

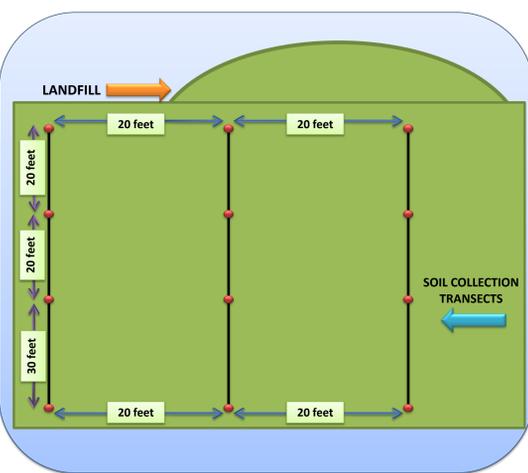
## Abstract

A landfill is a site for the disposal of waste materials by burial and is the oldest form of waste treatment. Capping landfills is a common practice to decommission the facility. The fact that a landfill is capped does not mean it is no longer an environmental danger, because generally they were made years ago, without any environmental precautions and waste remains below the cap. The objective of this project is to compare levels of potential pollutants in soil and groundwater samples near Indian Brook based on distance from capped landfill and local hydrology. The intent is to examine the effects of the landfill on the riparian areas surrounding Indian Brook. Water samples were filtered to isolate water soluble elements, while soil samples were extracted to compare total values. To see the variations in nutrients and pollutants in soil and ground water we used the Inductively coupled plasma atomic emission spectroscopy (ICP-AES), capable of trace multi-element analysis. This project presents a method of monitoring the adjacent area of a capped landfill; for determining the presence of contamination in soils and groundwater.

## Introduction

An important factor influencing the productivity of our planet's various ecosystems is the nature of their soils and ground water. Soils are not just a collection of fine mineral particles; they also contain air, water, dead organic matter, and various types of living organisms. The formation of a soil is influenced by organisms, climate, topography, parent material, and time (Pidwirny, 2008). Groundwater comes from rain, snow, sleet, and hail that soaks into the ground. The water moves down into the ground because of gravity, passing between particles of soil, sand, gravel, or rock until it reaches a depth where the ground is filled, or saturated, with water. Pollution is the introduction of contaminants into an environment that causes instability, disorder, harm or discomfort to the ecosystem, physical systems or living organisms. Pollutants, the factors of pollution, can be foreign substances or energies, or naturally occurring (Renata Luciani, 2002). A landfill or "waste dump" is a site for the disposal of waste materials by burial and is the oldest form of waste treatment. After the closure of a waste dump, the sealing of the site does not guarantee the removal of risk to the environment (M. Lopes, 2006). It might be possible that even when sealed, a landfill might contaminate the soils and groundwater of the area. In addition to these the effect of a landfill near the river bank could be the cause of changes in soil nutrients and inducing contaminants in the stream.

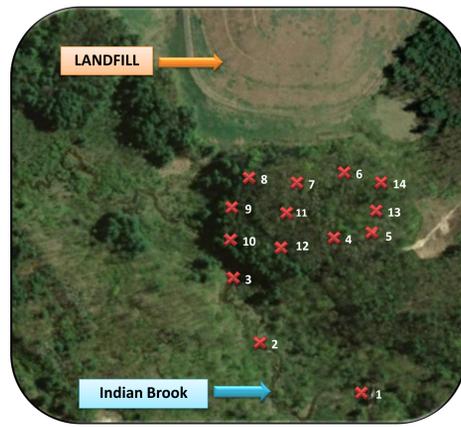
## Methods



**Figure 1.** Diagram of soil sample collection in 3 different transects. Red dots are the sampling locations. The blue arrows show horizontal distance between samples, while the purple arrows show vertical distance between samples.



**Figures 2, 3 and 4.** Show sampling methods for water and soils in the landfill area. Soil samples were taken with augers and water samples were taken with 100 mL plastic bottles.

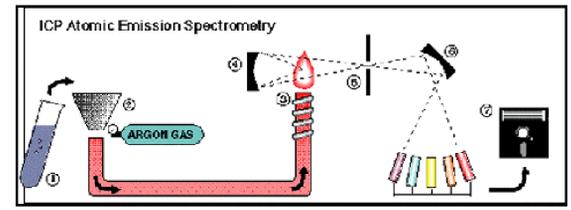


**Figure 5.** Map overview of water sampling collection spots. The red crosses are the approximate sampling locations.



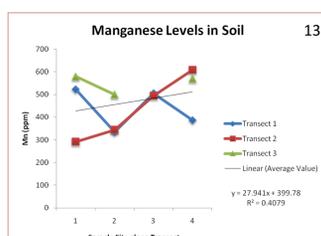
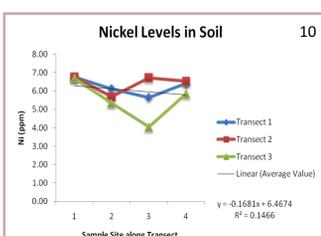
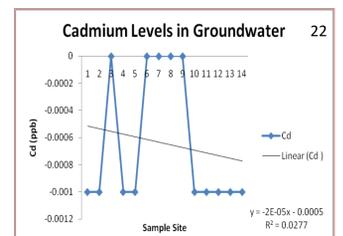
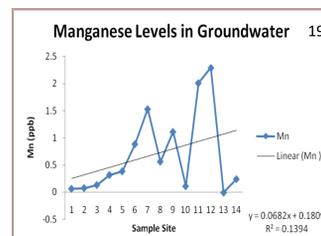
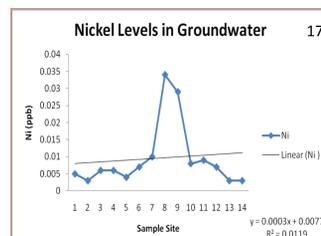
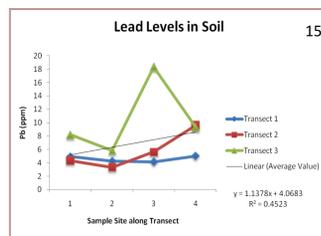
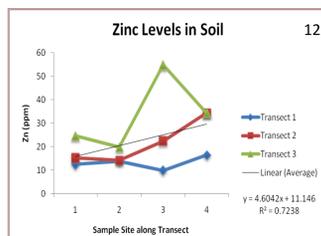
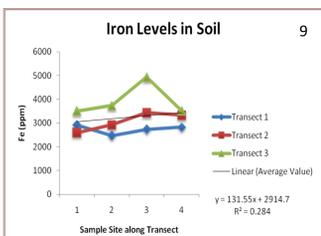
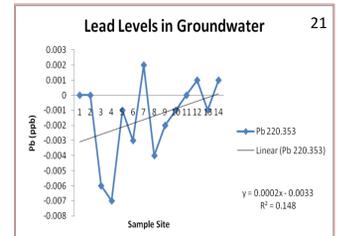
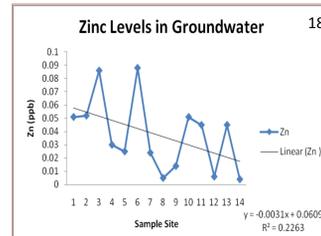
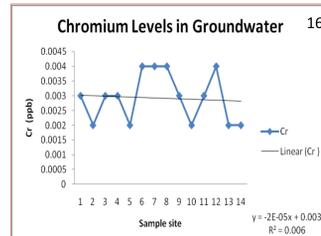
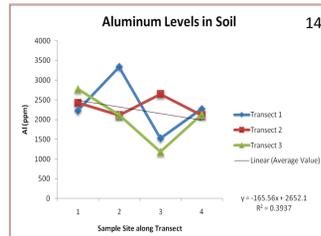
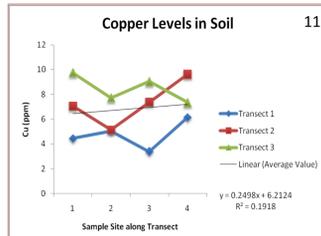
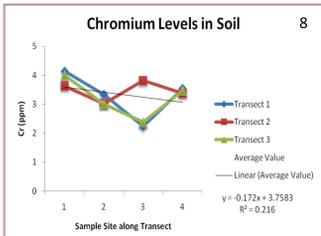
**Figure 6.** Shows the ICP-AES a machine capable of trace multi-element analysis. The soil samples were diluted in concentrated nitric acid and filtered for nutrient extraction. Each water and soil sample was passed through the ICP-AES for analysis.

**Figure 7.** Overview of how the ICP-AES works. The (1) aqueous sample is pumped and (2) atomized with argon gas into the (3) hot plasma. The sample is excited, emitting light wavelengths characteristic of its elements. (4) A mirror reflects the light through the (5) entrance slit of the spectrometer onto a (6) grating that separates the element wavelengths onto (7) photomultiplier detectors.

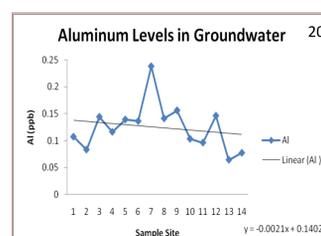


URL: <http://minerals.cr.usgs.gov/gips/na/5process.html>

## Results



**Figures 8 through 15.** Show the concentrations given by the ICP-AES for the soil samples taken near the landfill. According to the background levels as reported by R. Bartlett, all values detected for Iron, Nickel, Copper and Chromium exceeded the background levels of Vermont soils. In the EPA target reporting limits for trace metals all elements had higher concentrations than the recommended.



**Figures 16 through 22.** Illustrate the concentrations given by the ICP-AES for the groundwater samples taken near the landfill. According to the target reporting limits for trace metals by the EPA, almost all the water samples taken show lower concentration for each of the elements analyzed.

## Conclusion

- The data of this study suggests that most of the soil near the landfill has higher concentrations of heavy metals than the recommended by the EPA in the Target Reporting Limits for Trace Metals although there was no clear trends due to distance from landfill at the scale used in this study.
- Contaminate levels are low for Indian Brook water, indicating minimal groundwater contamination.
- The variable results of this study warrants further investigation of the Indian Brook landfill and surrounding regions under various weather conditions (high flow, etc) and at various scales.

## References

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