

WELCOME!

**Welcome to DES
&
to Today's Workshop
“Groundwater Basics, Landfill
Monitoring & Case Histories”**

WHY ARE YOU HERE?

- **Required by law and NH Solid Waste Rules.**
- **Build your resume & accumulate professional development hours.**

WHY THIS WORKSHOP?

- **From where do NH's citizens get their water?**
 - **60% rely on a well**
 - **25% rely on surface waters**
 - **15% use both**

DESKTOP MATERIALS & DISPLAYS

- **Agenda**
- **Evaluation**
- **BMP Manual**

TODAY'S AGENDA

- **Groundwater Basics**
- **Break and Demonstration**
- **MSW Unlined Landfill Case Study**
- **Landfill Monitoring Requirements**
- **SWOT Rule Changes**



Groundwater Basics

February 24, 2015

Paul Rydel, PG
New Hampshire Department of Environmental Services

Typical Solid Waste Transfer Station w/ Closed Unlined Landfill



Groundwater Monitoring Well



Definitions

Groundwater = water which occurs below the land surface (*saturated zone*).

Vadose Zone = zone between the land surface and the groundwater surface or water table (*unsaturated zone*).

Geology – study of the earth.

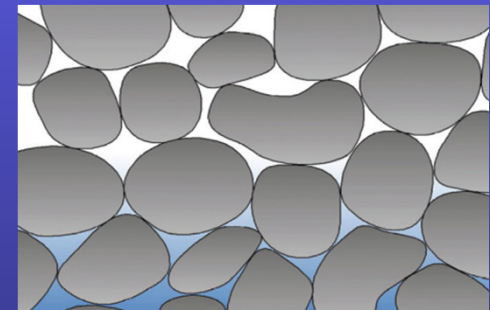
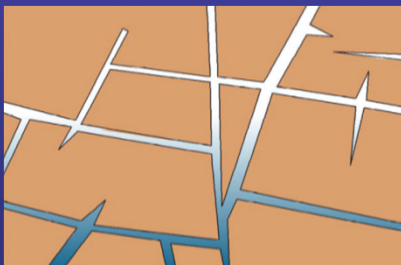
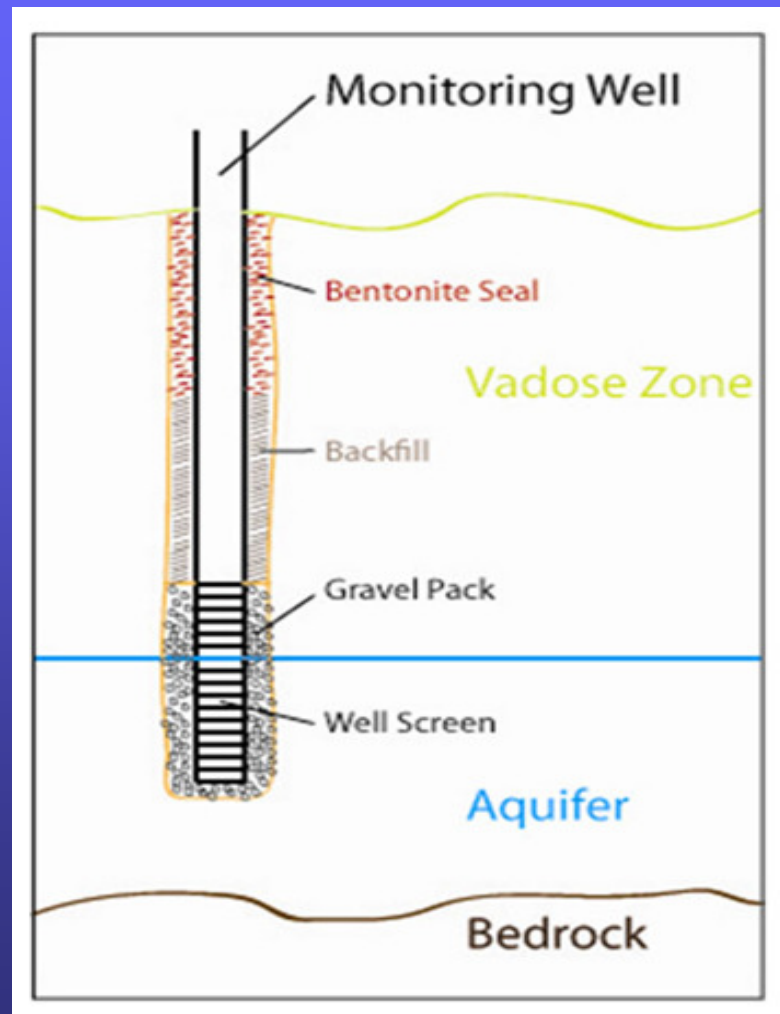
Hydrogeology – geology specific to water resources.

Aquifer – geologic material or unit (soil or bedrock) that yields groundwater to wells in usable quantities.

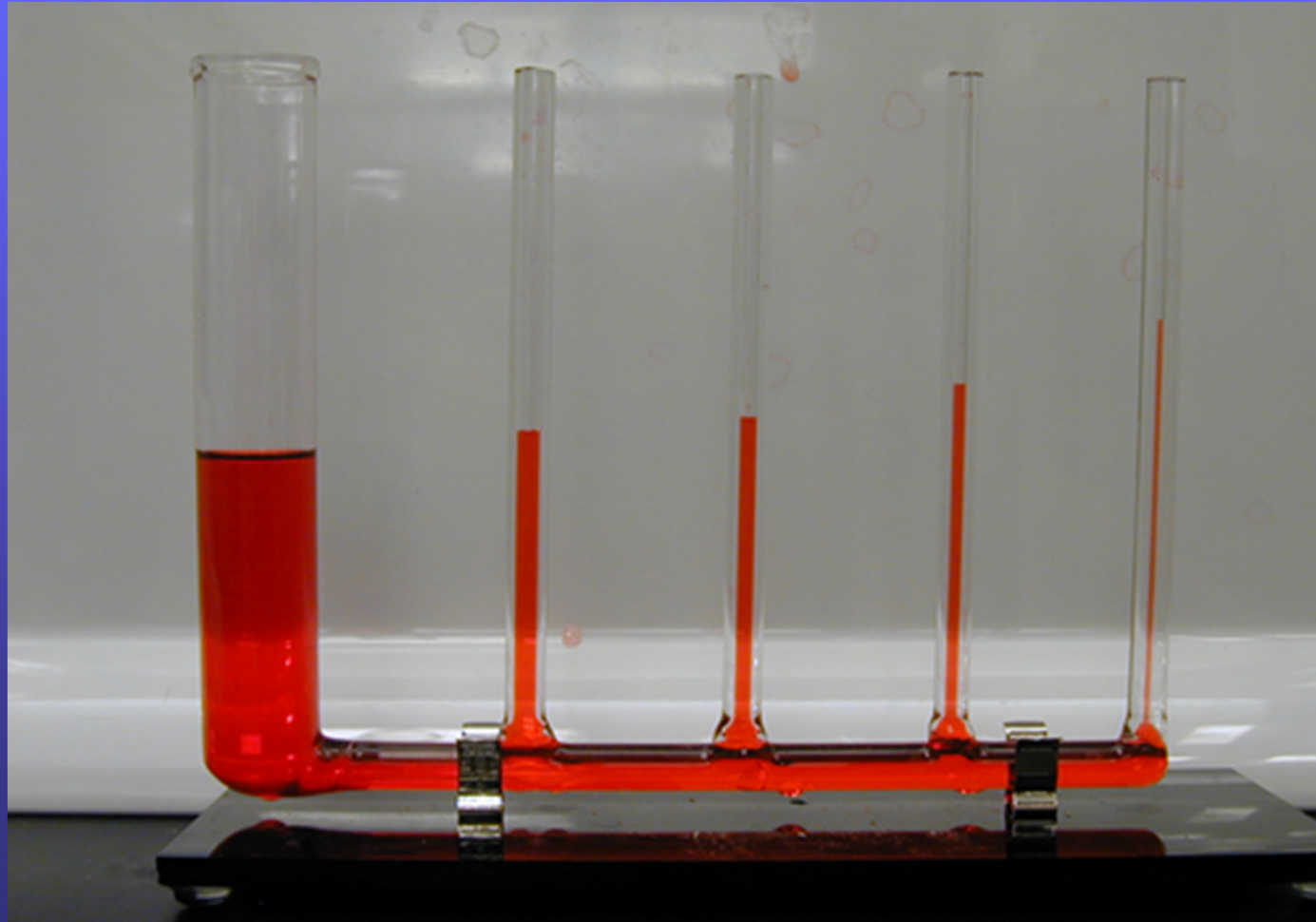
Drilling to Install Monitoring Well



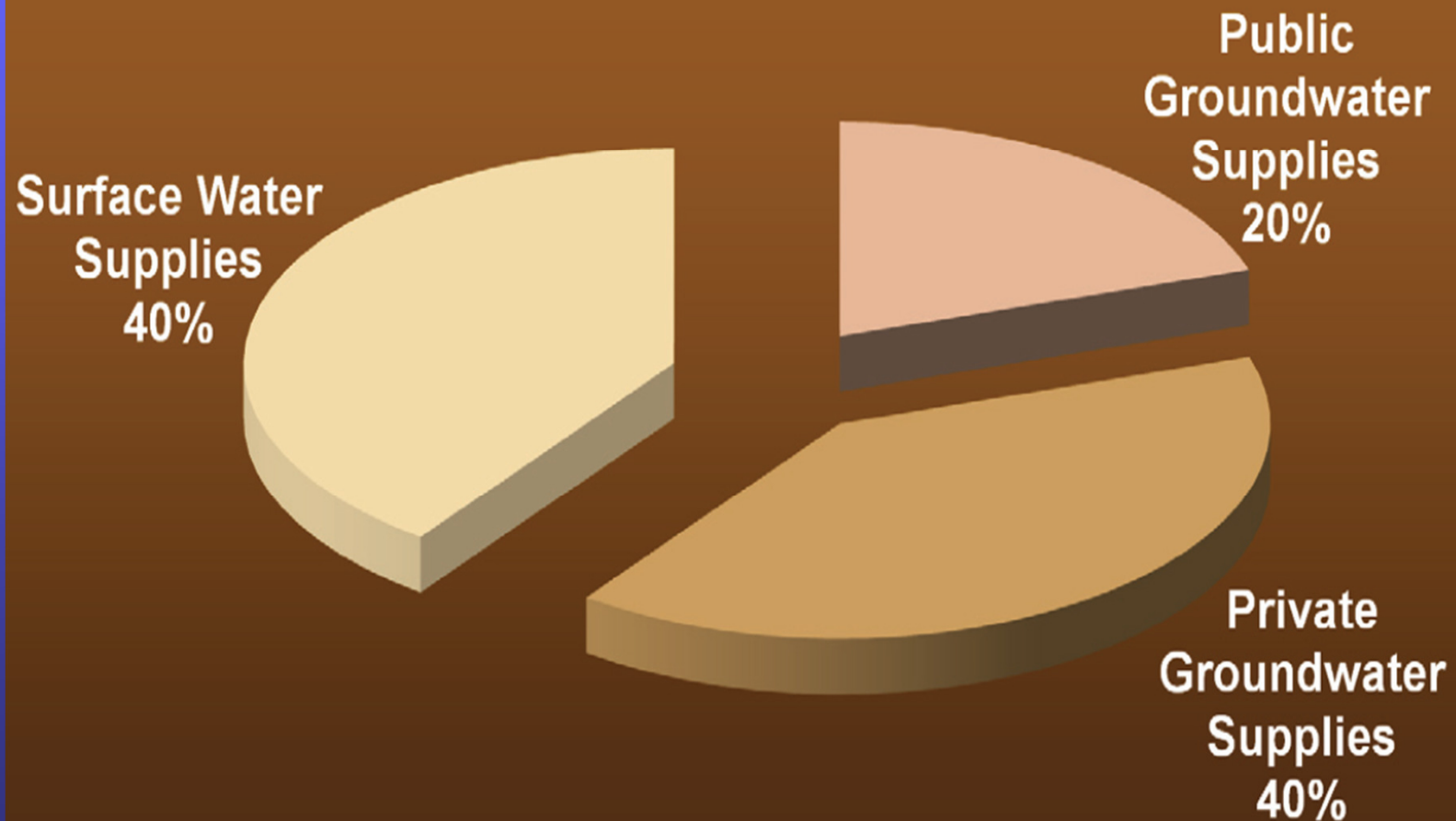
Monitoring Well Details

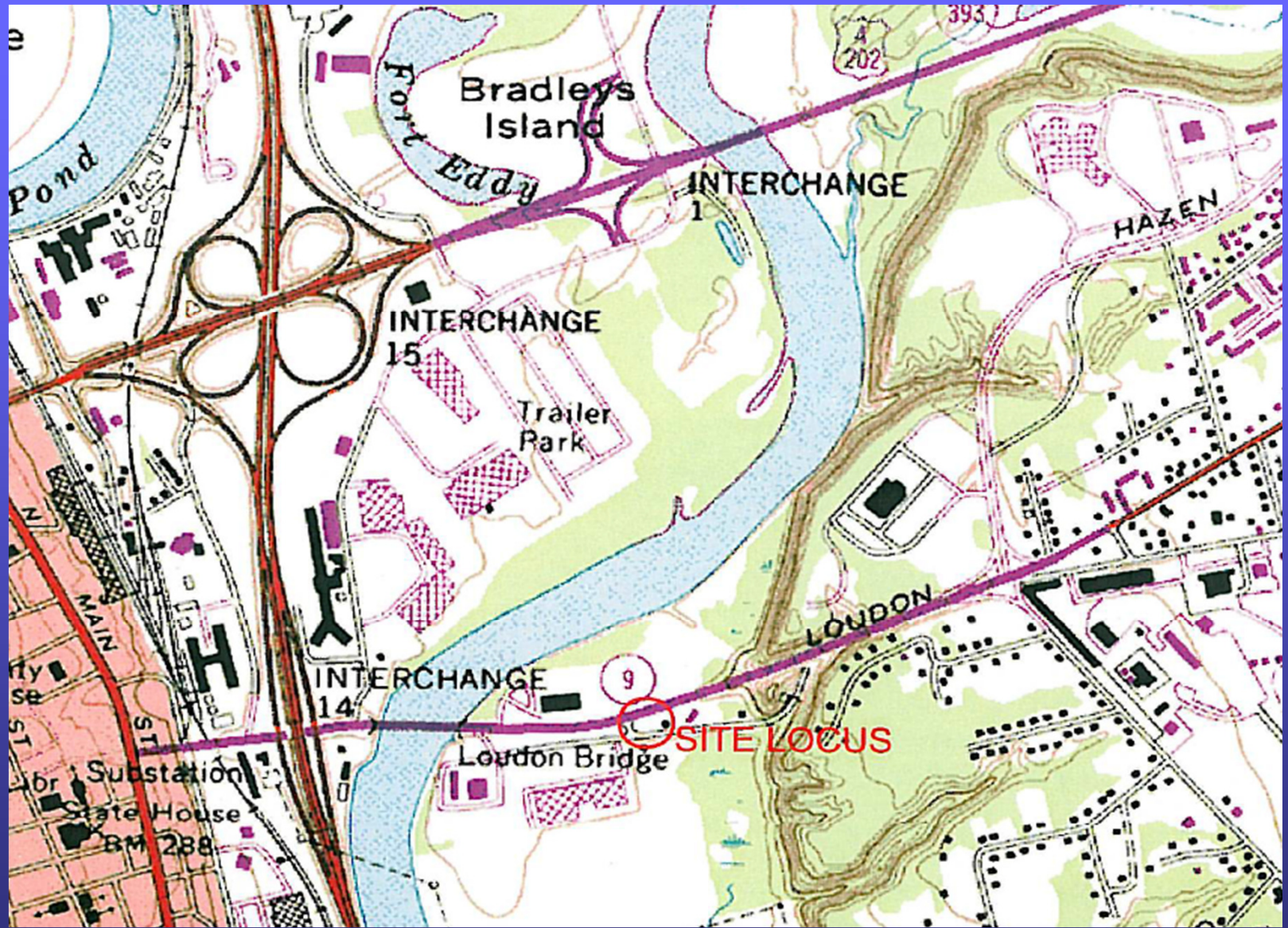


Capillary Fringe

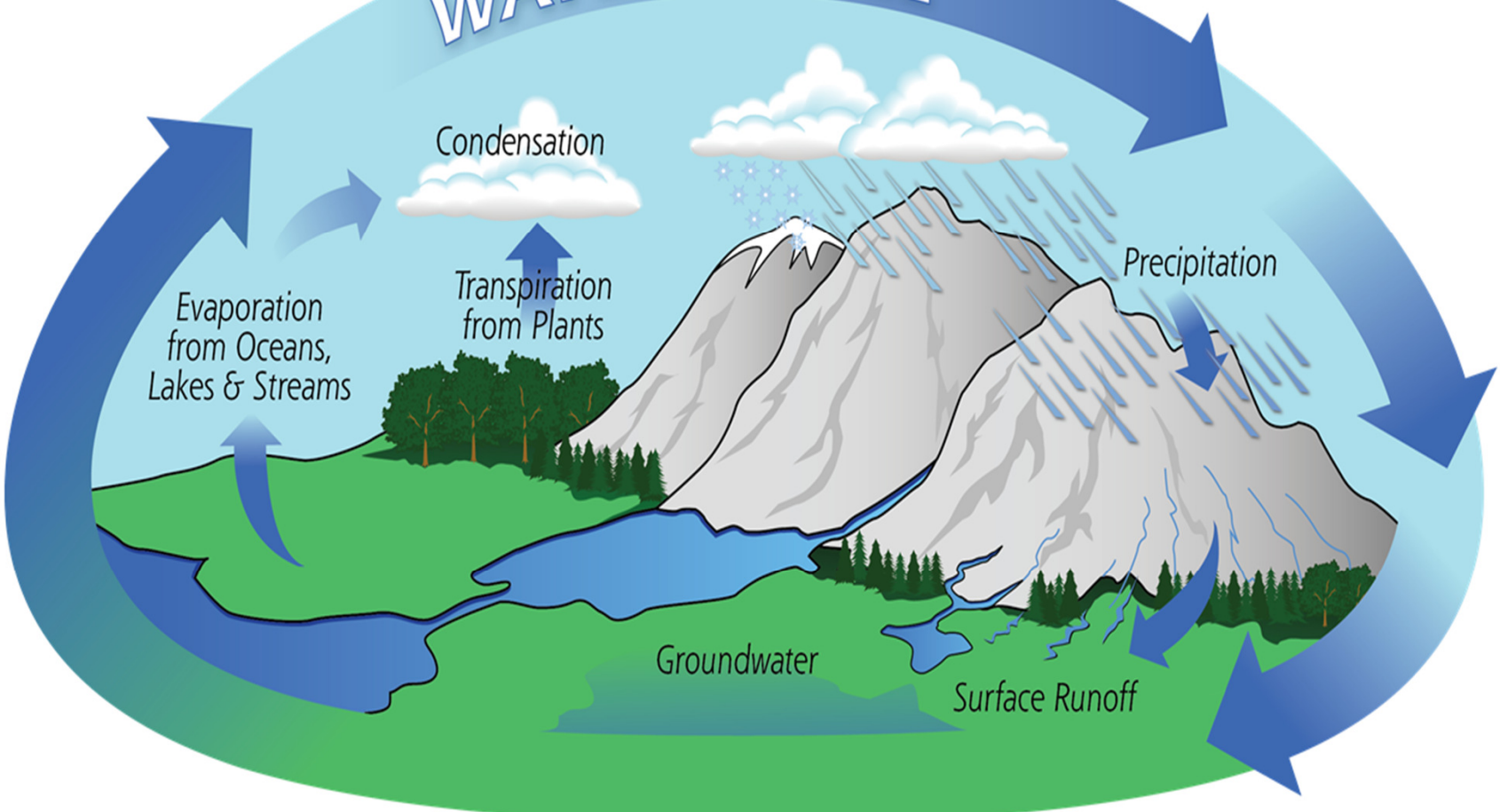


Sources of Drinking Water in New Hampshire





WATER CYCLE



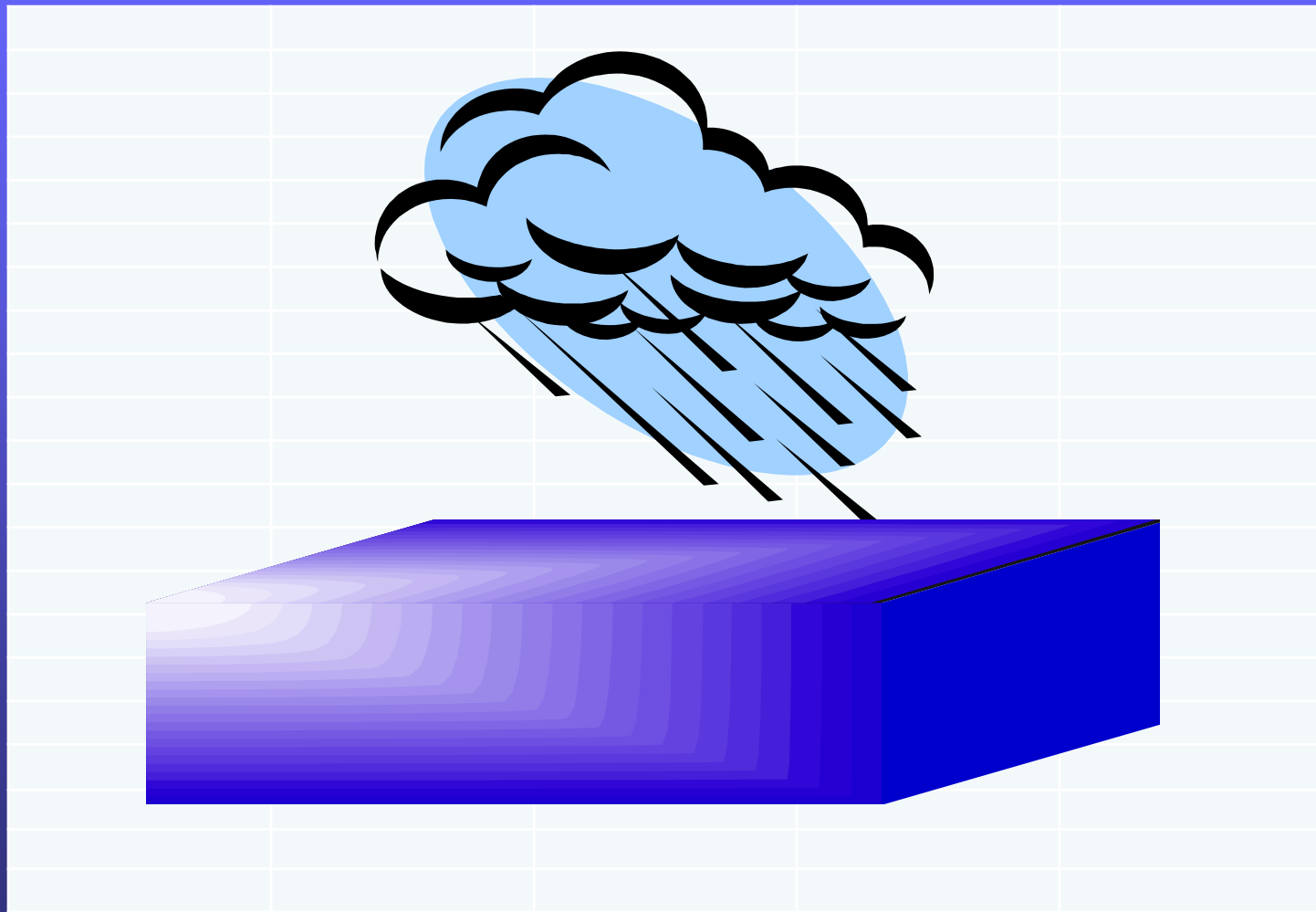
History of Solid Waste Disposal



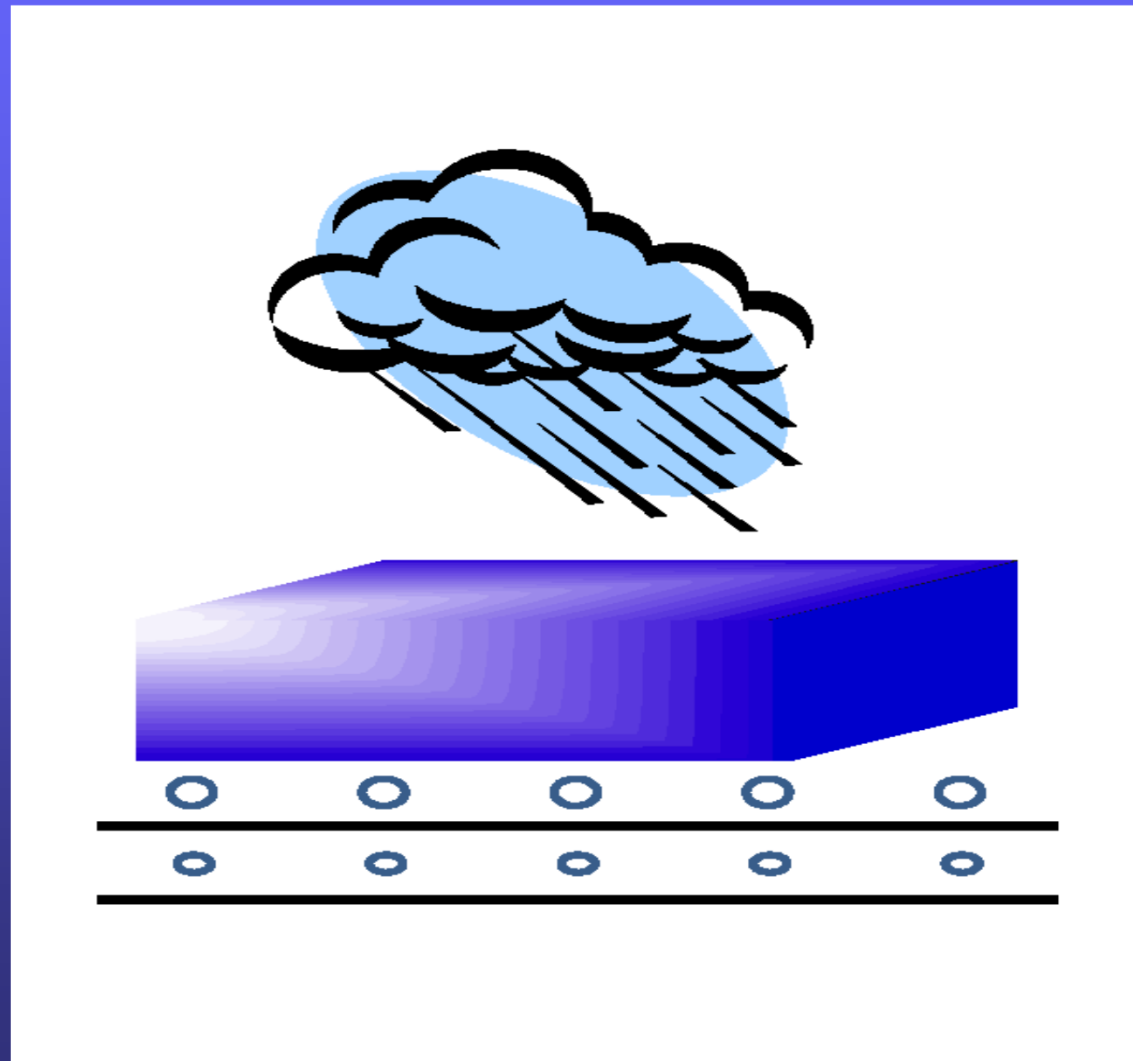
Sanitary Landfill



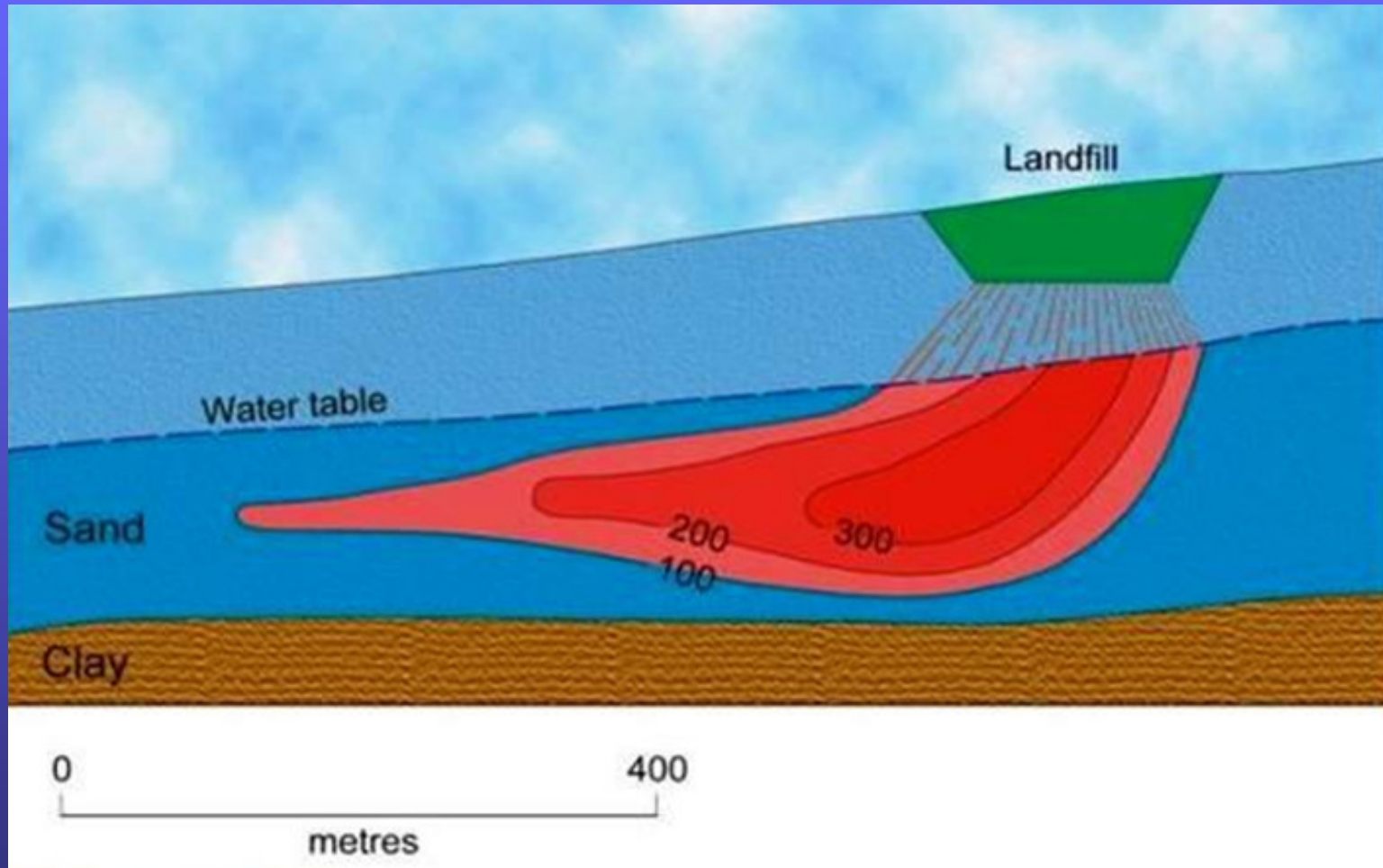
Unlined Landfill



Lined Landfill

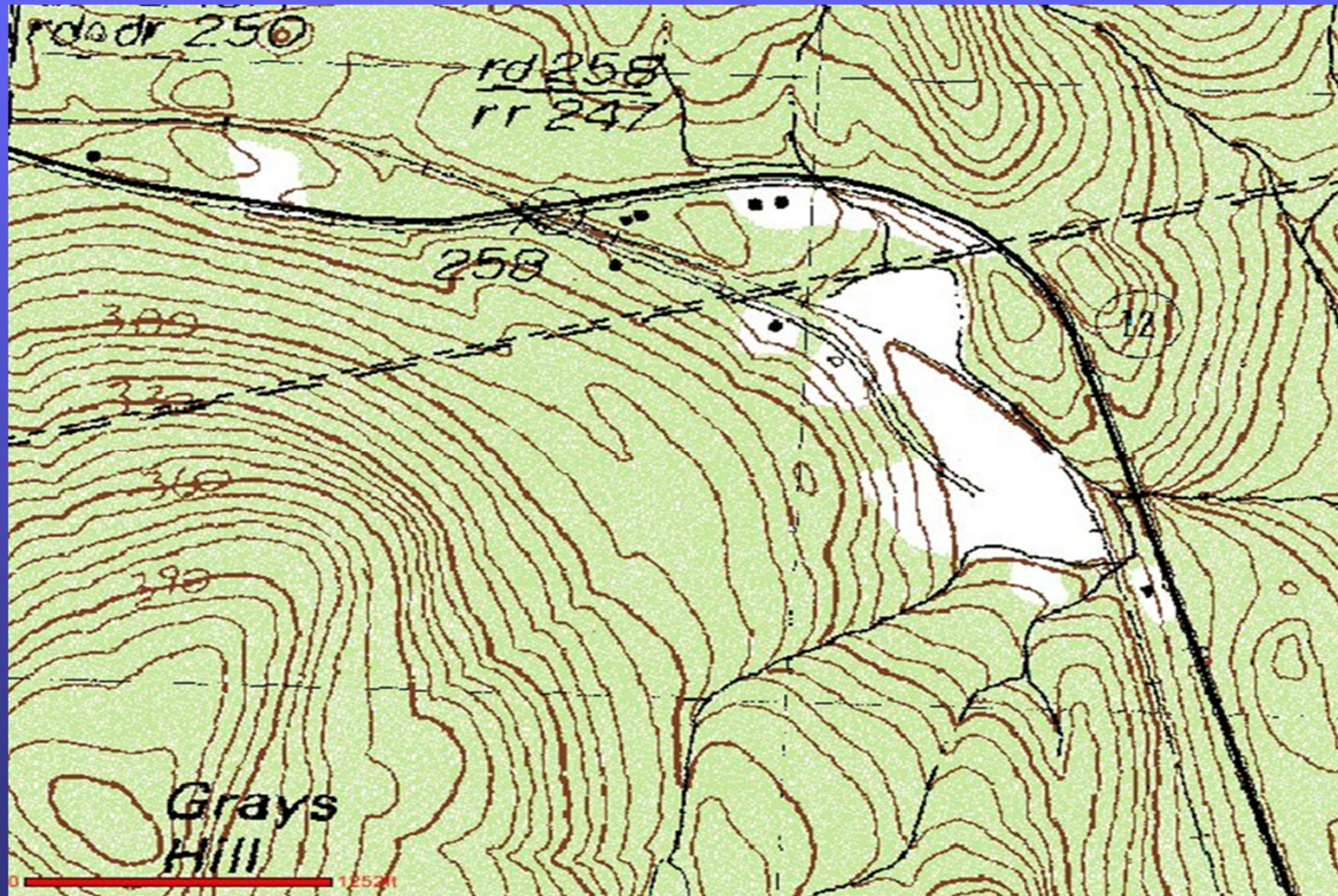


Groundwater Contamination





Unlined Landfill Monitoring



Unlined Landfill Monitoring

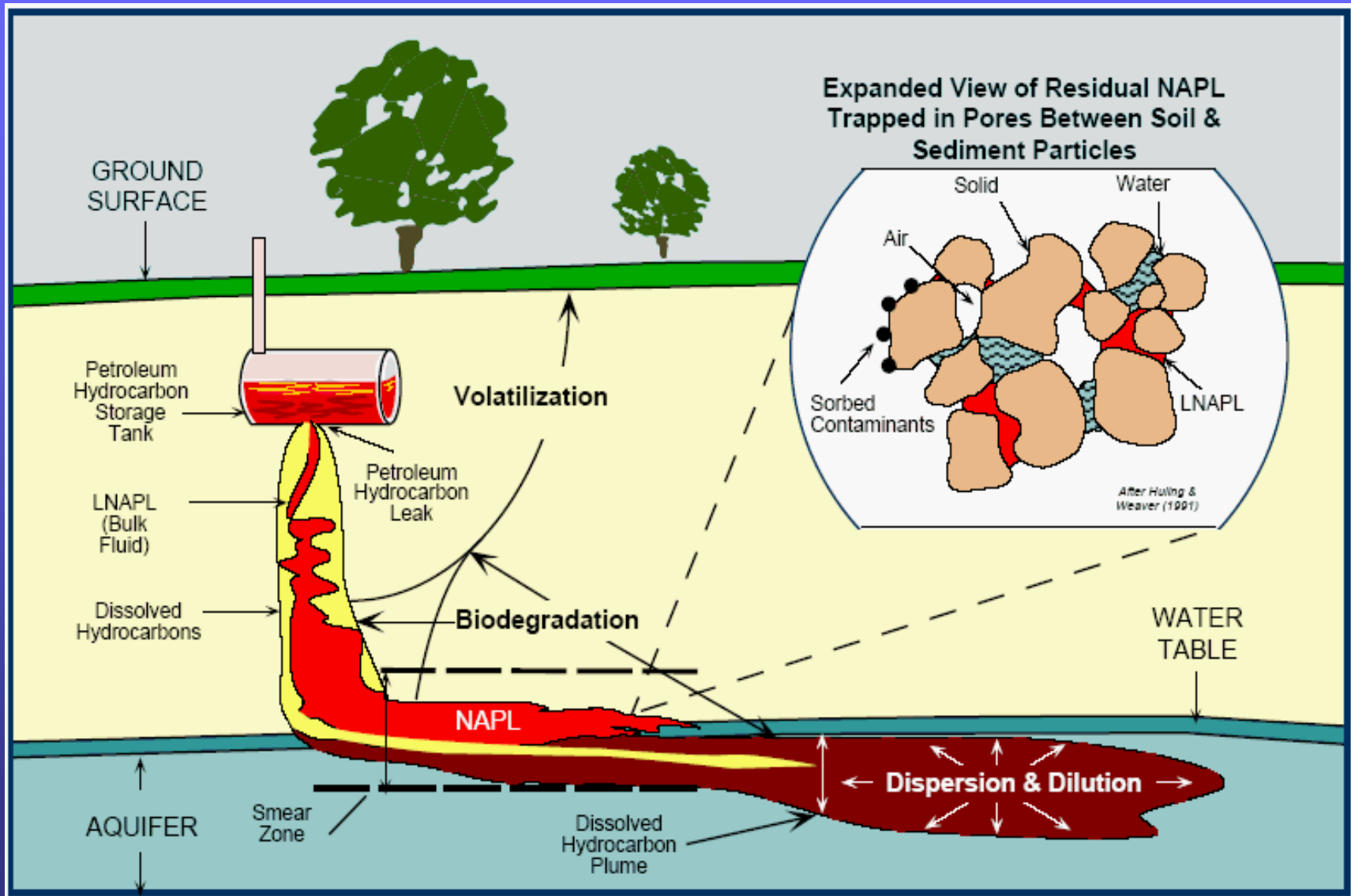


Groundwater Contaminants

- Volatile organic compounds (VOCs) –petroleum products (benzene, toluene, naphthalene, etc.) and solvents (PCE, TCE) – about 65 compounds;
- Metals (arsenic, iron, manganese, etc.);
- Chloride, nitrate, sulfate.
- Drinking water standards (*safe levels*) established for most common groundwater contaminants

Concentration Units

- Typical concentration units are parts-per-million or parts-per-billion;
- $60 \text{ seconds} \times 60 \text{ minutes} \times 24 \text{ hours} = 86,400$
seconds in one day – $1,000,000 \text{ seconds} / 86,400$
seconds per day = 11.57 days

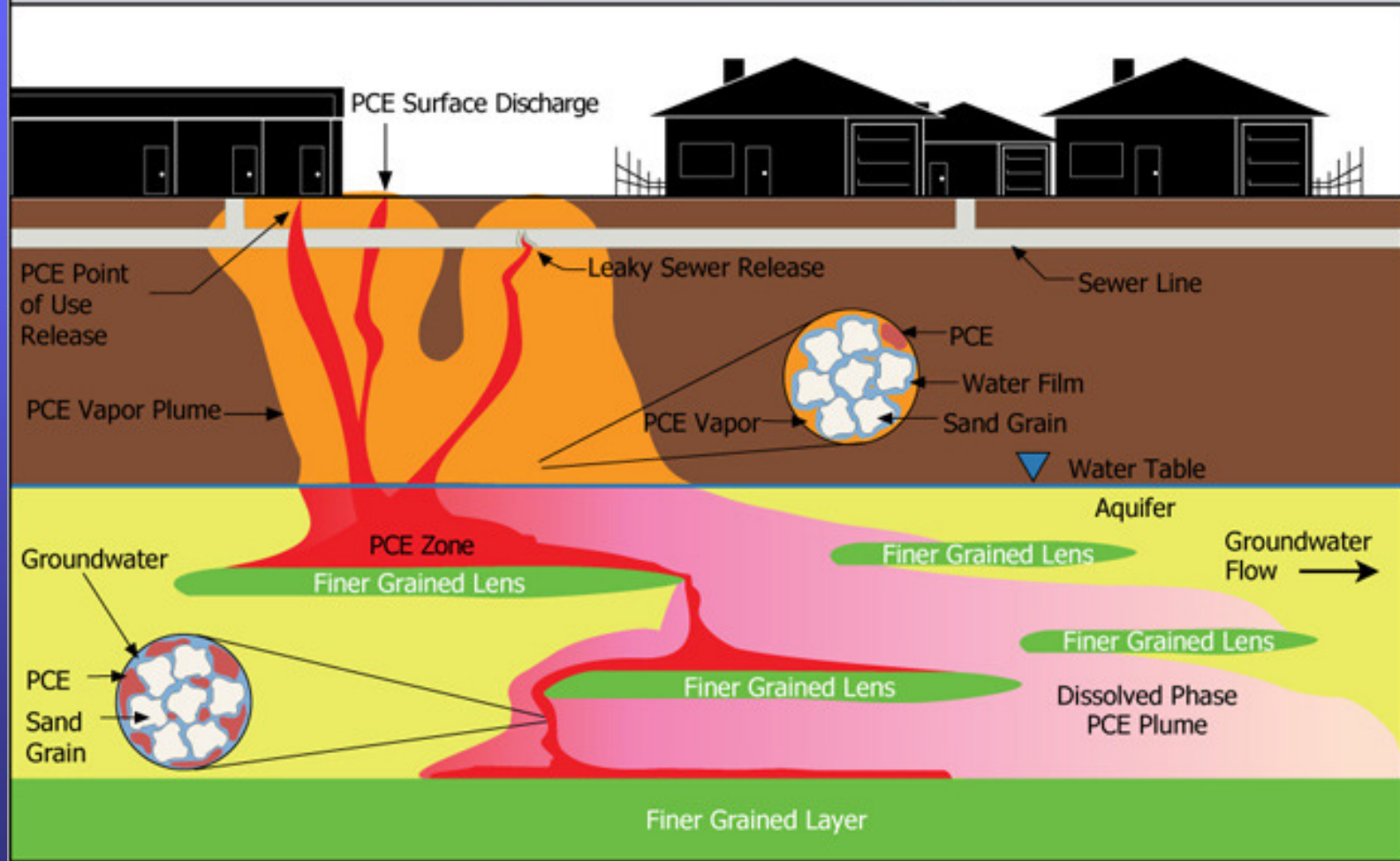




VIII.b.



The PCE Challenge



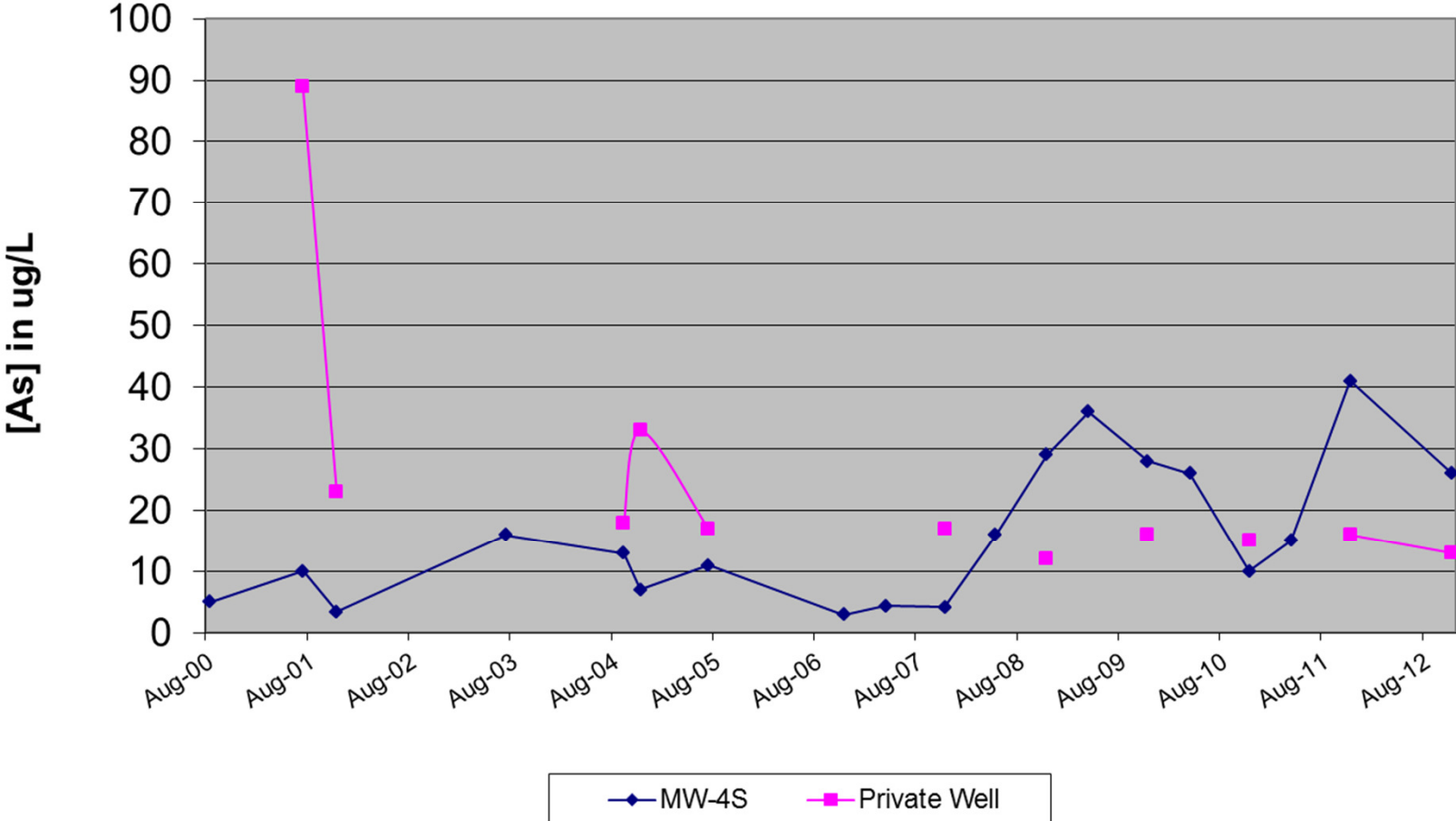
Case Study – Groundwater Monitoring at a Closed Unlined Landfill Site



Groundwater Quality Comparison

	<u>MW-1</u>	<u>MW-4S</u>	<u>Private well</u>
<u>Chloride</u>	2.2	112	8.6
<u>Iron</u>	0.25	13.8	0.47
<u>Manganese</u>	0.078	4.0	< 0.005
<u>Arsenic</u>	0.007	0.016	0.024

Arsenic Concentrations in Groundwater



Contact Information

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Methane Basics and Monitoring - A Closed Landfill Case Study



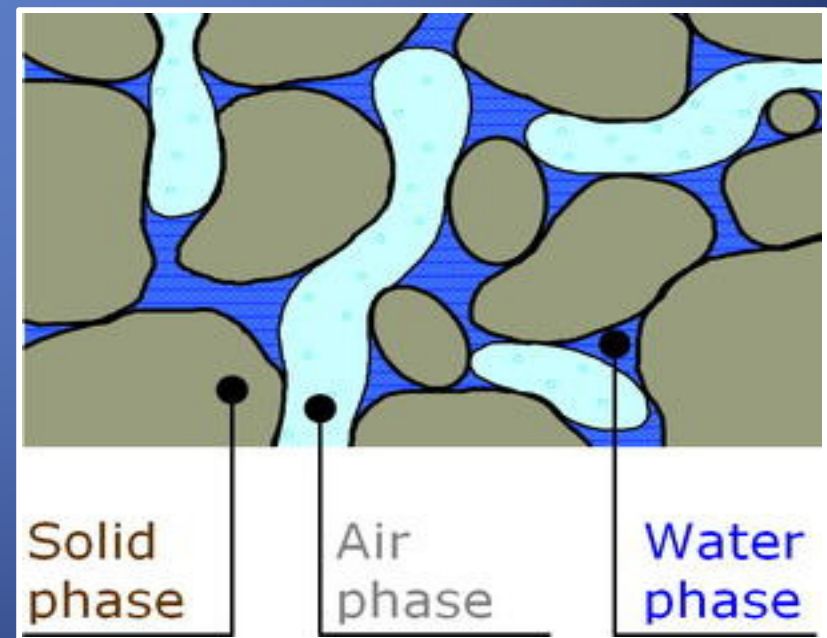
Douglas Kemp
Waste Management Specialist
NHDES - Waste Management Division

Landfill Gas

- Composed of mostly methane and carbon dioxide, and hundreds of other gases
- Composition changes over time from mostly carbon dioxide to methane
- Methane forms from bacteria in the landfill
- Landfills can generate methane for decades

Methane Gas

- Is explosive between 5% to 15% of the total volume of air [LEL = Lower explosive Limit & UEL = Upper Explosive Limit]
- Can migrate horizontally via void spaces in soils
- New Hampton landfill



Rule Requirements

- Landfill gases must be controlled to prevent hazards to human health and safety, and property
- Methane conc. must not exceed 25% of the LEL in structures on or off-site
- Methane conc. must not exceed 50 % of the LEL in the soil at the property line

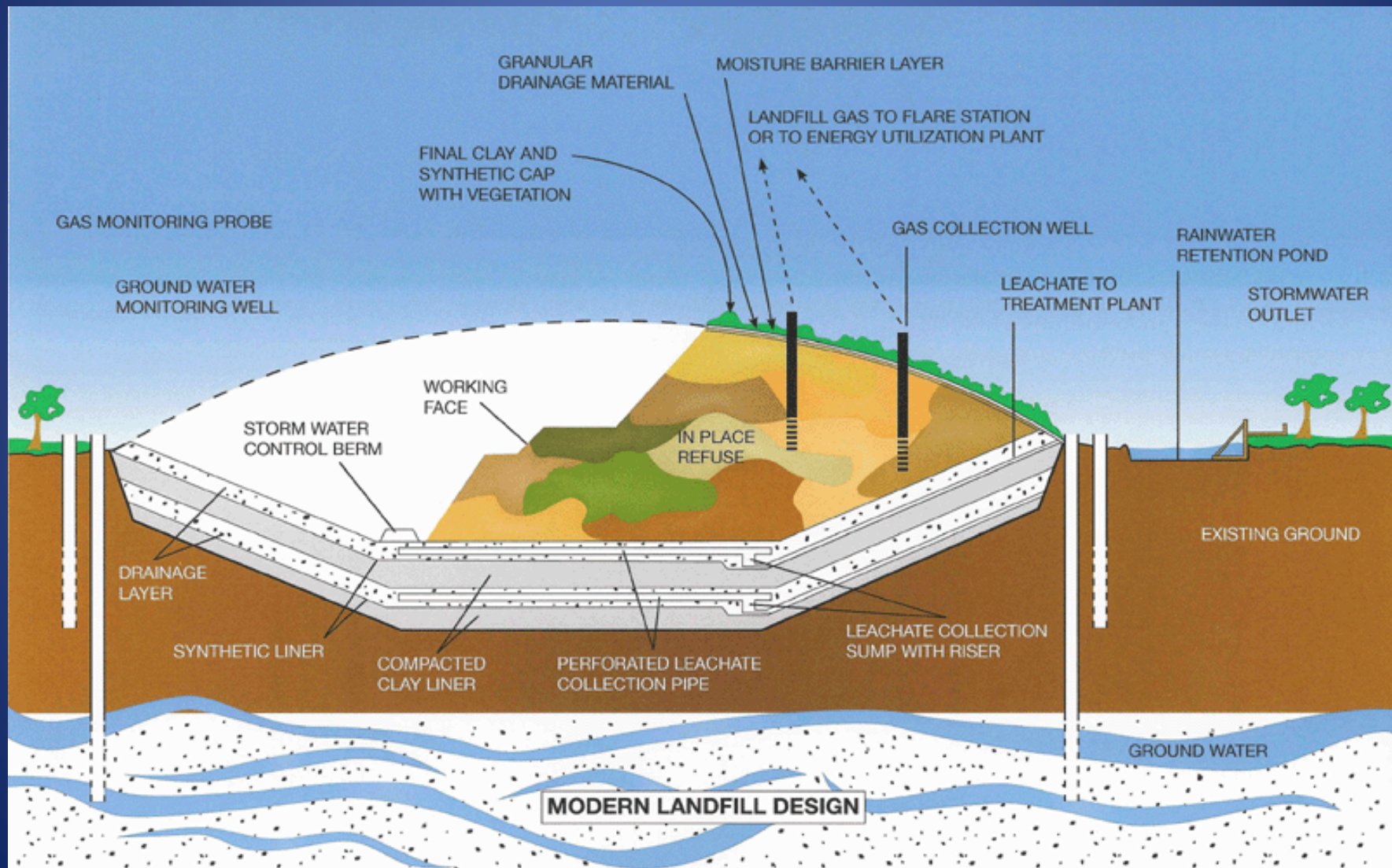


Methane % vs LEL %

SITE ID	DATE	% LEL	% METHANE
TGV-1	6/21/2012	96	4.8
TGV-2	6/21/2012	220	11.0
TGV-3	6/21/2012	280	14.0
TGV-4	6/21/2012	720	36.0
TGV-5	6/21/2012	54	2.7
TGV-6	6/21/2012	454	22.7
TGV-7	6/21/2012	128	6.4

- To convert from LEL % to methane % - divide the LEL value by 20
- To convert methane % to LEL % - multiply the methane value by 20
- 100% LEL = 5% methane

Closed Landfill Cross Section

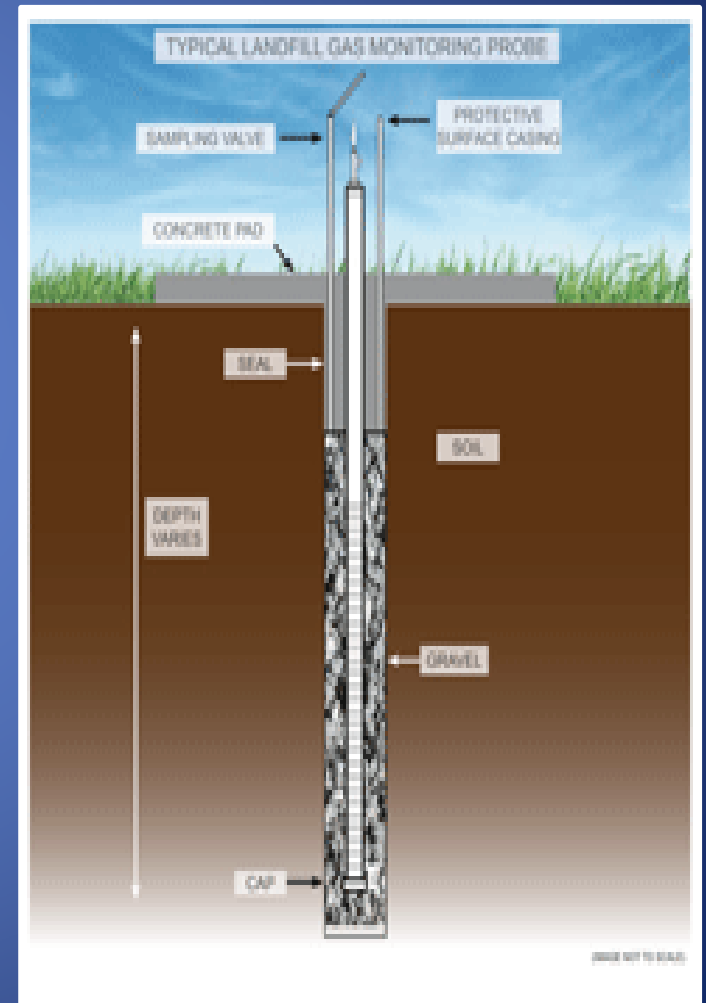


Typical Landfill Gas Vents



Landfill Gas Monitoring

- Soil gas monitoring
- Ambient air monitoring
- Monitoring inside buildings



Drilling Equipment



Constructing Gas Monitoring Well



Typical Gas Monitoring Wells



Methane Monitoring In Buildings



Gas Monitoring Equipment

Monitoring equipment can directly measure methane gas or present its readings as a percentage of the Lower Explosive Level [LEL]



Methane Migration Case Study



Closed Hampton Landfill

- Approximately 32 acres in total area
- Located in a suburban area
- Stopped accepting waste in 1995
- Capped during 1996 with plastic sheeting [LLDPE]
- Closure costs >\$6 million
- Methane was detected >100% LEL in 3 gas wells
- HFD detected >100% LEL at a pipe penetration
- The homeowners were relocated out of the home

Methane Survey

- The Town conducted a landfill gas survey in 1997, installing 26 temporary gas monitoring wells
- Methane >100% LEL was detected at varying depths in 13 of the 26 soil gas wells sampled in March 1997
- DES approved a trench design on Dec. 19, 1997
- The trench was completed in 1998
- HFD continued to monitor the home



N

Google earth

1992

Imagery Date: 10/9/2014 42°55'29.04" N 70°49'31.35" W elev 16 ft eye alt 4570 ft



1992

Imagery Date: 10/9/2014 42°55'36.61" N 70°49'23.81" W elev 74 ft eye alt 1559 ft



1992

Imagery Date: 10/9/2014 42°55'42.18" N 70°49'33.14" W elev 50 ft eye alt 753 ft

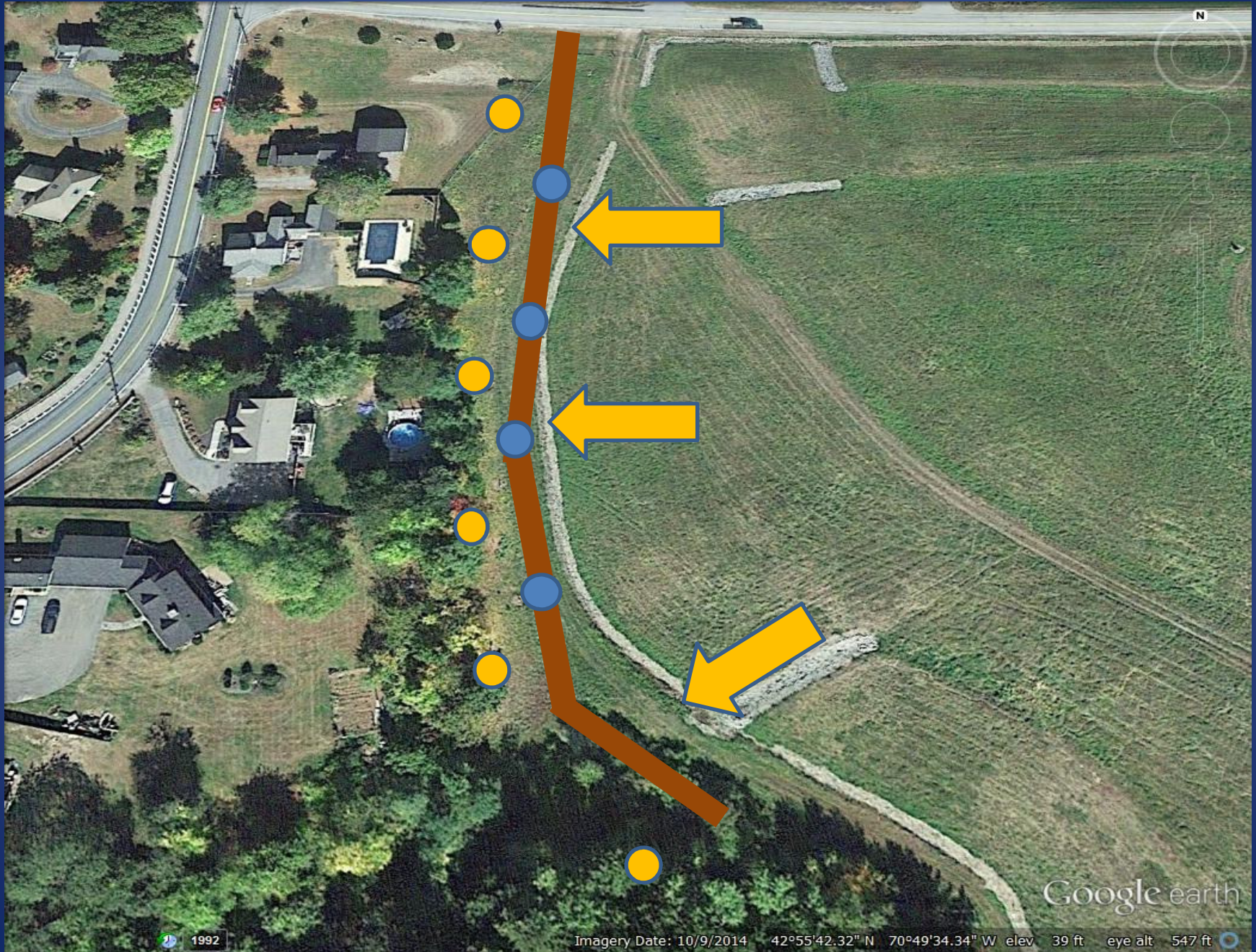
Google earth

Migration Cut-Off Trench

- Roughly 530 feet long
- Maximum depth of 20 feet
- Excavated to the water table
- Lined with geomembrane & geo-fabric
- Backfilled with crushed stone
- Installed a horizontal, perforated PVC pipe
- Installed 7 PVC Vents every 75 feet

Trench Construction





1992

Imagery Date: 10/9/2014 42°55'42.32" N 70°49'34.34" W elev 39 ft eye alt 547 ft

Google earth

Results

- Elevated levels of methane continue to be detected in the trench vents
- Low to No methane has been detected in the gas monitoring probes between the trench and adjacent homes
- The home was sold to new owners

Questions?



Landfill Monitoring Requirements



Douglas Kemp
Waste Management Specialist
NHDES - Waste Management Division

Operating Lined Landfills

- Landfill designs follow engineered standards.
- DES staff conduct routine inspections.
- Owners are required to:
 - conduct inspections,
 - monitor air, water, and waste disposal capacity,
 - submit routine reports to DES,
 - submit incident reports and repair any damage.



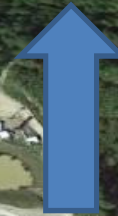




1992

Imagery Date: 9/19/2013 43°36'53.27" N 72°19'43.40" W elev 433 ft eye alt 2694 ft

Ammonoosuc
River



© 2015 Google

Google earth

1994

Imagery Date: 9/18/2013 44°15'37.65" N 71°37'44.08" W elev 1435 ft eye alt 3748 ft



1995

Imagery Date: 8/24/2013 42°43'35.36" N 71°31'07.79" W elev 204 ft eye alt 3693 ft

Google earth

Closed Unlined Landfills

- Closure designs follow engineered standards.
- Remain a potential threat.
- Roughly 130 landfills have been closed since 1985.
- Vast majority are municipal unlined landfills.
- Closure costs exceeded \$1,000,000.
- Post-Closure costs could reach \$500,000.



2003

Imagery Date: 4/7/2013 43°25'21.28" N 71°08'35.26" W elev 540 ft eye alt 1884 ft

Google earth





Unlined Landfill Closure Process

- The closure process could take 2 plus years
- Hydrogeology study
- Submittal of cap design concept
- Submittal of cap design and post-closure plans
- Cap construction
- Submittal of Record Drawings
- Post-closure monitoring and maintenance period
- The post-closure period is performance driven

Can You Spot the Landfill?







1992

Imagery Date: 10/11/2014 42°59'41.44" N 71°30'05.57" W elev 267 ft eye alt 1219 ft

Google earth



Google earth

Imagery Date: 10/11/2014 42°59'49.34" N 71°30'12.82" W elev 257 ft eye alt 746 ft

1992







Landfill Post-Closure Requirements

- Inspect, monitor, and repair any damage
- Achieve the “performance standards” in the NH Solid Waste Rules:
 - Stop generating leachate,
 - Stop generating methane,
 - Achieve maximum settlement,
 - Remove harmful impacts to air and water,
 - Remove threat to human health and the environment.

Post-Closure Inspections

- Protect the closure system from damage:
 - Landfill slopes,
 - Vegetation,
 - Gas management system,
 - Drainage system,
 - Fencing, signage, and
 - Groundwater and gas monitoring wells.
- <http://des.nh.gov/organization/divisions/waste/swmb/css/categories/forms.htm>















Post-Closure Summary

- If one or more of the performance standards is not met, must continue to monitor
- If one or more of the performance standards is met, submit a permit modification to change a post-closure requirements
- To alter the report submittal frequency or other Rule requirement, submit a waiver request
- Contact DES prior to using the landfill site for other purposes

Questions?



SOLID WASTE FACILITY OPERATOR WORKSHOP

**SWOT Rule Revisions
Effective July 1, 2014**

OPERATOR TYPES

Establishes two types of operators:

1. Principal operator

- **Attend basic training and pass the exam.**
- **May be in supervisory/management position.**

OPERATOR TYPES

2. Assistant operator

- **Attend basic training, but do not take/pass the exam.**
- **Must work under supervision of principal operator.**

OPERATOR QUALIFICATIONS

- **No more minimum education/experience requirements.**
- **Employers determine who is competent, not DES.**

TRANSITION FROM LEVEL TO STEP

- *Attendant in Training → Assistant Operator*
- *Level 1 → Principal Operator, Step 1*
- *Level 2 → Principal Operator, Step 2*
- *Level 3 → Principal Operator, Step 3*
- *Level 4 → Principal Operator, Step 4*

SENIOR PRINCIPAL OPERATOR

To recognize those individuals who have 20 years of continuous certification, we have designated them as Senior Principal Operators.



STEPS

- **Recognition for continuing professional development.**
- **Awarded automatically with renewal.**
- **Step increases with hours of accrued training starting July 1, 2014.**

PRINCIPAL OPERATOR STEPS

Step	Hours of Accumulated Continuing Professional Development
1	2.5 total
2	12.5 total
3	25 total
4	37.5 total
Senior	50 total

ASSISTANT OPERATOR STEPS

- **Assistant Operators advance in steps according to years of certification.**

Years Certified	Step
One to 4 total	1
5 to 9 total	2
10 to 14 total	3
15 or more total	4

PROFESSIONAL DEVELOPMENT

- **“Continuing Professional Development” means professional or technical instruction that imparts information and instruction relevant to waste management and solid waste facility operations to individuals who have already attended basic training.**

PROFESSIONAL DEVELOPMENT

- 2.5 hour minimum for annual renewal for **ALL** designations.
- Must be completed in the 12 months in-between expiration dates before you are considered late.

PROFESSIONAL DEVELOPMENT

- **Repeated courses do not qualify for certification renewal or step increases.**
- **In-house and third party training count, provided the topic is waste-related.**
- **If you aren't sure if the training you want to take will count, call and ask us before you go.**

GRACE PERIOD

- **There is a 90-day grace period for renewal applications**
- **A \$25 late fee will be assessed if your complete renewal application is received within 90 days after your certification expiration date**

BEYOND THE GRACE PERIOD

- **If you miss the grace period, you must start over.**
 - **Come back to Basic Training; and**
 - **Take the test again**

SIGNATURE

- **The operator's signature shall certify:**
 - **the information is true, complete and not misleading;**
 - **the operator understands s/he is subject to penalties of law for false swearing; and**
 - **the operator understands s/he is required to comply with RSA 149-M and SW Rules.**