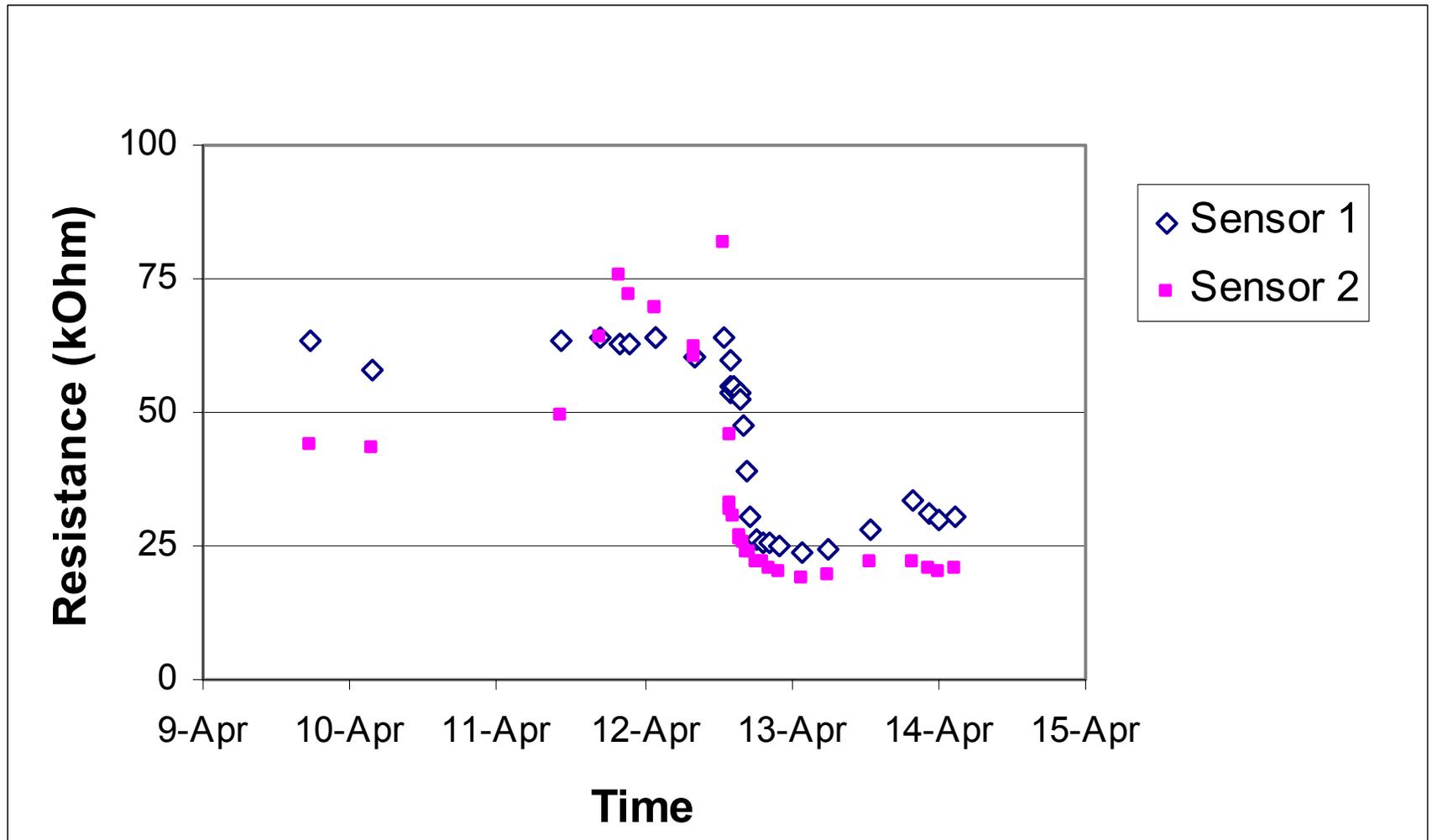




# Resistivity Probe Used in Florida

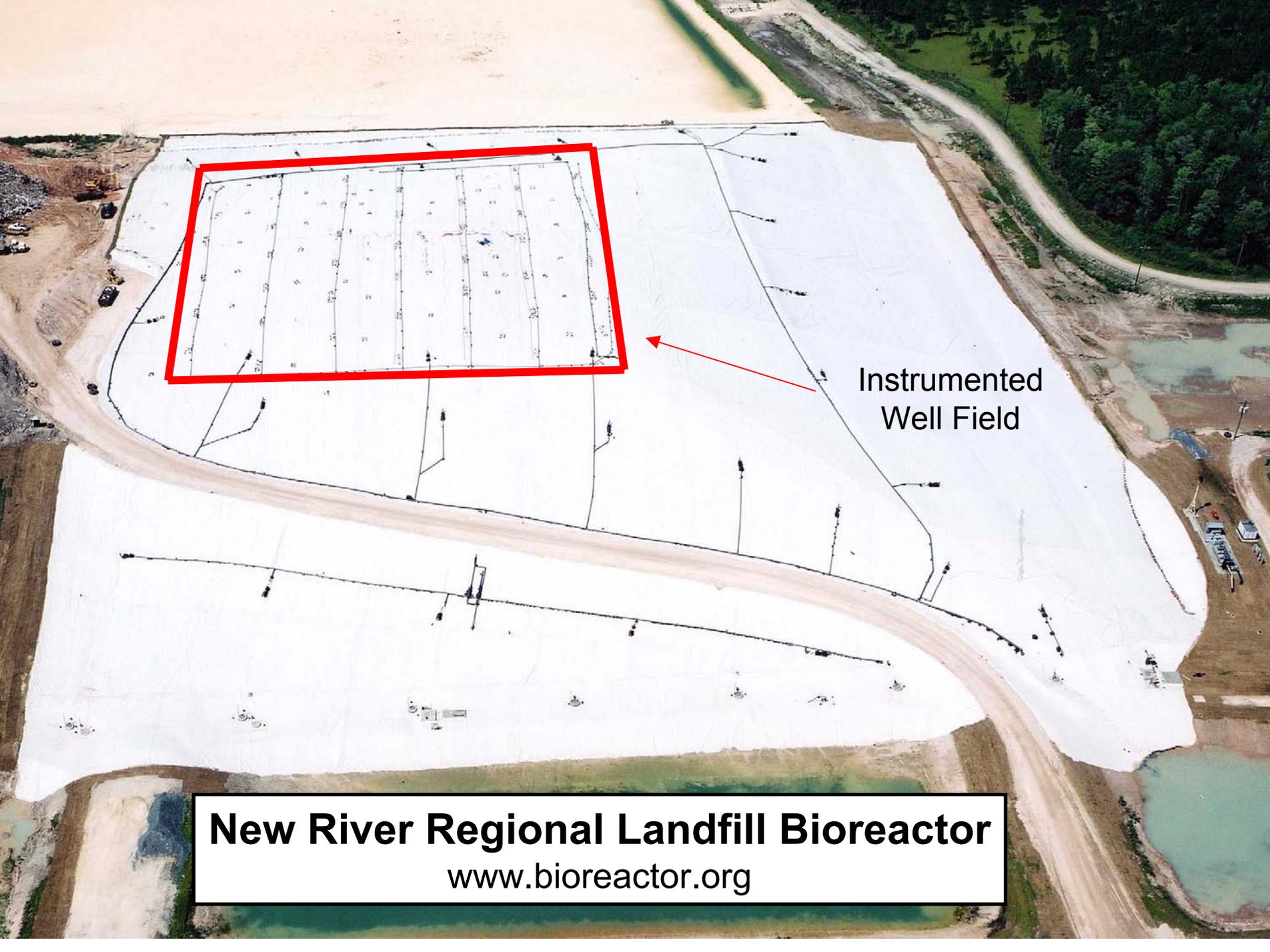


# Results of Field Trial





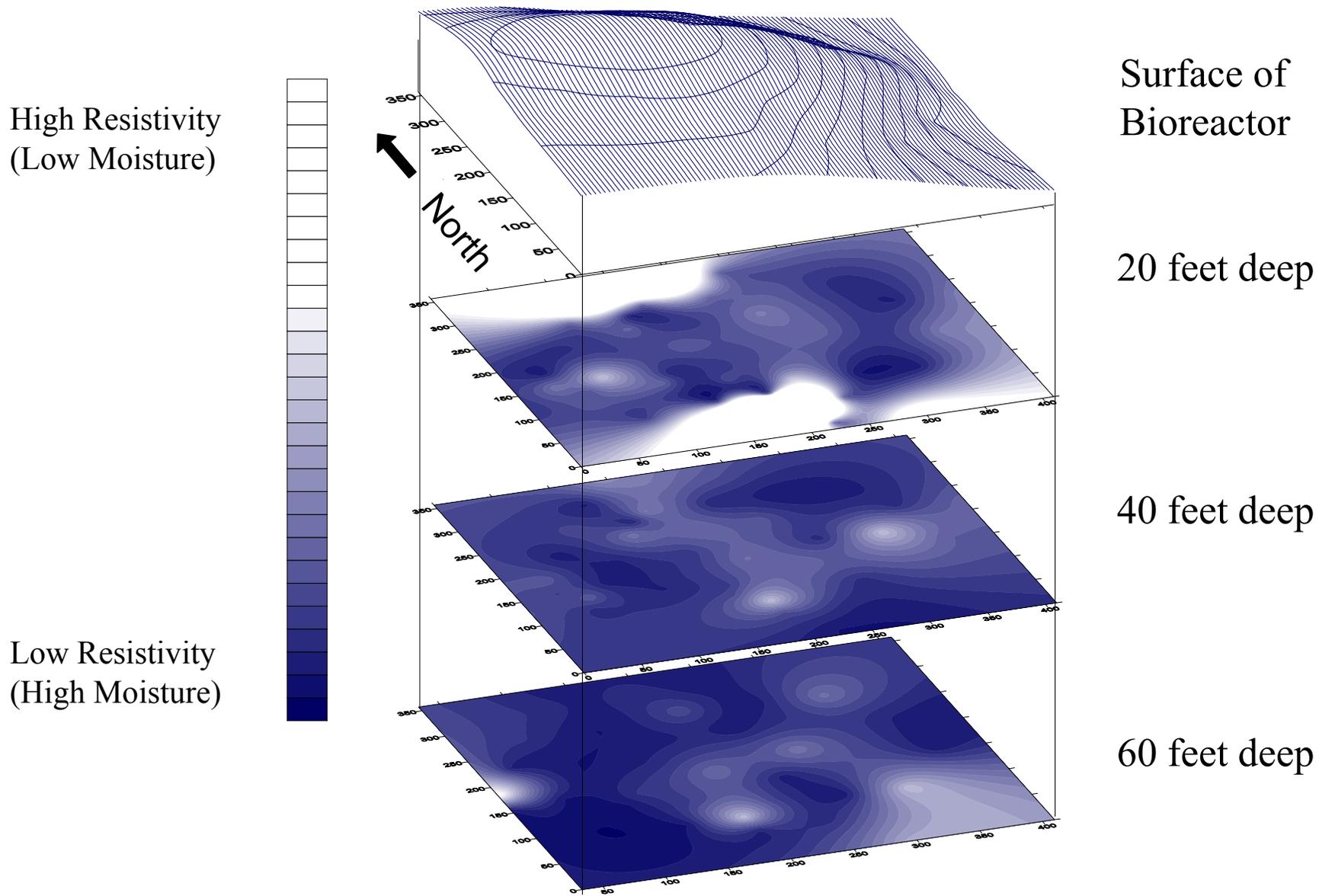
**New River Regional Landfill Bioreactor**  
[www.bioreactor.org](http://www.bioreactor.org)



Instrumented  
Well Field

**New River Regional Landfill Bioreactor**  
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# Resistivity distribution inside NRRL Bioreactor, 12/18/02



# Remaining Questions

- How long will they work?
- Once wetted, do they stay wet?
- Does installation create preferential flow paths?
- Can true moisture content be measured, or only relative moisture content?
- Are they economical?
- Can wireless measurement be implemented?