

Module 3

Landfill Operations and Maintenance Part A: Design & Construction

Module Goal

To identify ideal conditions for surface water, landfill gas and groundwater and to look at different design features that might improve your landfill site

Module Objectives

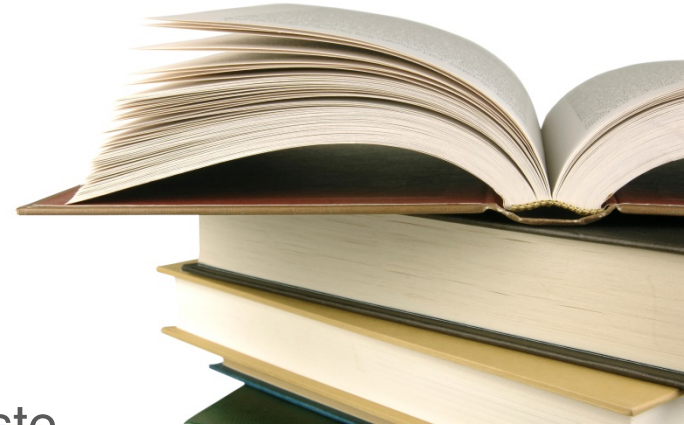
At the end of this module, you will be able to:

- Describe best practices for managing surface water, landfill gas, and groundwater
- Describe the ideal conditions for your landfill
- Explain the benefits of making changes



Plan your Operations

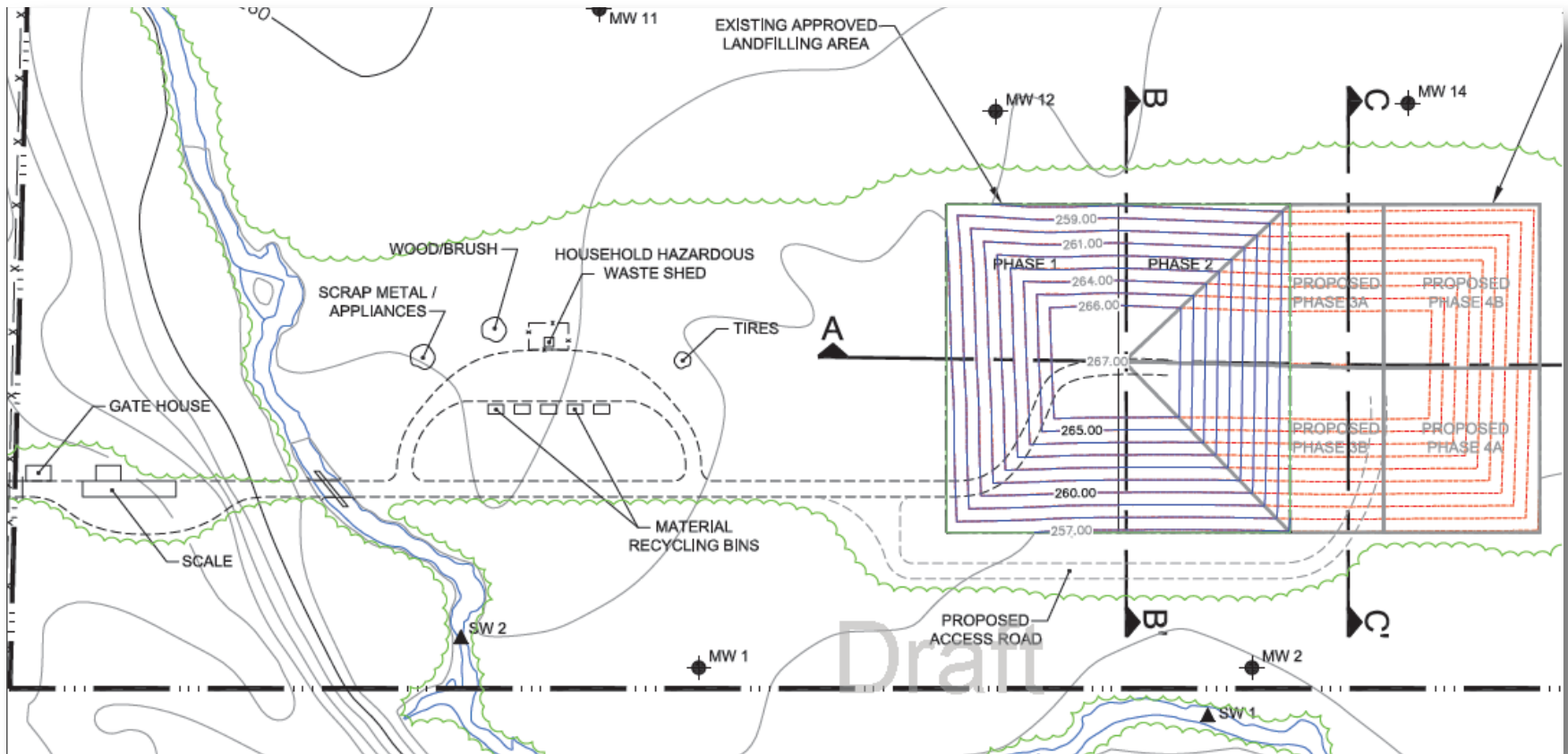
- A properly operated landfill:
 - reduces impacts on air, land and water
 - minimizes impact on adjacent properties
 - maximizes potential landfill space for waste disposal
 - prevents landfills from being open dumps
- Make a Plan!
 - Design and Operations Plan
 - Environmental Study (groundwater, surface water, air, predict, species)
 - Closure Plan (post-closure care & monitoring)



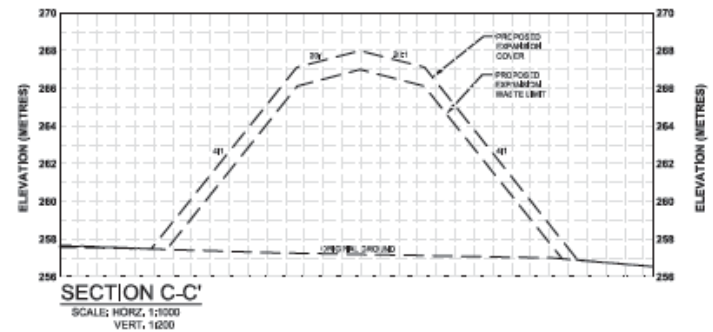
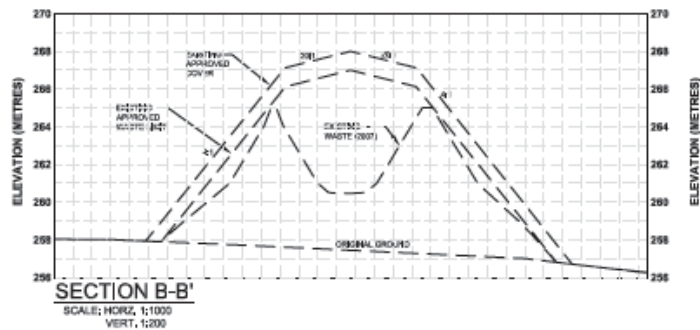
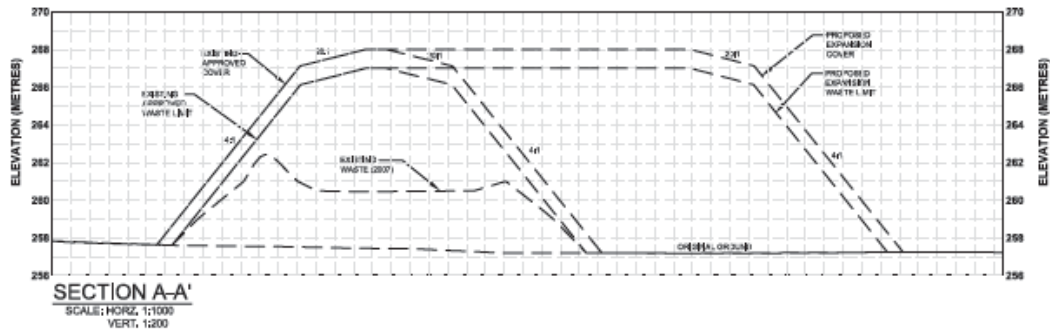
Design & Operation Plan

- Contours and capacity (volume of waste)
- Phasing
- Environmental control measures
- Daily operations and maintenance
- Monitoring
- Contingency measures and site closure
- Assessment on potential for environmental impacts

Typical Layout & Design



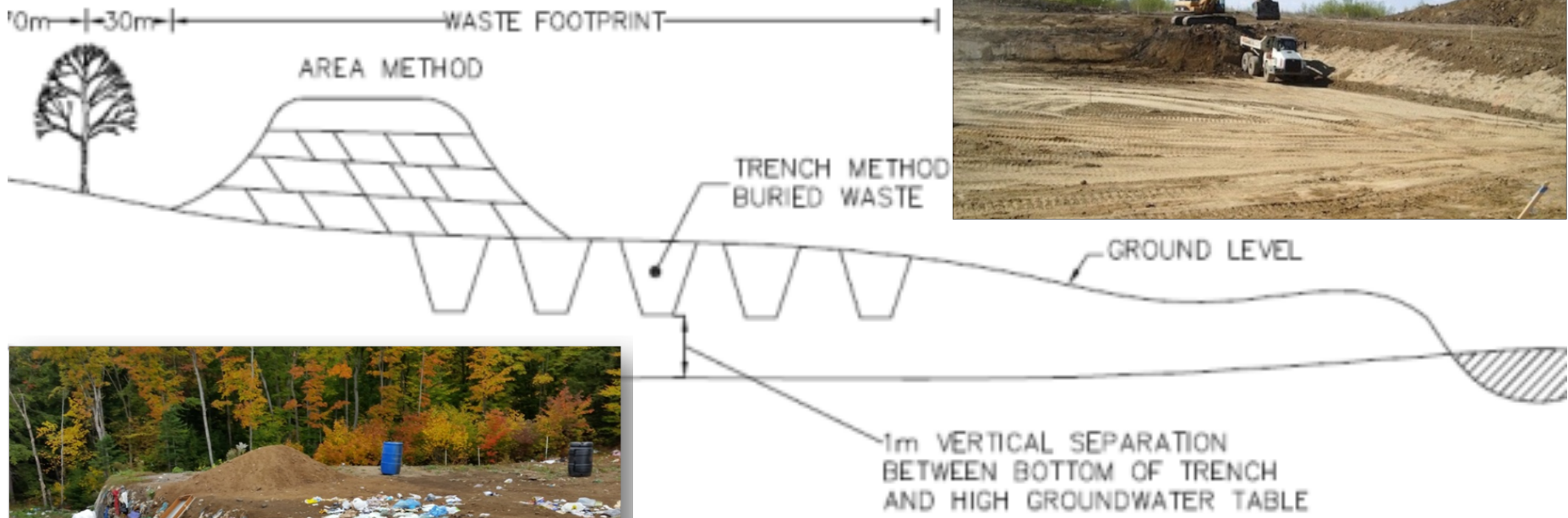
Typical Layout & Design





Managing the Fill Area

Area vs Trench Method





Cell Structure

Capacity





Ideal Conditions for Surface Water

Ideal Conditions for Surface Water

- Slope of 5% to 25% on fill area so long term settlement will not effect drainage
- Diversion structures in place to prevent clean water intercepting waste
- Soil stockpiles protected from wind
- Runoff to have settling pond to allow suspended solids to settle out
- Maintain healthy vegetation on side slopes to minimize erosion



**Fill area should have a slope of
5% to 25%.**



Slope on Final Cover at 25%

Abundant vegetation prohibits erosion.



Diversion structures should carry water away from the active face.



Soil stockpiles should be protected against erosion.



Run-off should be monitored.



Landfill runoff should not damage the water quality of a natural watercourse.



Landfill Runoff

Runoff is directed to flat area with vegetation.
Water will infiltrate into ground within 1-2 days.



Best Practices for Managing Landfill Gas

Ideal Conditions for Landfill Gas

- Buffer area adequate for natural venting
- Soil composition checked
- If inadequate attenuation, gas interception and ventilation systems installed
- If dwellings nearby, monitoring devices installed



The buffer area should be at least 100 metres wide on all sides to allow for natural venting.



If landfill gas does not vent naturally to surface, interception and ventilation systems should be considered if there is potential for impact to surrounding land uses.

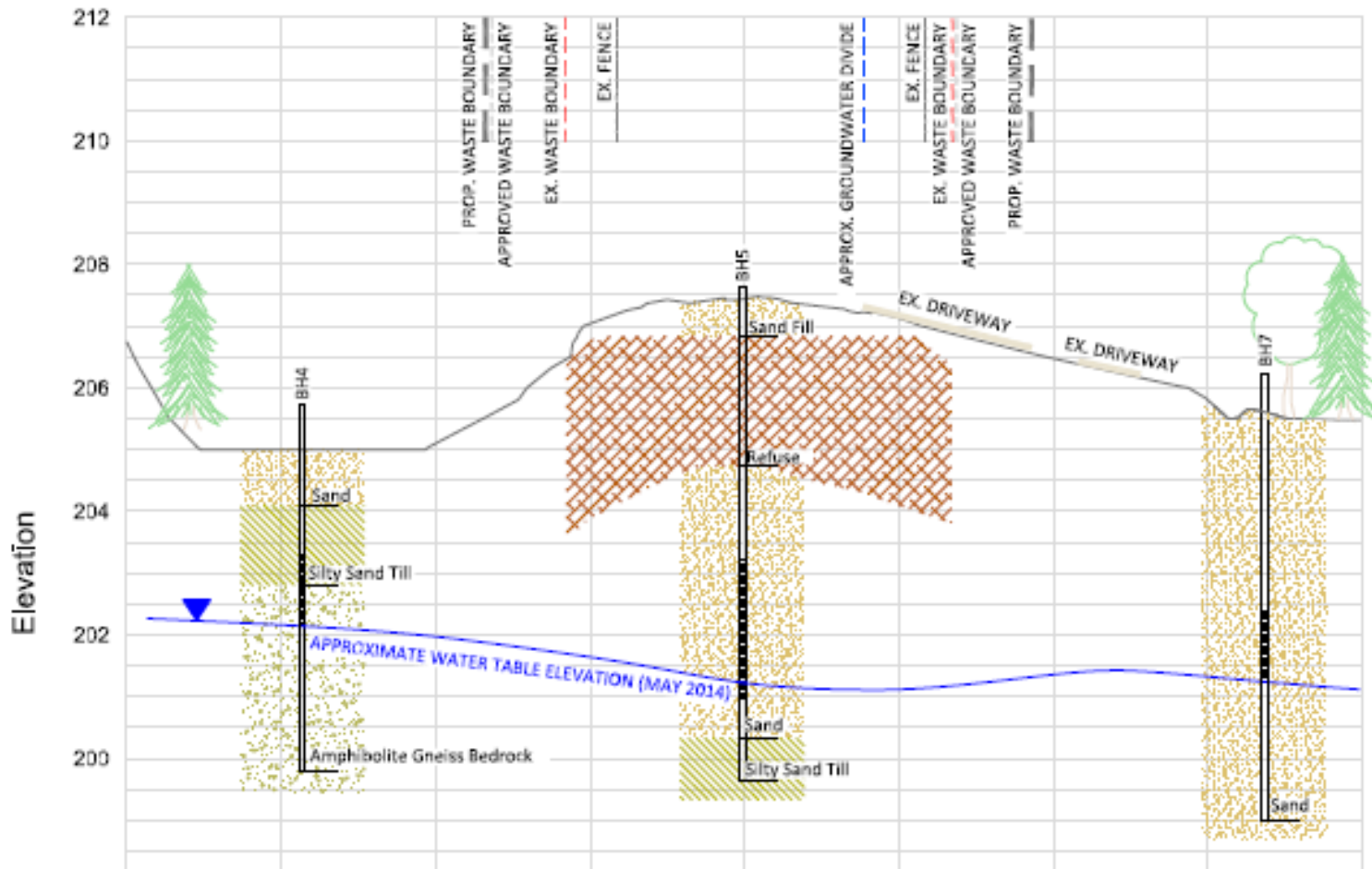
Ideal Conditions for Groundwater

- Waste not placed in water – bottom of waste above seasonally high water table
- Soil underlying waste to preferably have moderately low hydraulic conductivity, such as silts
- Groundwater hydraulic gradient to be low
- Groundwater quality monitored regularly



Landfills should be at least 1 meter above the seasonally high groundwater table to minimize contamination.

Waste Placed Above Water





Landfill Design Features



Roads

Ideal Road Conditions

- Easy to access
- Gravel surfaced or paved
- 6 m wide to accommodate two lane traffic and trucks
- Drainage ditches and culverts for road base drainage
- Alignment and vegetation should not restrict visibility – provide 20m wide clearing
- Maximum grade between 10-12%



Access Road to a Rural Landfill in Ontario

What design features are missing ?



Buffers

Ideal Conditions for Buffers

- Minimum of 100 metres (ideally 500 metres down gradient)
- Separate from adjacent land owners

Ideal Conditions for Buffers



Who has adequate buffers already established around their landfill site?

Signs



LANDFILL SITE

HOURS OF OPERATION

MON. & THURS. 8AM. - 7PM.

SAT. & SUN. 10AM. - 2PM.

WARNING

DO NOT DUMP GARBAGE
BY TRAILER AFTER HOURS
OR YOU WILL BE FINED
UNDER BY-LAW #19=B-04
SECTION 11-1

VIDEO SURVEILANCE
DUMP IS MONITORED

Chippewas of Ge...

Entrance Sign

Ideal Conditions for Signs

- Easy to read: legible from within vehicle
- Erected in a prominent location
- Site operation information
- Hazard warnings
- Waste segregation areas



Gates and Fences

Ideal Conditions for Gates and Fences

- Enclose the landfill site
- Discourage scavengers
- Keep litter contained
- Made of sturdy material
- Extend into the ground
- Equipped with locks

Ideal Conditions for Fences

Do you have a lockable gate at the entrance to your landfill?

Why did you get one?

Is it working?

How did the community react?



Entrance Gate: Pikwàkanagàn



Fence for Recycling Bins at Pikwakanagan



Page Wire Gate at Entrance



Fences for Material Storage



Fences for Material Storage

Concrete barriers can be moved to adjust the storage size as demand grows.

Ideal Drainage Features:

- Slope of 1 to 2% on ditch bottom
- Use of natural features
- Diversion channels
- Protection of cover material



Drainage

Module Discussion

- ✓ Landfill Design Features
- ✓ Ideal Conditions (GW, SW, LFG)
- ✓ Monitoring Equipment
- ✓ Managing the Fill Area