FLORIDA BIOREACTOR DEMONSTRATION PROJECT: Design and Construction Experiences

Debra R. Reinhart, Timothy G. Townsend, Philip T. McCreanor

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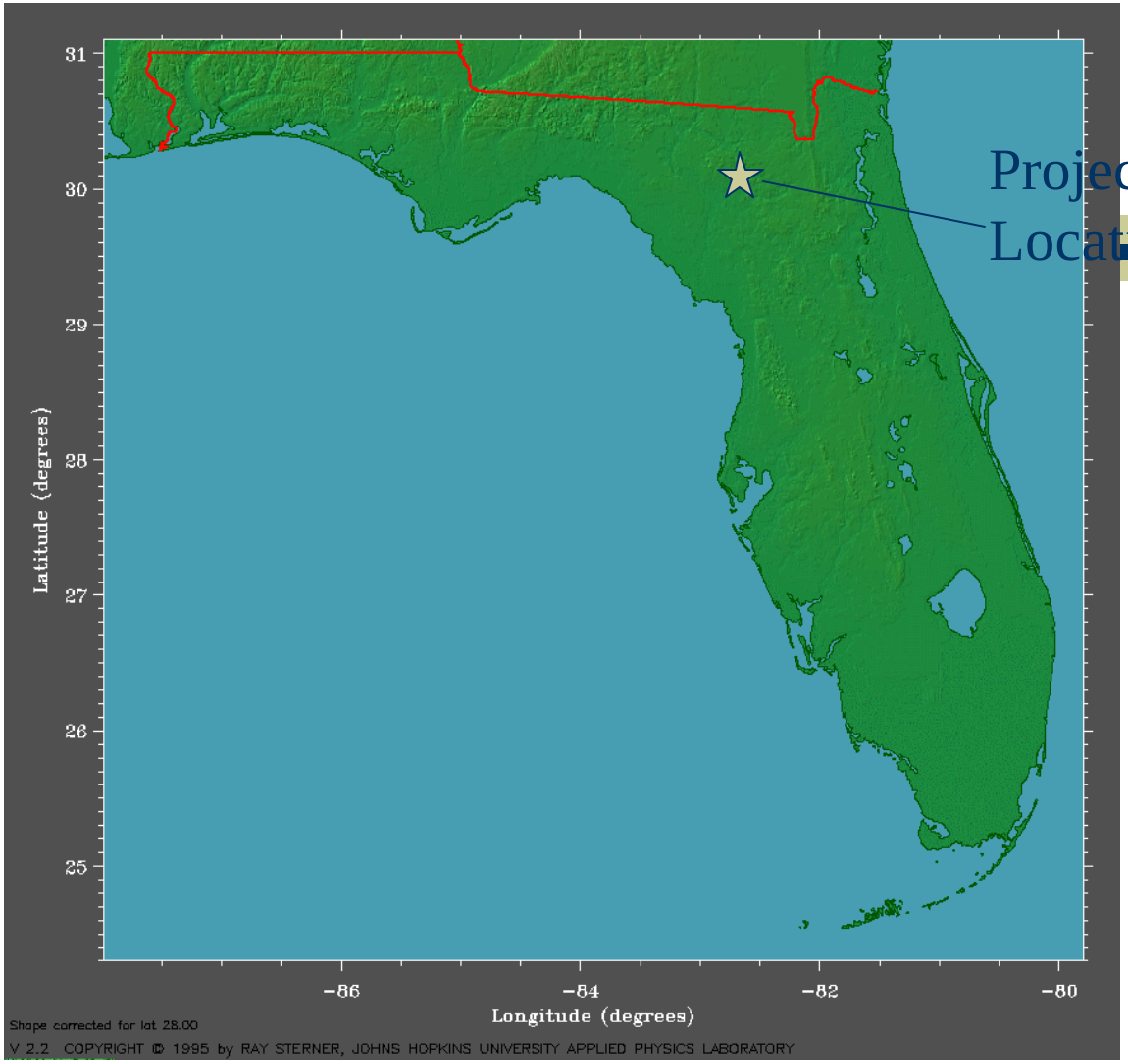
Project Objectives

- Demonstrate the full-scale use of bioreactor technology
- Evaluate aerobic bioreactor technology
- Compare aerobic and anaerobic processes
- Control and measure all inputs and outputs


Project Location
31
30
29
28
27
26
25
Latitude (degrees)
-86
-84
-82
-80
Longitude (degrees)
Shape corrected for lat 28.00
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Florida

BIOREACTOR LANDFILL DEMONSTRATION PROJECT

www.bioreactor.org

Moving Florida into the 21st Century:
a cooperative bioreactor landfill project that will demonstrate the efficient mass treatment of municipal solid waste.
For more information, please visit our website.

OWNER

New River Solid Waste Association

SPONSOR

Florida

CONTRACTOR

National Piping & Construction

RESEARCHERS

University of Florida

Florida Engineering

University of Central Florida

OTHER CONTRIBUTORS

GSE

ENGINEERS

Darabi and Associates, Inc.
Environmental Consultants

Jones Edmunds & Associates, Inc.

JEA

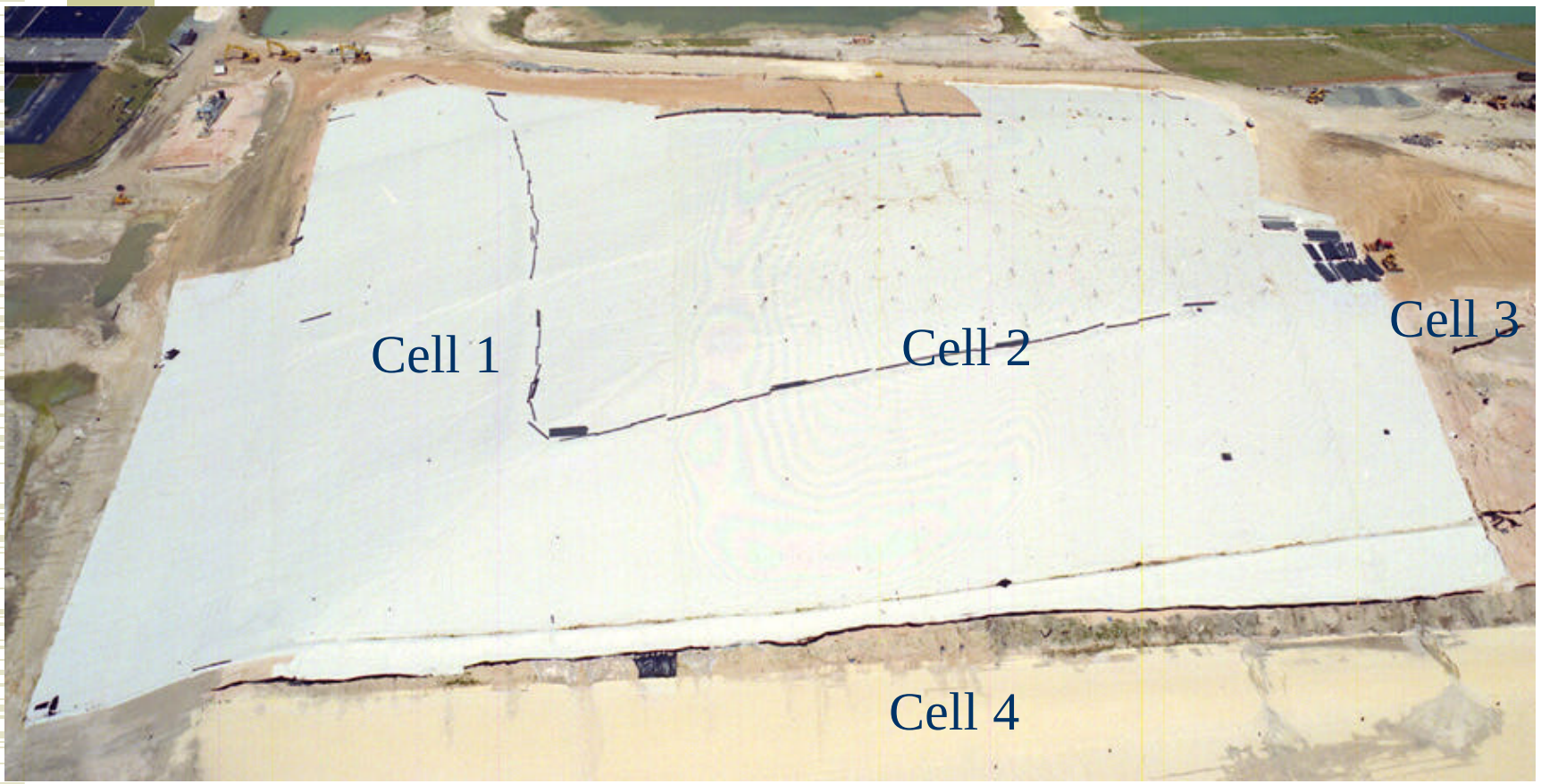
PROJECT MANAGER

Florida Center for Solid & Hazardous Waste Management

Florida Bioreactor

- New River Regional Landfill serving 5 counties, approximately 800 tons/day
- 46 lined acres, up to 75 ft in height
- Bioreactor ~ 10 acres
  - 576,000 yd^3, ~ 287,800 tons of waste
  - Construction cost $2,174,798
  - Design cost $639,887

NRRL Bioreactor Construction Aerial – View to North



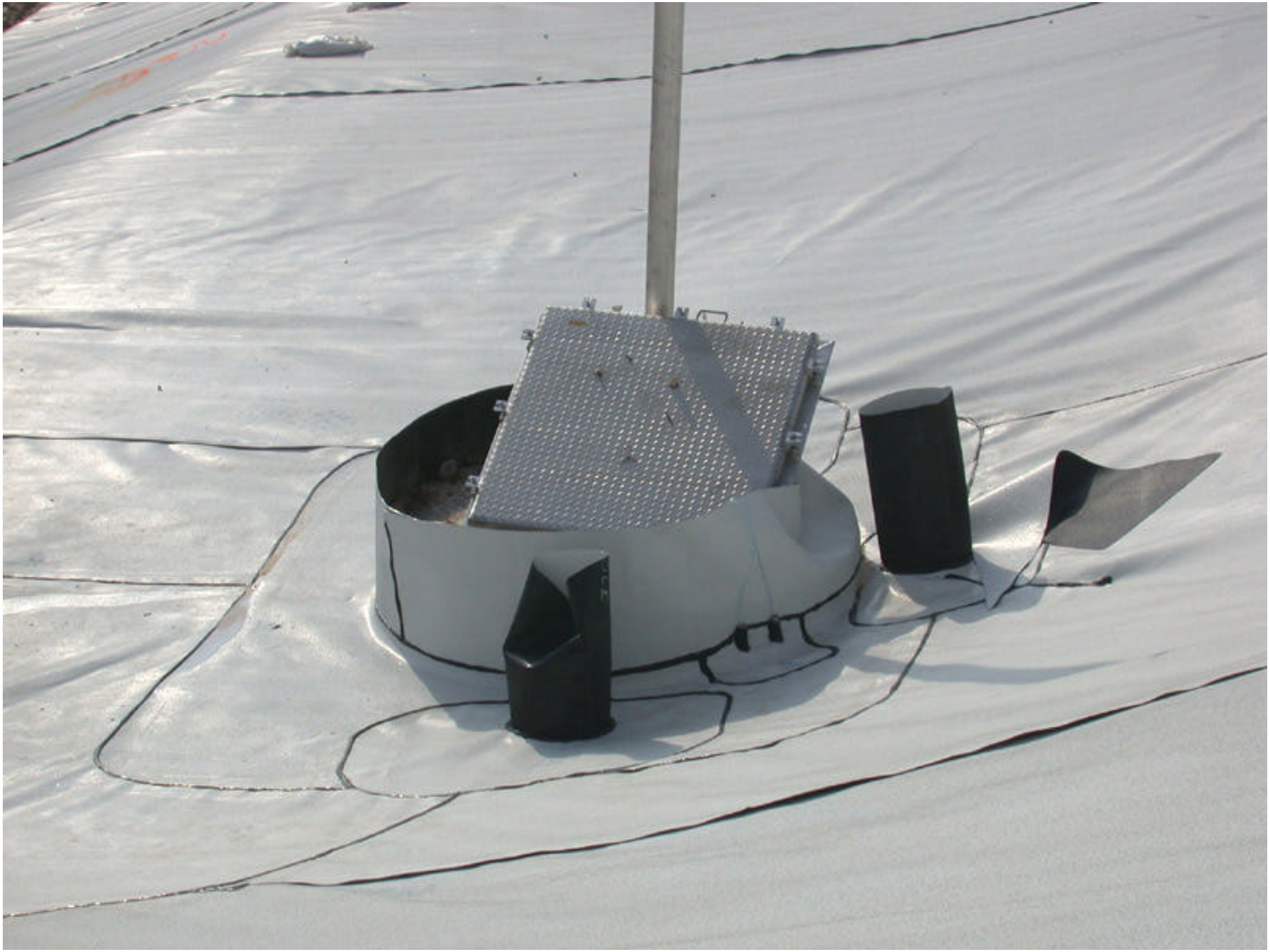
March 24, 2002

Unique Design/Construction Issues

- Leachate isolation and flow measurement
- Air introduction
- Liquid addition
- Exposed membrane cap
- Settlement accommodation
- Gas extraction

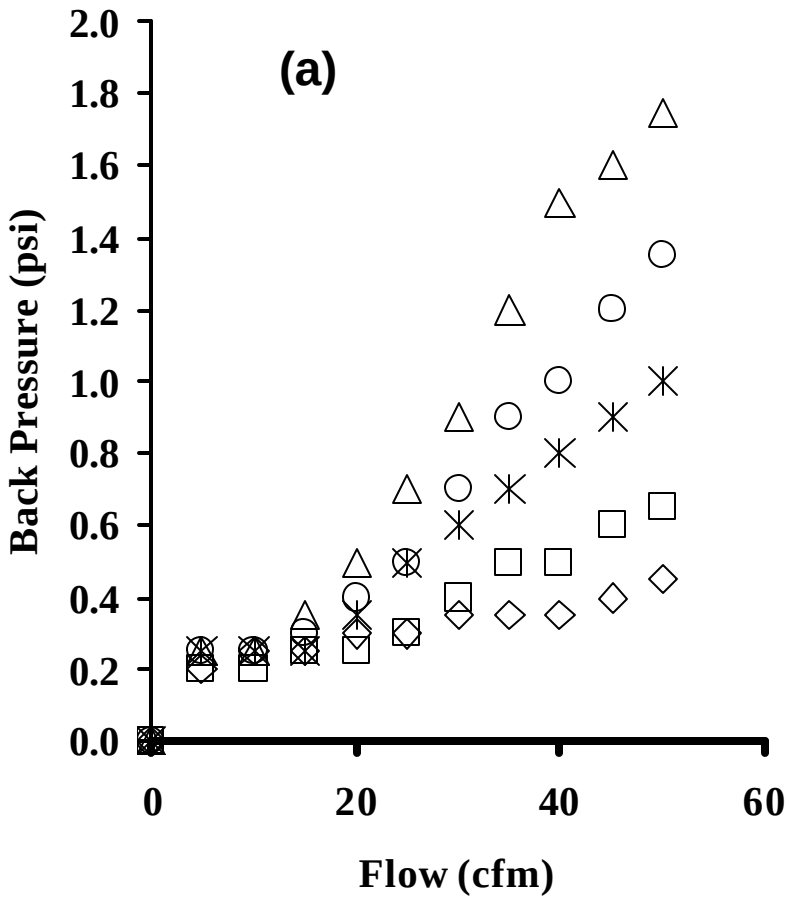
Leachate Isolation and Flow Measurement

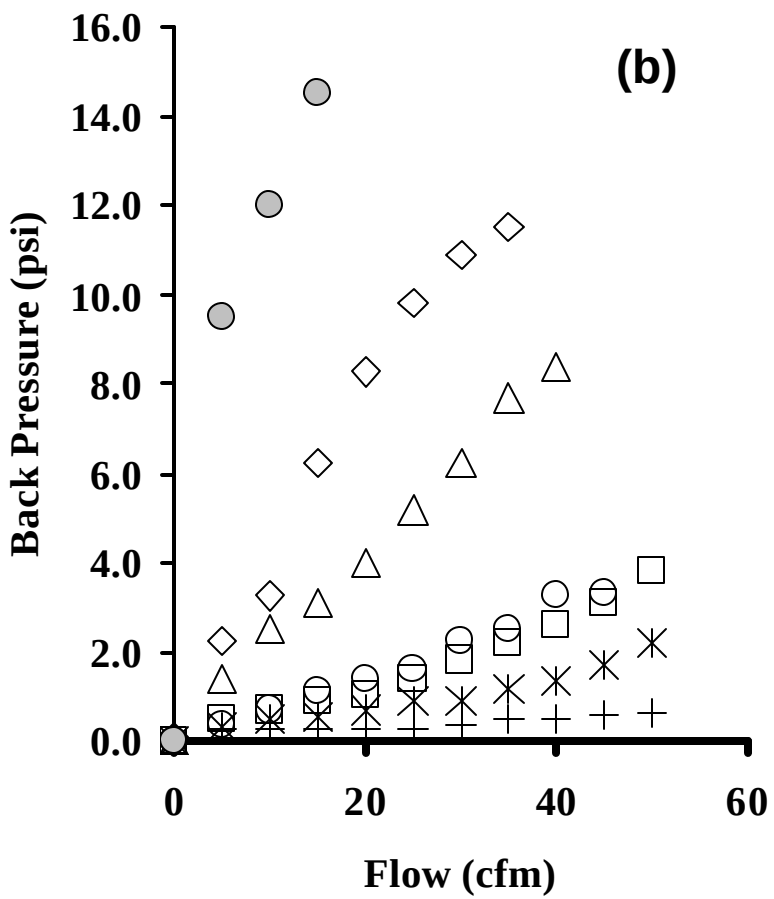
- 9 leachate collection lines isolated via manhole modification
- Ultrasound level measurement and v-notch weir
- Tied to gas collection system



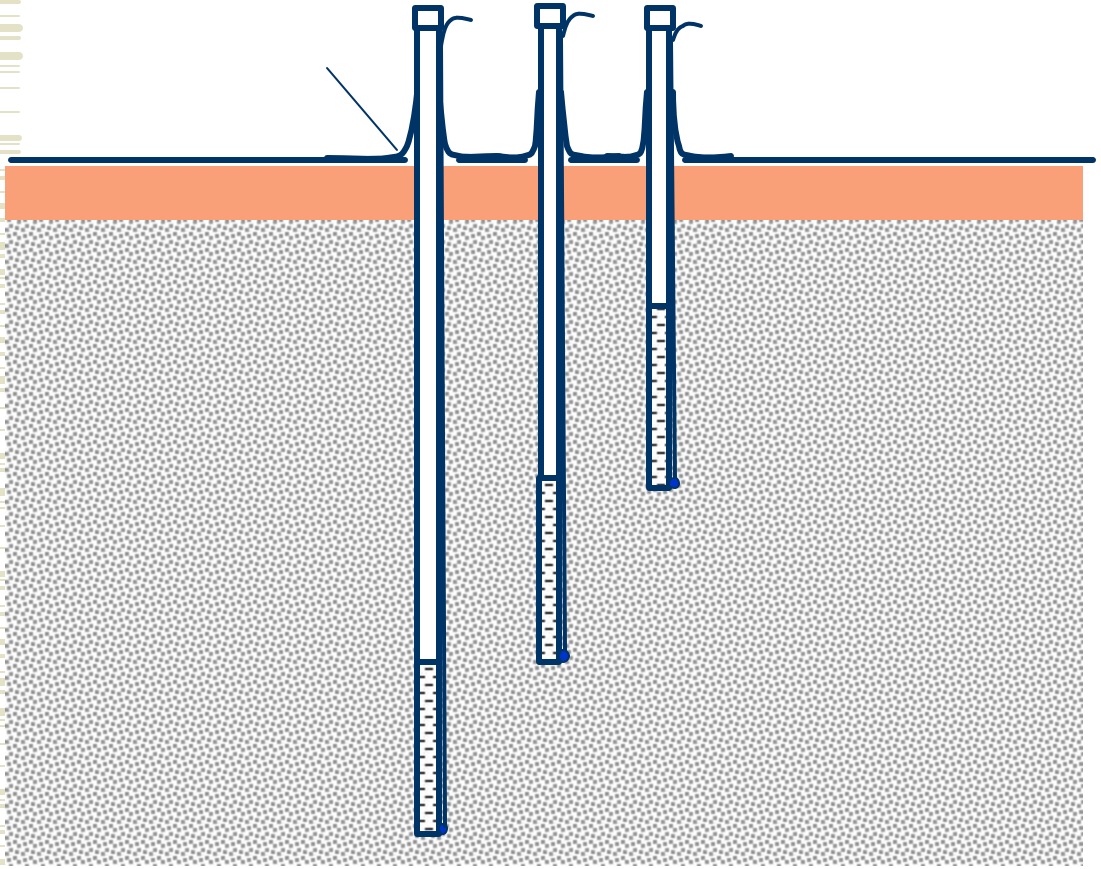
Air/Water Injection

- Aerobic
  - 25% of bioreactor (2.5 acres)
  - 1550 scfm of air
  - 2350 gpd water
- Anaerobic
  - 4860 gpd water
- Requires supplemental moisture


(a)
Back Pressure (psi)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
Flow (cfm)

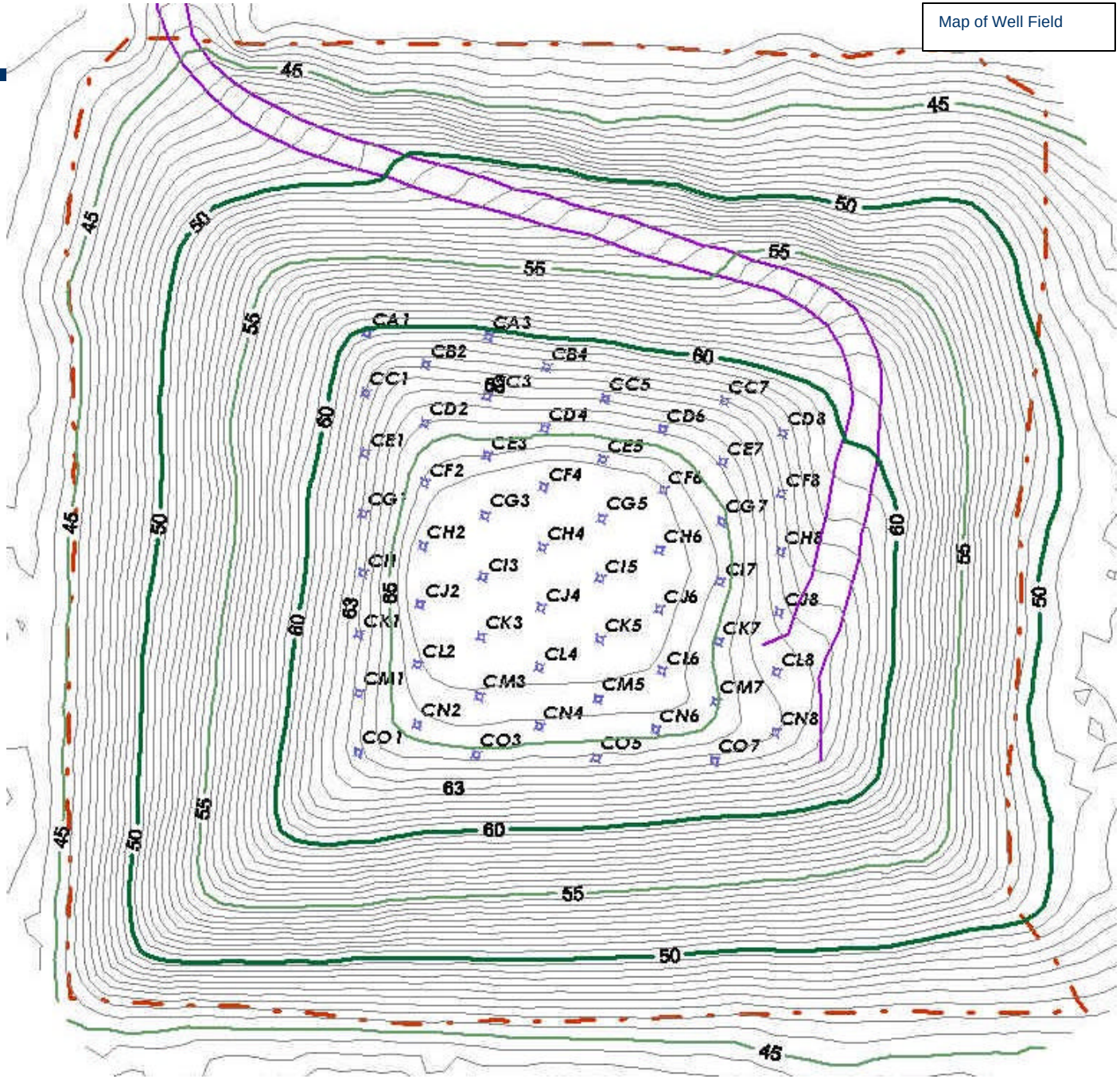

(b)
Back Pressure (psi)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
20
40
60
Flow (cfm)

Air, Water, and Leachate Injection Wells



Installing a well.

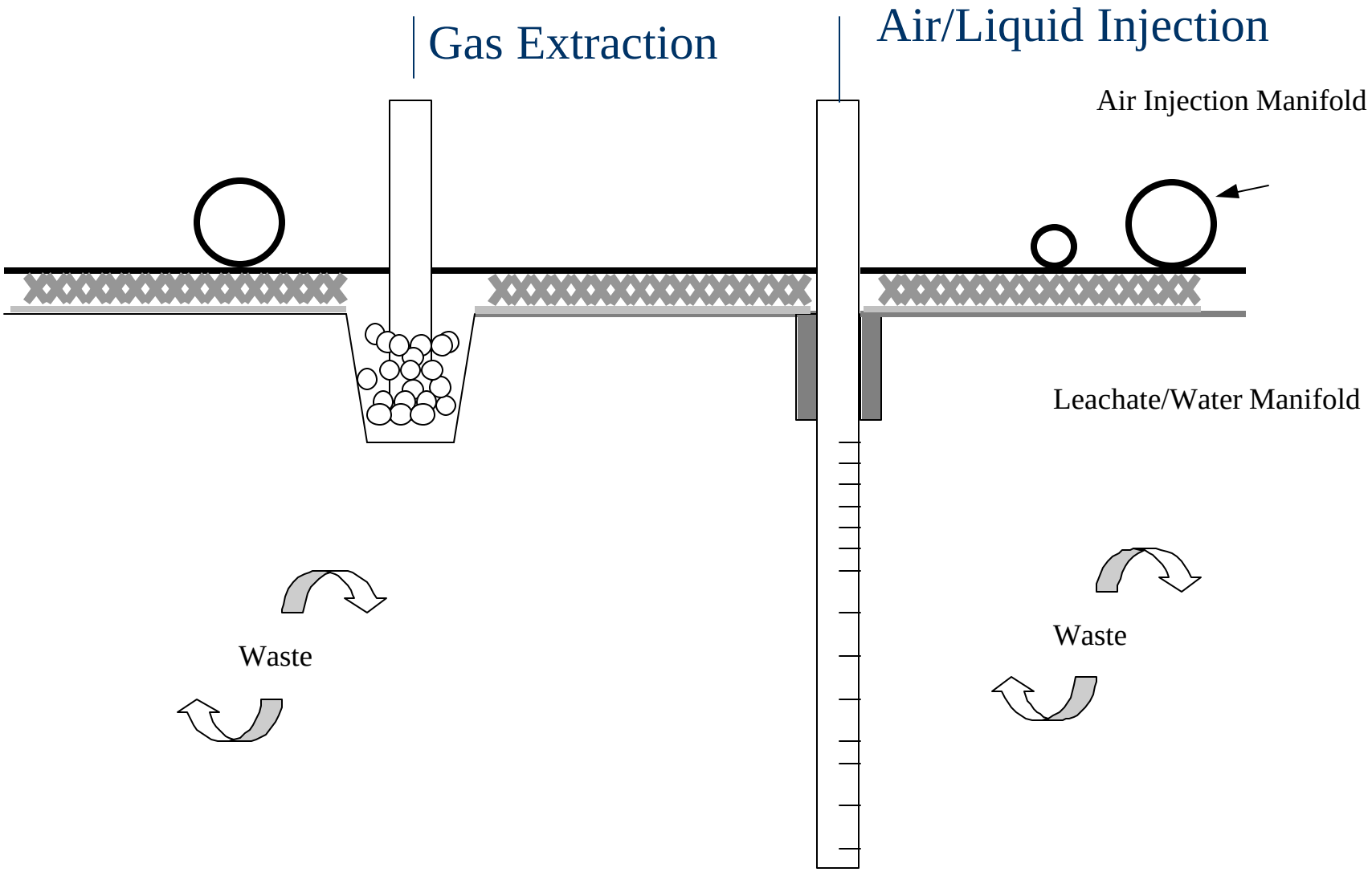
Cluster Well Locations with Labels



Blowers/Gas Extraction

Exposed Membrane Cap

- Objectives
  - Complete capture of gas
  - Control of moisture addition
  - Control of side seeps
  - Evaluate gas composition
- Issues
  - Ballooning of cap
  - Buildup of Explosive gases
  - Heat buildup
  - Cap penetrations/tiedown


Gas Extraction
Air/Liquid Injection
Air Injection Manifold
Leachate/Water Manifold
Waste
Waste

Deploying Geomembrane

As soon as geomembrane is pulled over wells, location is marked.

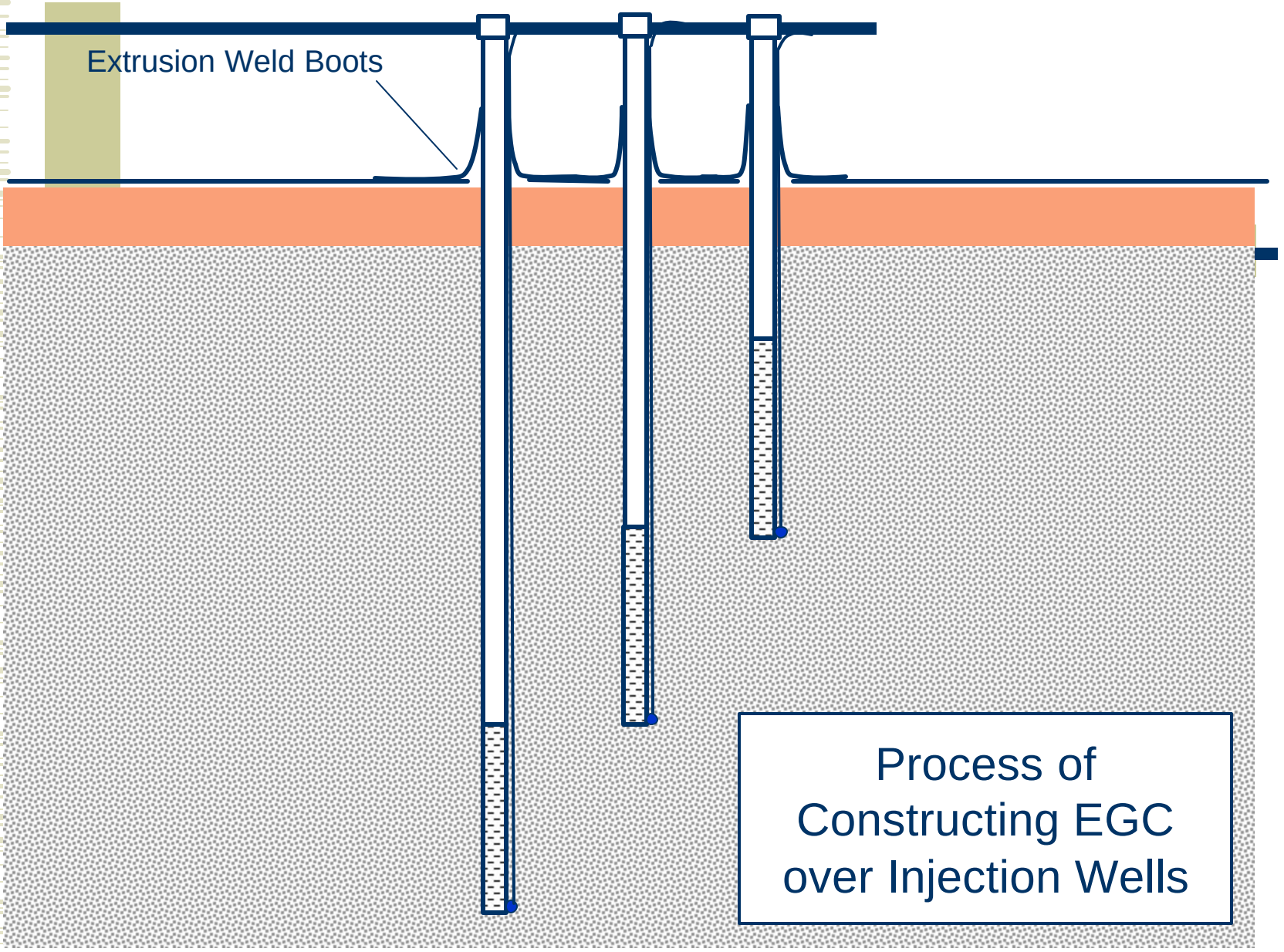
At a later time, the geomembrane is cut around well.

Fusion Welder

Geomembrane rolls are fusion welded together with a double hot wedge weld.

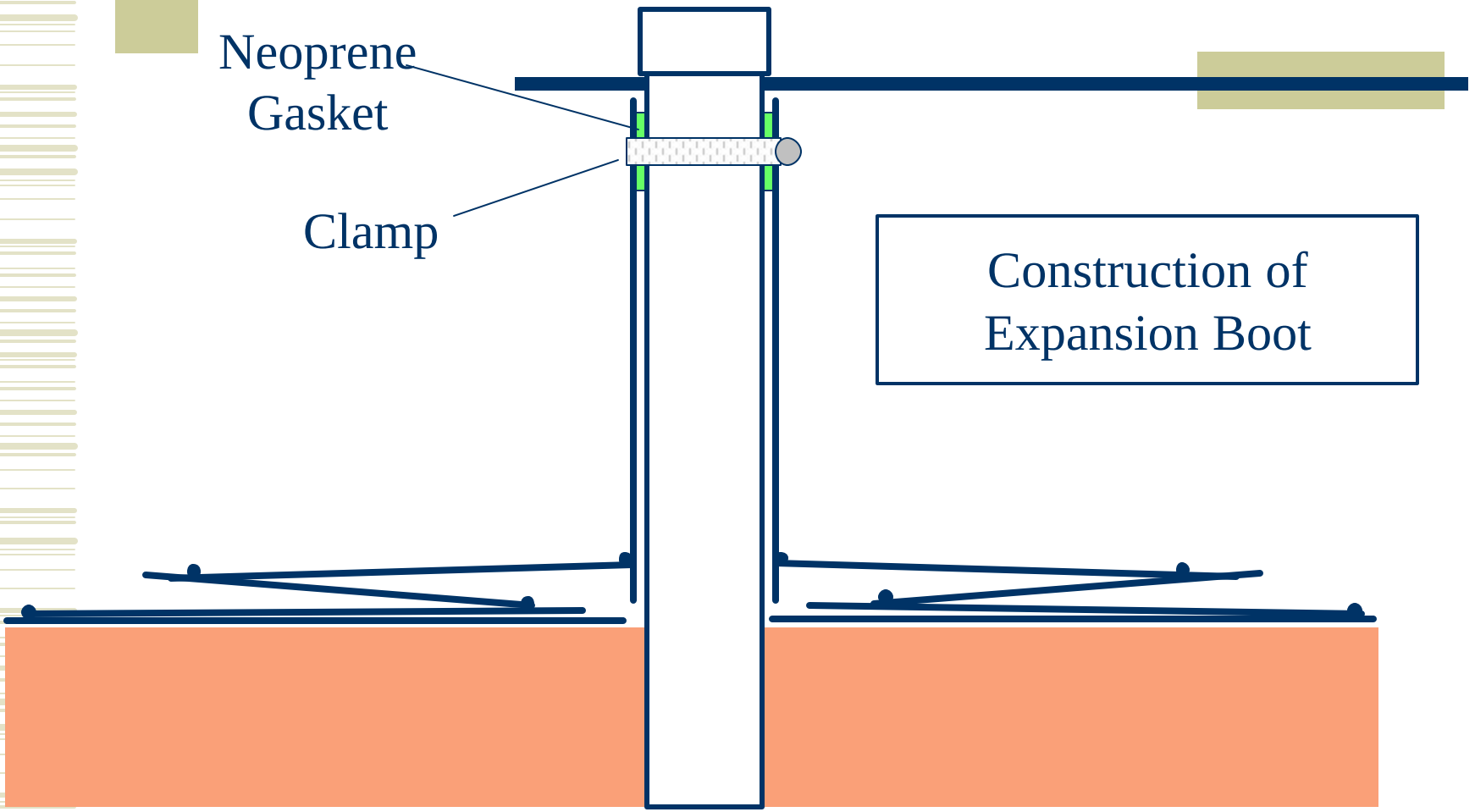
Cap – Anchor Trench

Cap Penetrations


Extrusion Weld Boots
Process of Constructing EGC over Injection Wells

West Side Toe Drain

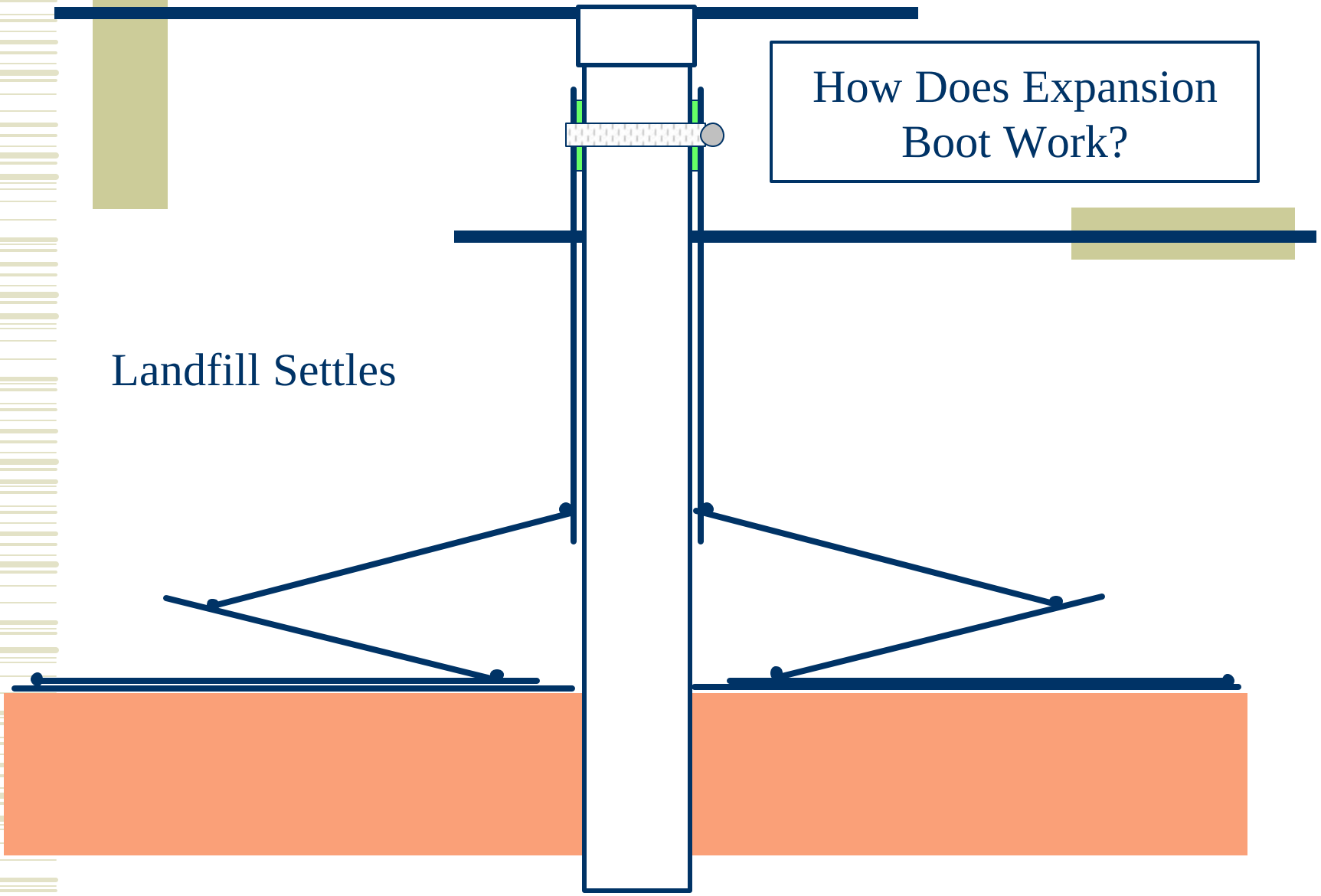
Settlement Issues



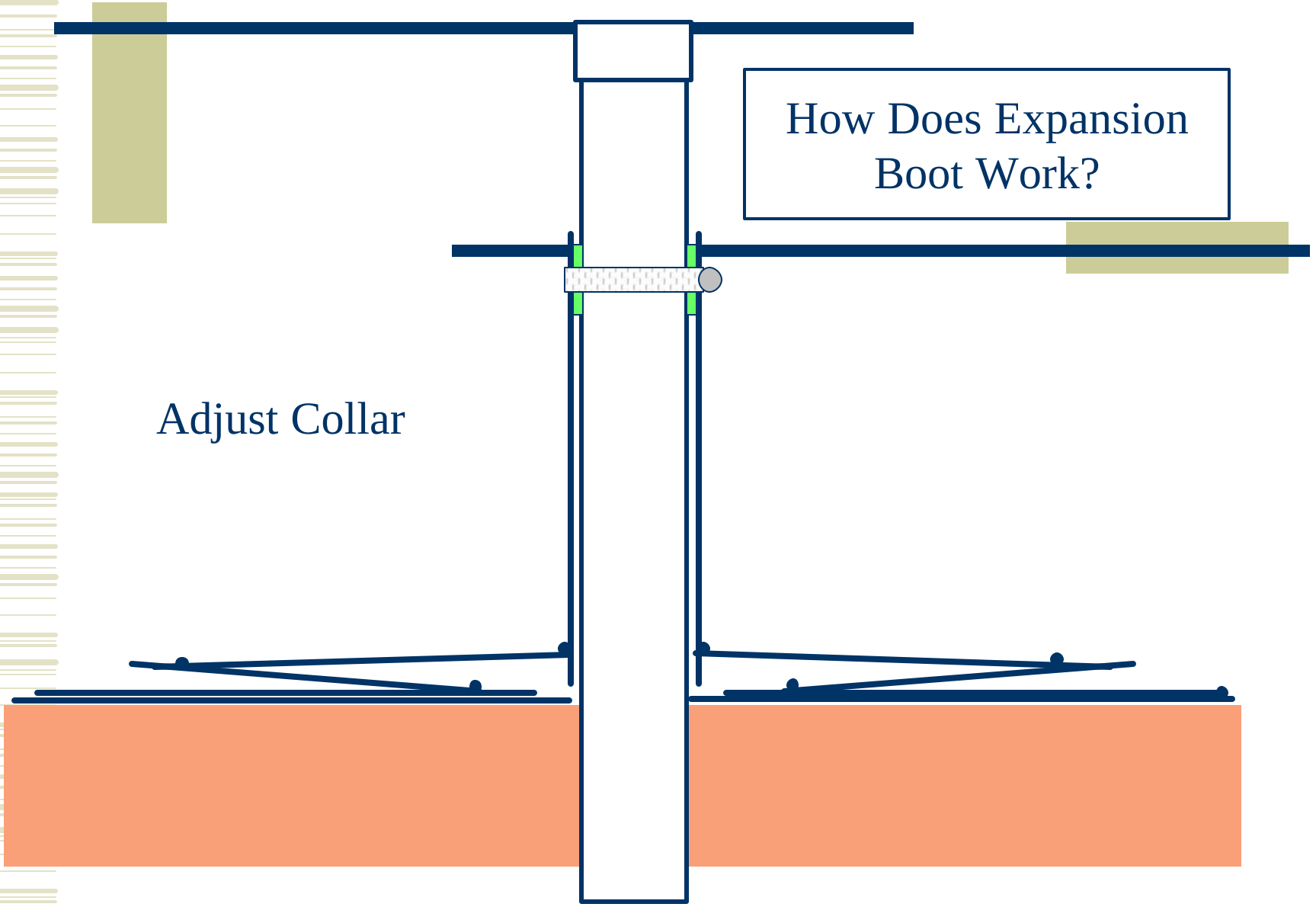
Construction of
Expansion Boot

How Does Expansion Boot Work?

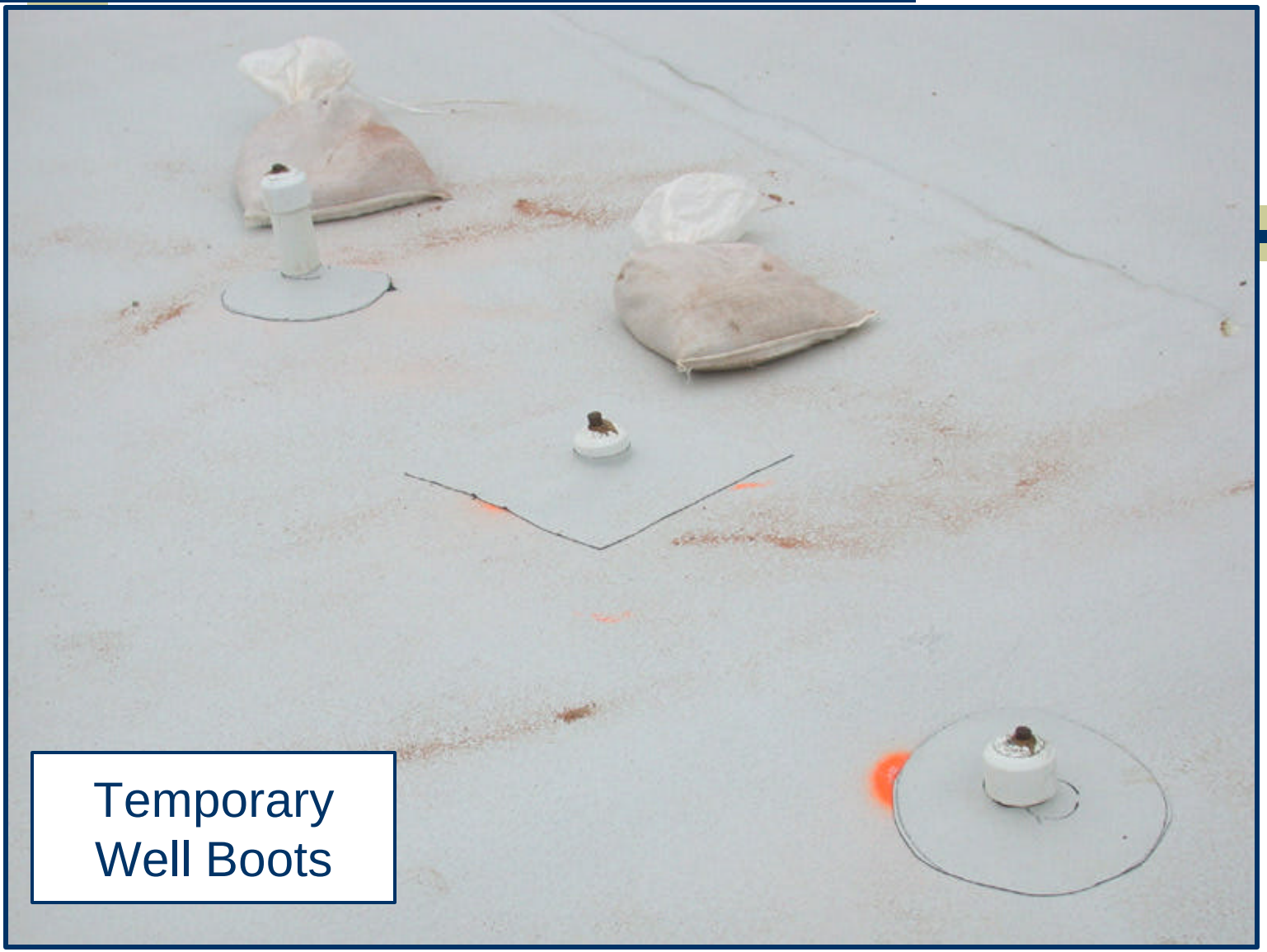
Landfill Settles



How Does Expansion Boot Work?



Prefabricated Well Boots


Temporary
Well Boots

Permanent Well Expansion Boots

Gas Collection

West Slope:
Intersection of Toe Drain and Gas Collector

Skid-Mounted Gas System

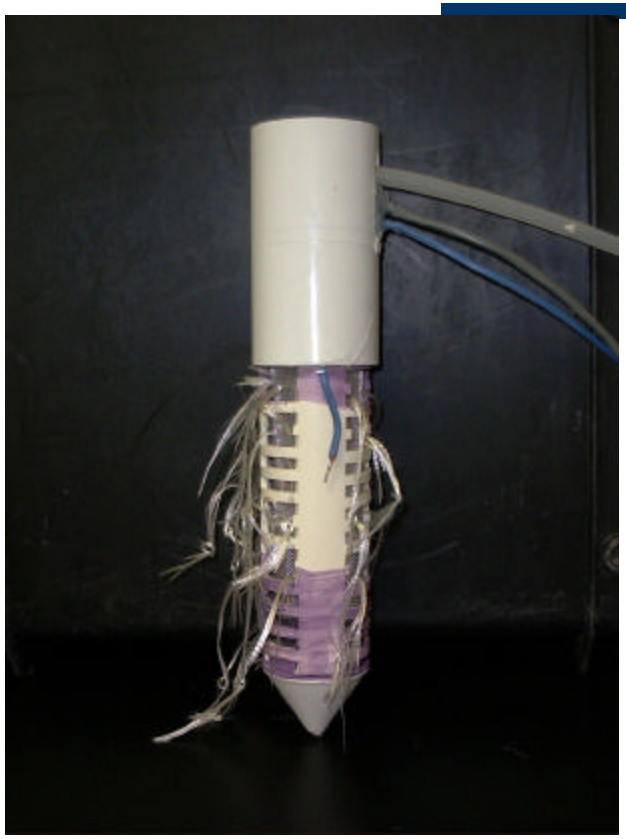
Operating Issues

- Special Permit Requirements
  - Operations Plan
  - Reporting
  - Limits on recirculation
    - First 250 days (to achieve field capacity) – 35,040 gpd
    - After field capacity maximum design flow 6395 gpd
  - Side slope monitoring of pore pressures
  - Initial daily monitoring of temperature, O_2, CH_4
  - Monitoring and response to potentially explosive conditions

Bioreactor Monitoring

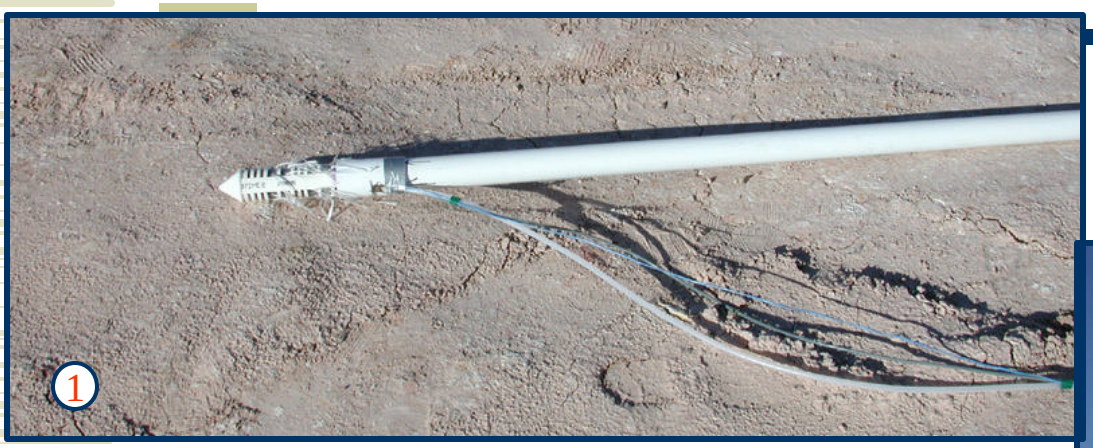
- In Situ Moisture Content
- In Situ Temperature
- Leachate and Gas Quantity and Quality
- Topography (GPS)

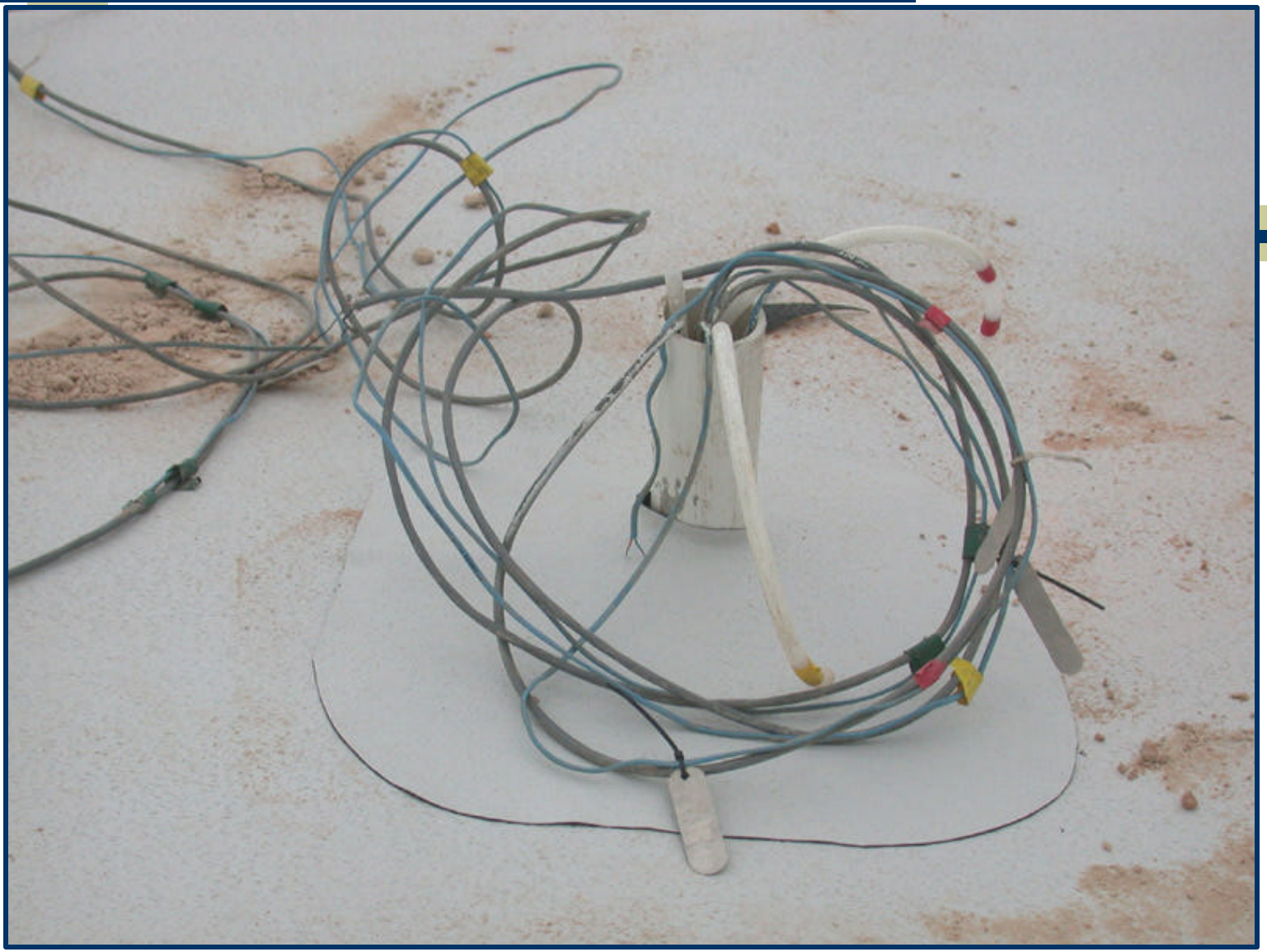
Features of the MTG sensor



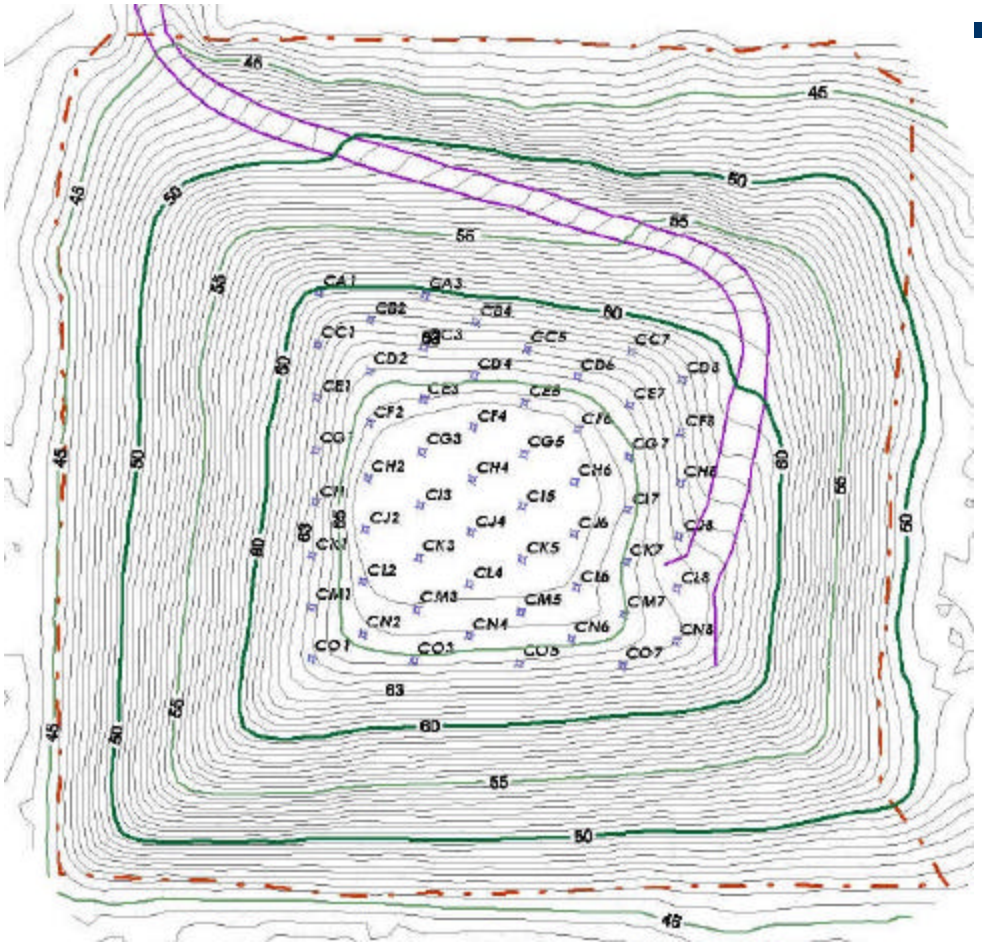
- Granular matrix resistance sensor.
- Incorporates thermocouple and gas sampling tube.
- Glass fiber wicks for enhancing moisture transfer.

Installation of MTG Sensors



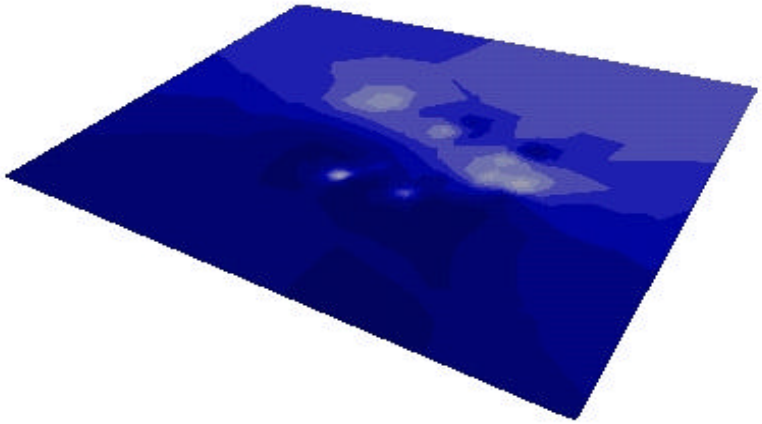


Instrumentation and Injection Wells



Moisture Distribution in landfill

Bottom Moisture Level

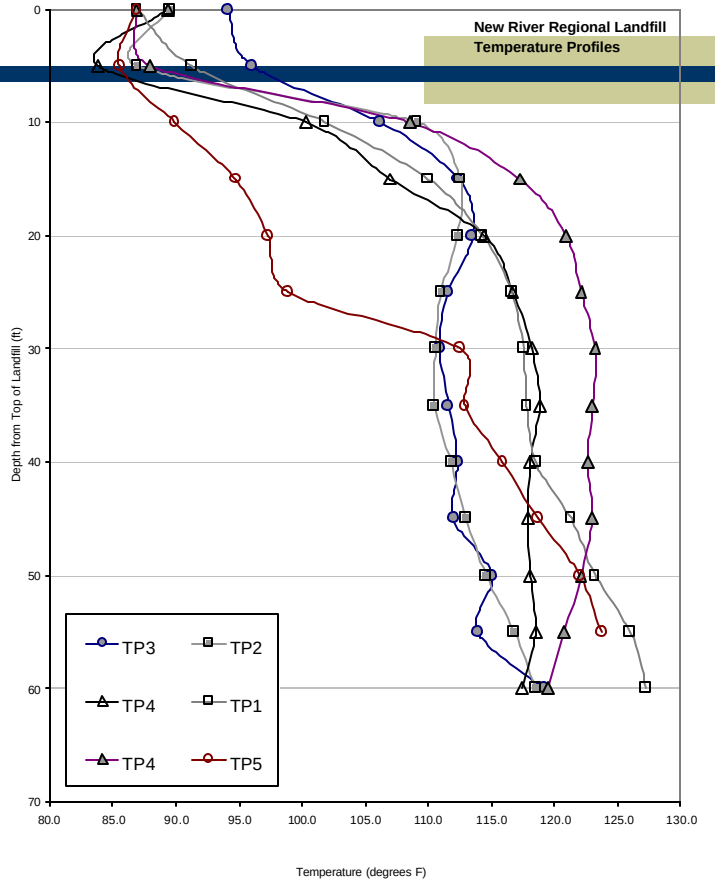


Legend

- 21.3 - 26.8
- 26.8 - 32.3
- 32.3 - 37.7
- 37.7 - 43.2
- 43.2 - 48.7
- 48.7 - 54.1
- 54.1 - 59.6
- 59.6 - 65.1
- 65.1 - 70.5

Temperature Measurements

Thermocouple profile well near anchor trench



Example of T-Profile Well Results

Global Positioning System

Web site

www.bioreactor.org