

WELCOME

NOFNEC

OCTOBER 4TH 2012

WASTE MANAGEMENT – SESSION 1

STANTEC CONSULTING LTD.

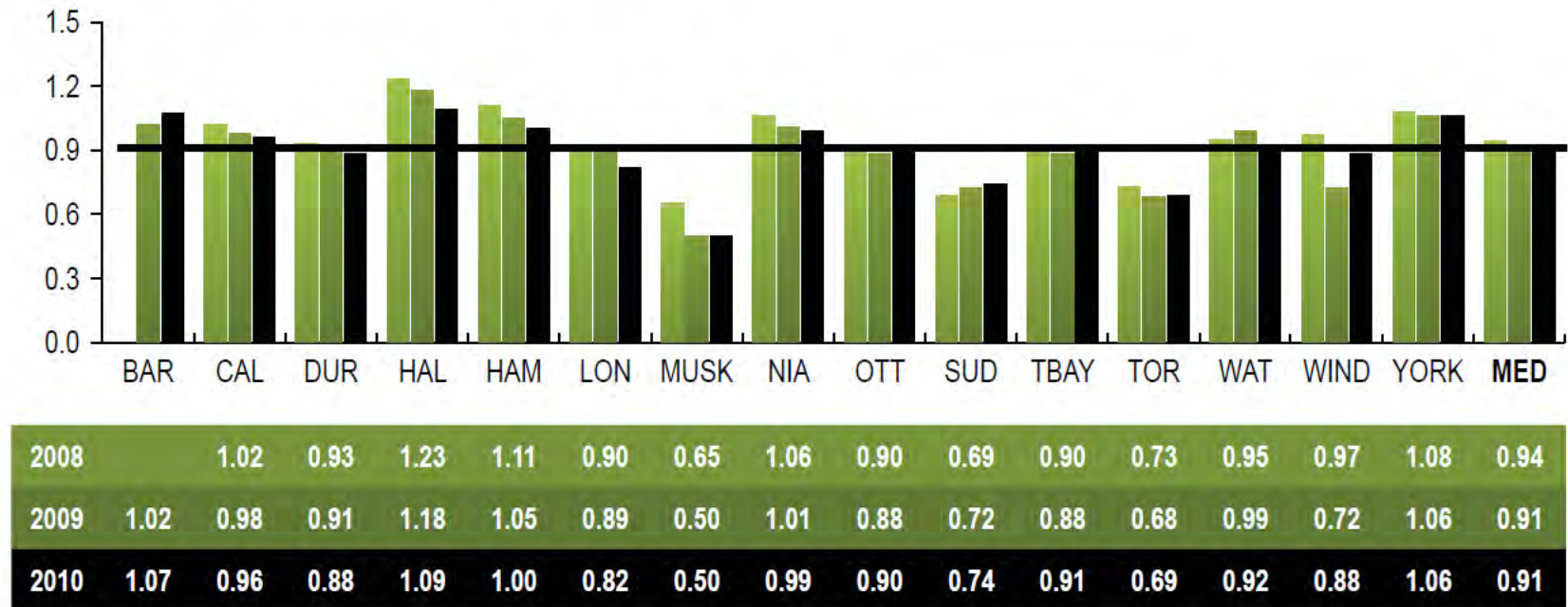
AGENDA

- Introduction – Gerry Lalonde – Stantec Consulting Ltd.
- How waste management integrates with other community infrastructure.
- Summary of water/sewage/waste management costs for northern Ontario.
- Landfill Best Practices

Total Waste Generation

How many tonnes of residential waste is collected per household?

Fig. 26.1 – Tonnes of All Material Collected per Household



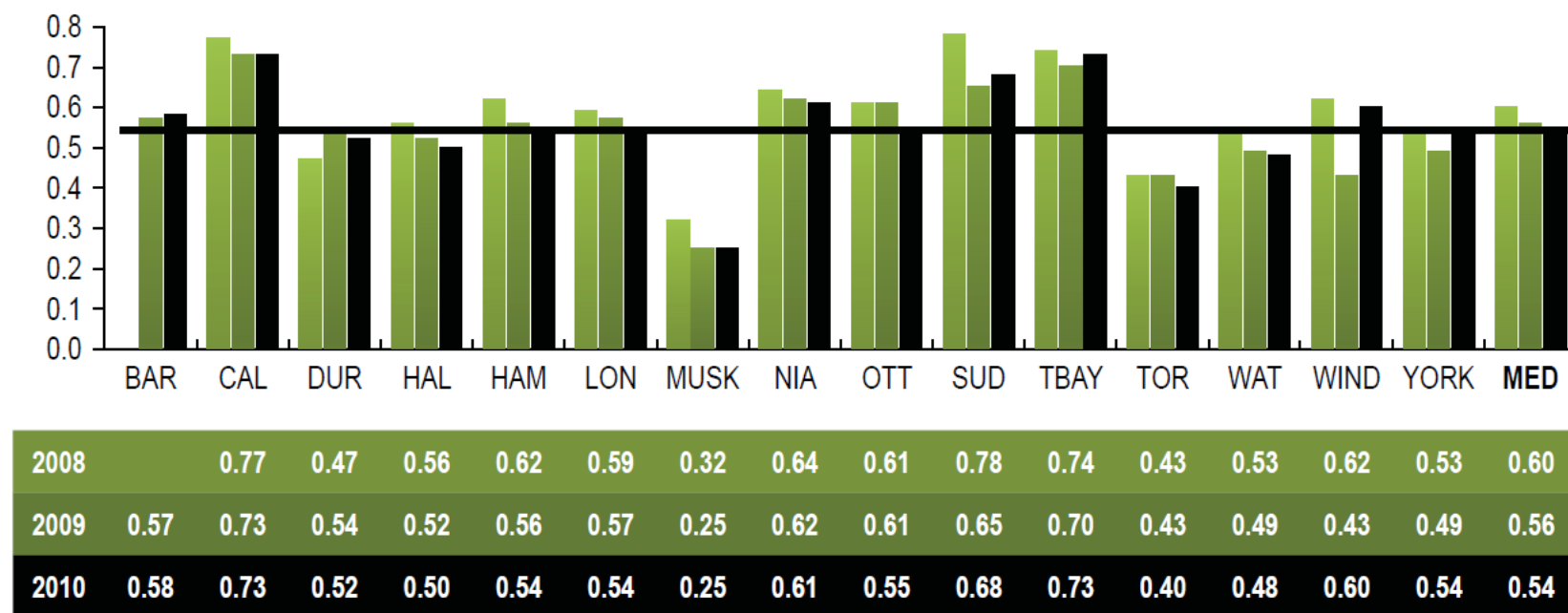
Source: SWST205 (Service Level)

Figure 26.1 illustrates the number of tonnes of waste collected from residential households, which includes organics, blue box, leaf and yard, municipal hazardous or special waste and other recyclable materials such as wood, metal and tires.

Disposal per household (tonnes)

How many tonnes of residential garbage are disposed in landfills?

Fig. 26.3 – Tonnes of Solid Waste Disposed per Household - Residential



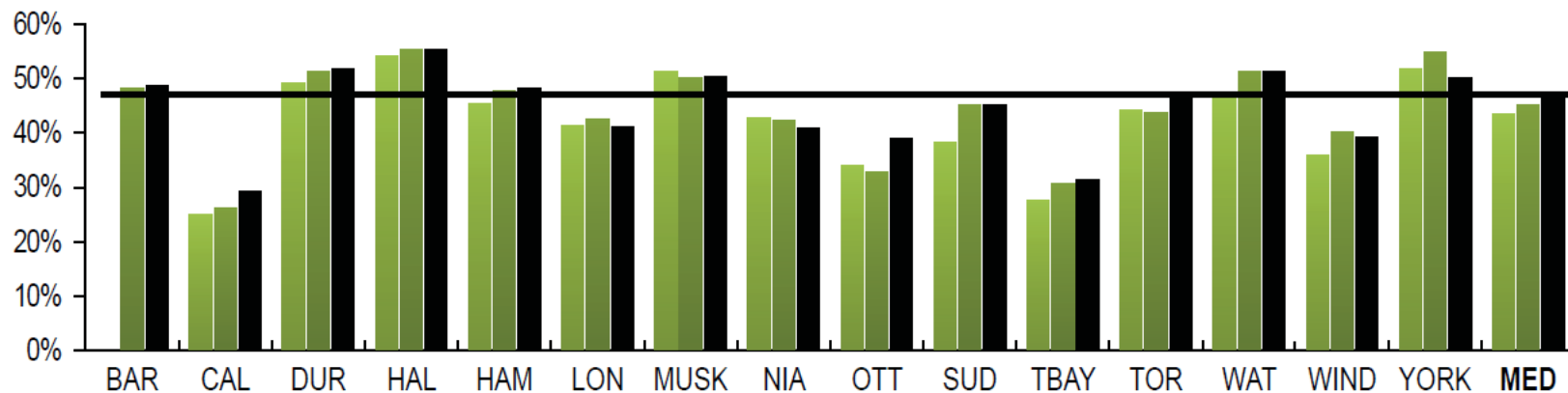
Source: SWST220 (Service Level)

Figure 26.3 indicates the total tonnes collected and going to landfill. Given the life expectancy of several landfills across the province and the fact there are many diversion programs and services in place, there is still a high volume of waste going to landfills.

Solid Waste Diversion %

What percent of residential waste is diverted away from landfills?

Fig. 26.5 – Percent of Solid Waste Diverted - Residential



2008	25%	49%	54%	45%	41%	51%	43%	34%	38%	28%	44%	47%	36%	52%	43%
2009	48%	26%	51%	55%	48%	50%	42%	33%	45%	30%	44%	51%	40%	55%	45%
2010	49%	29%	52%	55%	48%	50%	41%	39%	45%	31%	47%	51%	39%	50%	47%

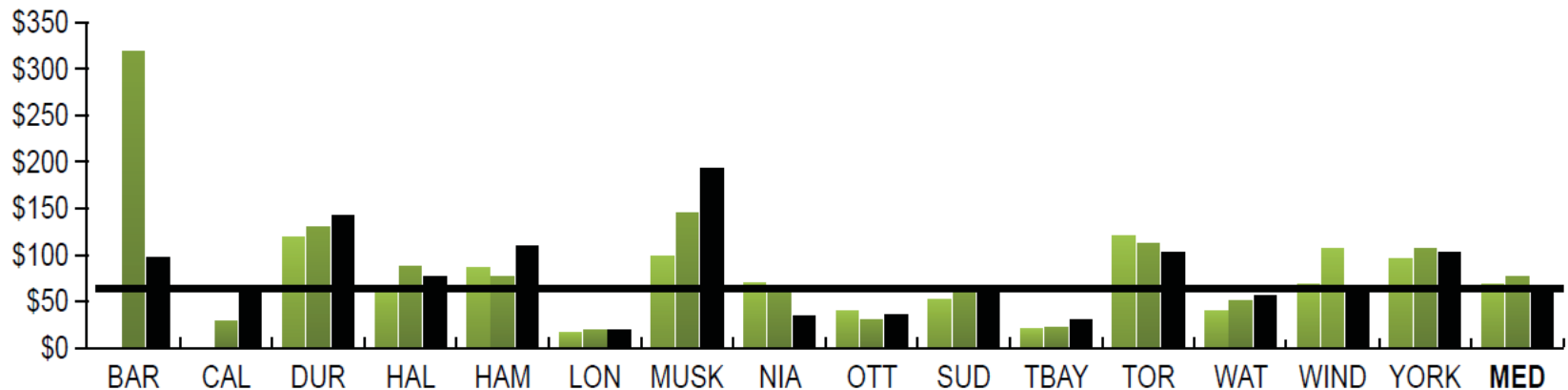
Source: SWST105M (Community Impact)

Figure 26.5 demonstrates the amount of residential waste diverted away from landfills and incineration through programs such as organics, blue box, leaf and yard, municipal hazardous or special waste and other recyclable materials (wood, metal and tires).

Disposal Costs for Residential

How much does it cost to dispose of a tonne of garbage?

Fig. 26.4 – Operating Cost for Solid Waste Disposal per Tonne (All Streams)



2008			\$118	\$65	\$85	\$16	\$98	\$69	\$39	\$52	\$20	\$119	\$39	\$68	\$95	\$68
2009	\$318	\$28	\$129	\$87	\$75	\$19	\$145	\$67	\$29	\$63	\$21	\$111	\$50	\$106	\$106	\$75
2010	\$96	\$63	\$142	\$75	\$108	\$19	\$192	\$33	\$35	\$64	\$29	\$102	\$56	\$63	\$102	\$64

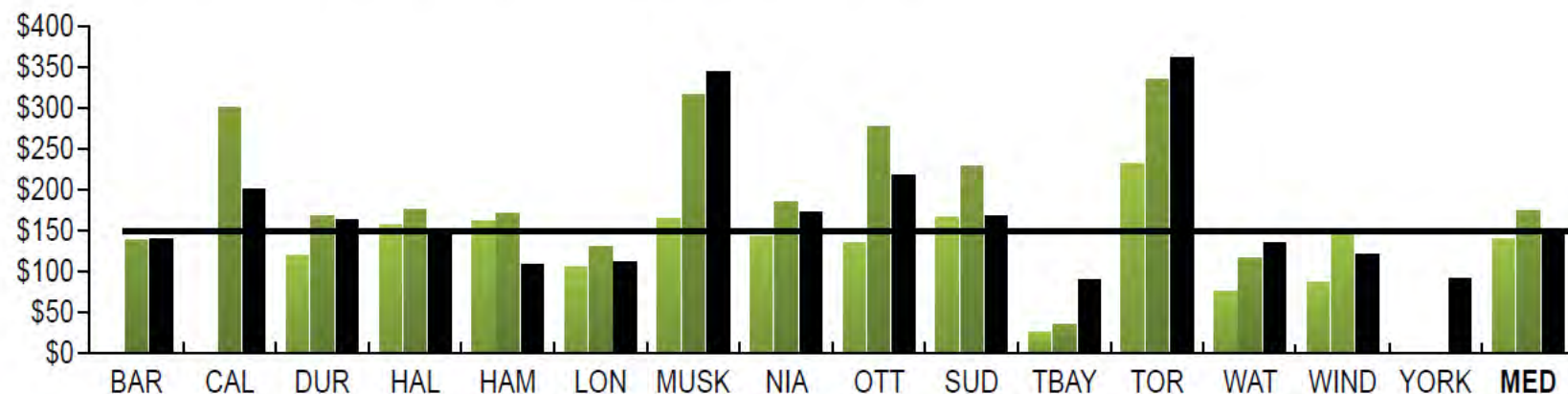
Source: SWST325M (Efficiency)

Figure 26.4 illustrates how much it costs to dispose of a tonne of residential garbage. This trend can be attributed to declining landfill capacities thereby resulting in increased landfill rates, additional costs of transporting waste outside a community, aging infrastructure, capital costs, costs associated with the incineration of garbage, service agreements, increase in leachate treatment, and fluctuating fuel costs.

Waste Diversion Costs

How much does it cost to divert a tonne of garbage?

Fig. 26.6 – Operating Cost for Solid Waste Diversion per Tonne - Residential



2008			\$117	\$155	\$159	\$103	\$162	\$142	\$134	\$165	\$23	\$230	\$74	\$84		\$138
2009	\$137	\$299	\$167	\$174	\$170	\$129	\$315	\$184	\$276	\$227	\$33	\$334	\$114	\$149		\$172
2010	\$138	\$199	\$162	\$147	\$107	\$109	\$343	\$171	\$216	\$166	\$88	\$359	\$134	\$119	\$89	\$147

Source: SWST330M (Efficiency)

Figure 26.6 shows the cost to divert a tonne of garbage and indicates the majority of municipalities have decreased their cost. This can be attributed to increased revenues in 2010 vs. 2009 when all municipalities experienced a decrease in revenues.

Municipal Benchmarking-2010

Thunder Bay

Total waste
stream collected

- 0.91 tonnes/household (hse)

Disposal

- 0.73 tonnes/hse

Diversion

- 0.18 tonnes/hse

Diversion %

- 31% diversion

Disposal Cost

- \$ 29/tonne

Diversion Cost

- \$ 88/tonne

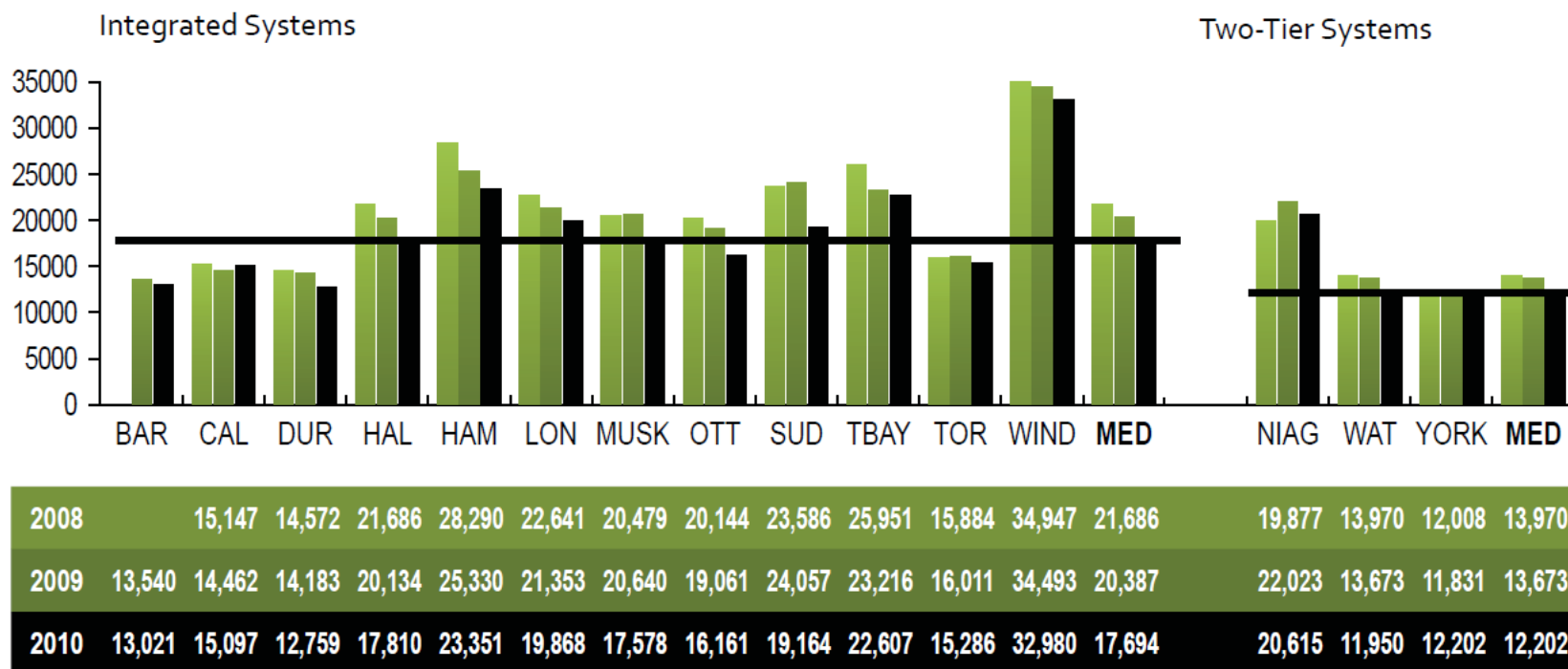
Cost for
disposal and
diversion

- \$ 37.01/hse

Wastewater – 588 cubic metres/hse/yr

How much wastewater is treated in each municipality?

Fig. 27.1 – Megalitres of Treated Wastewater per 100,000 Population (Integrated and Two-Tier Systems)



Source: WWTR210 (Service Level)

NOTE: Refer to Additional Information

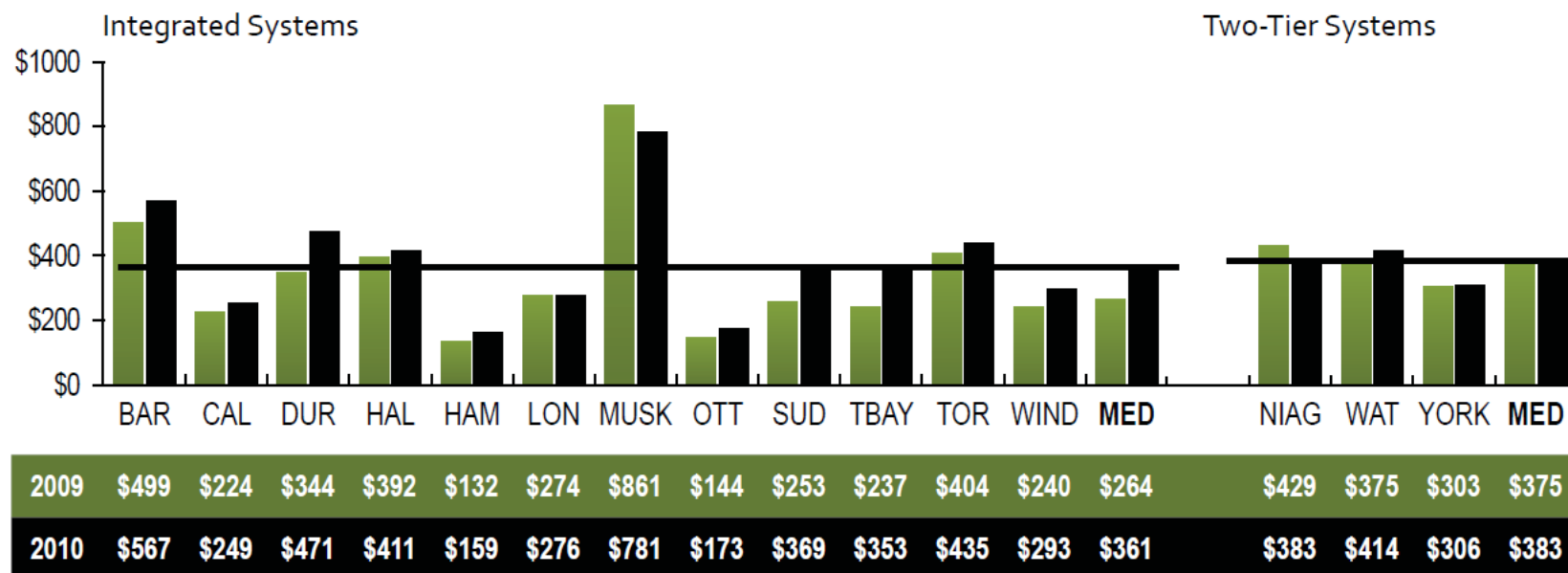
Figure 27.1 shows the volume of treated wastewater in megalitres from both residential and ICI sectors per 100,000 persons.

Based on 2.6 persons/house (2006 Census) or 38,461 households

Treatment & Disposal - \$ 207/hse/year

How much does wastewater treatment and disposal cost per megalitre?

Fig. 27.5 – Operating Cost of Wastewater Treatment and Disposal per Megalitre Treated (Integrated and Two-Tier Systems)



Source: WWTR310M (Efficiency)

NOTE: Refer to Additional Information

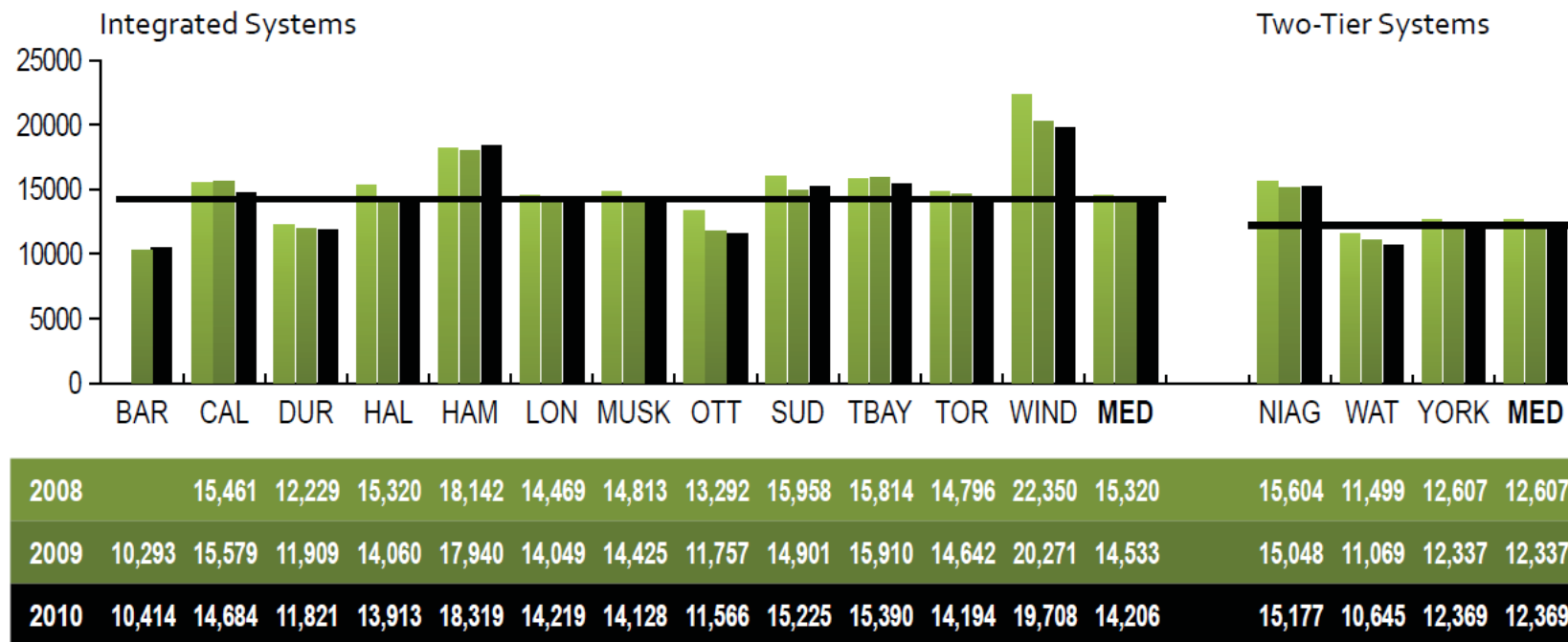
Figure 27.5 shows the cost of treating wastewater and disposing of bio-solids per megalitre of wastewater. Bio-solids are primarily organic accumulated solids separated from wastewater that have been stabilized by treatment. Wastewater is treated to meet or exceed the provincial Ministry of the Environment regulations and standards.

Based on 588 cubic metres/hse & \$ 353/cubic metre

Water – 400 cubic metres/hse/yr

How much water is treated in each municipality?

Fig. 28.1 – Megalitres of Treated Water per 100,000 Population (Integrated and Two-Tier Systems)



Source: WATR210 (Service Level)

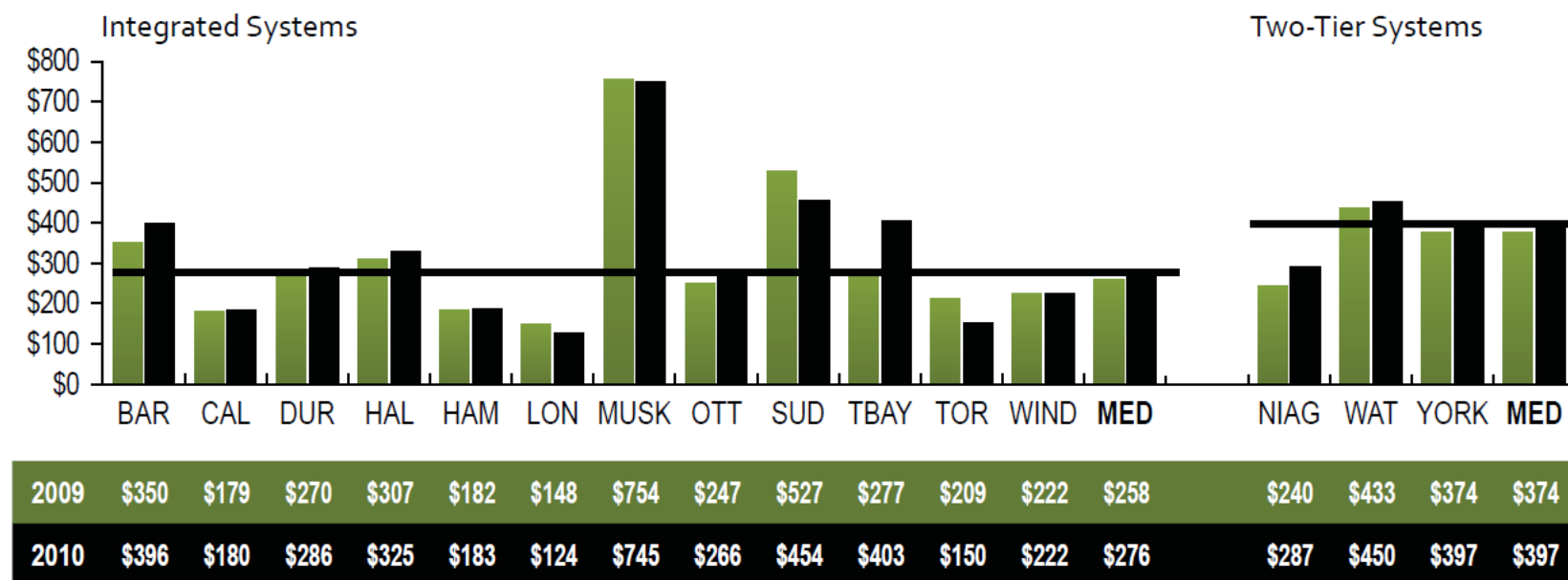
NOTE: Refer to Additional Information

Figure 28.1 shows the volume of drinking water treated per 100,000 persons. Overall demand includes water provided to the residential and ICI sectors. These volumes shown are in megalitres (one megalitre is equivalent to one million litres).

Water Treatment - \$161/hse/yr

How much does the treatment of drinking water cost?

Fig. 28.5 – Operating Cost for the Treatment of Drinking Water per Megalitre of Drinking Water Treated (Integrated and Two-Tier Systems)



Source: WATR310M (Efficiency)

NOTE: Refer to Additional Information

Figure 28.5 shows the cost of treating a megalitre of drinking water. Costs include operation and maintenance of treatment plants as well as quality assurance and laboratory testing to ensure compliance with regulations.

Based on 400 cubic metres/house and 38,461 houses

Infrastructure Comparison

- Waste & Diversion \$ 37/hse/year
- Wastewater Treatment \$ 207/hse/year
- Water Treatment \$ 161/hse/yr

The above amounts include ICI and excludes capital costs for initial infrastructure and related services – comparison is intended to show that on a household basis, some investment in managing waste properly can reduce potential negative impacts on more expensive infrastructure – all of which are required for a healthy community.

Session Objectives

- Describe how a natural attenuation landfill works
- Describe contamination sources, pathways and receptors
- Identify best practices and legislation for siting landfills
- Explain how landfills can affect the environment and human health
- Share your experiences and compare your situation with others in the session

Legislation

- Ontario Regulations don't apply on reserve lands but are referenced as best practice
- Federal regulations are very limited e.g. Indian Reserve Waste Disposal Regulations, CRC, c 960

Operational Plan

- A report & plan(s) to show the site development, operations & management, and closure.
- Identifies the total site area and ownership; outlines where waste should be placed (length, width, height) and how (type, compaction, equipment); predicts annual waste quantities and calculates remaining life for a defined servicing area; identifies potential impacts to the environment and monitoring programs for groundwater, surface water and landfill gas; outlines the closure activities once capacity is reached and post closure care.

Waste Disposal Types

- Three types of facilities (Ontario):
 - Dump
 - Natural attenuation landfill
 - Engineered landfill



Engineered Landfill

Landfilling - facility with design features typically includes: berms, drainage ditches, liners, covers, pumps, leachate control system, landfill gas control system





DUMP

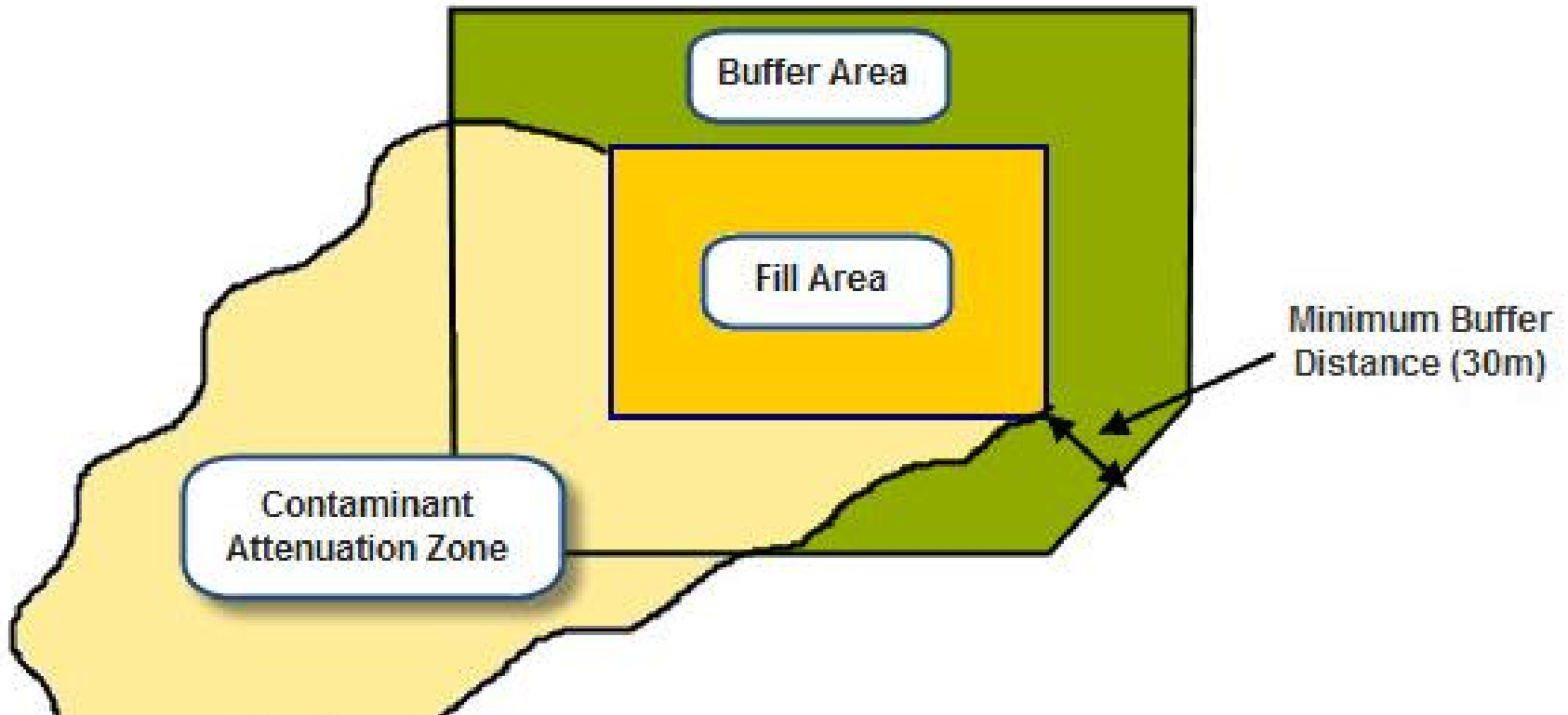
- Usually remote or isolated
- Small waste quantities and serviced population
- Large buffers manage impacts to groundwater, surface water and air quality – including landfill gas.

Natural Attenuation Landfill

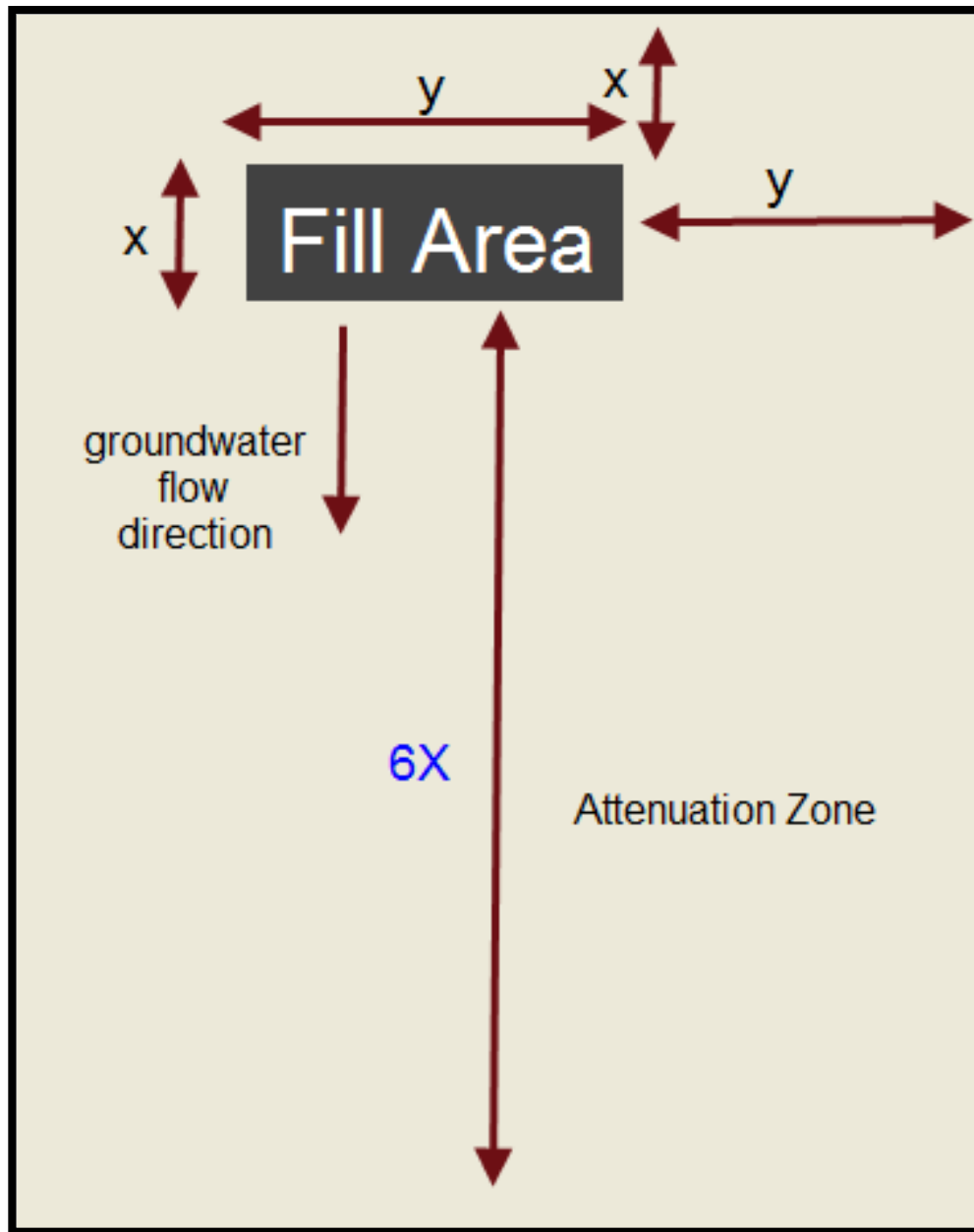
- Natural attenuation is the most common form of landfill found on reserves in Ontario.
- Natural Attenuation: The process by which a compound (i.e., leachate) is reduced in concentration over time, through absorption, adsorption, degradation, dilution and/or transformation.



Landfill Buffer Zone



Buffer zone has to be a minimum of 30 metres wide at every point (preferably 100 metres wide)



MOE
Hydrogeological
Risk Assessment
Configuration –
Northern Ontario

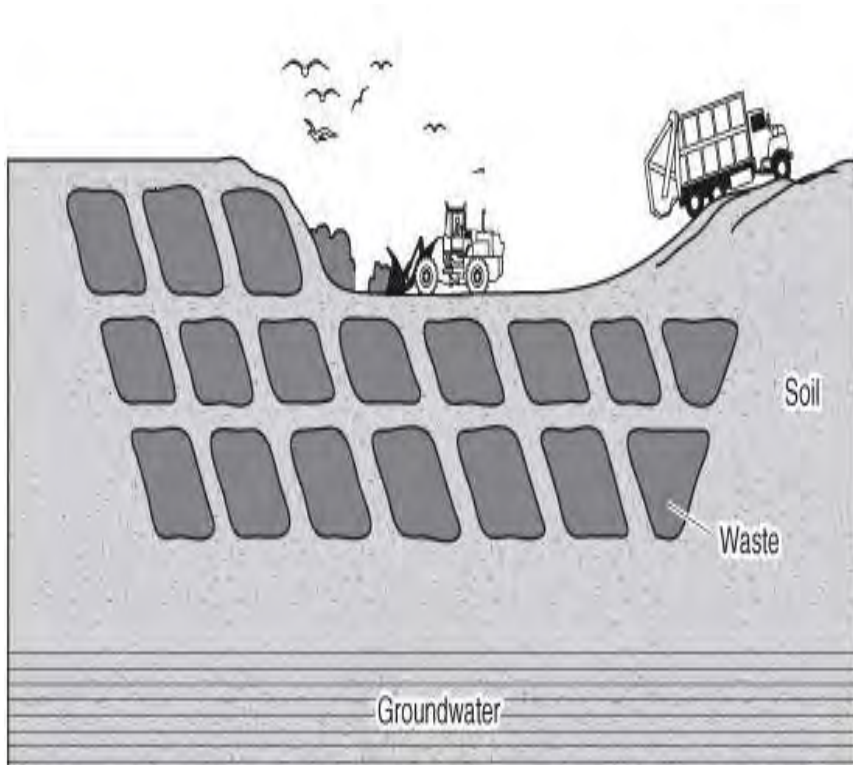
Source Water Protection

- Clean Water Act is requiring Conservation Authorities to implement Action Plan to protect vulnerable water supply sources – thus any future contaminant attenuation zone for groundwater management is likely to be prohibited within these defined areas.

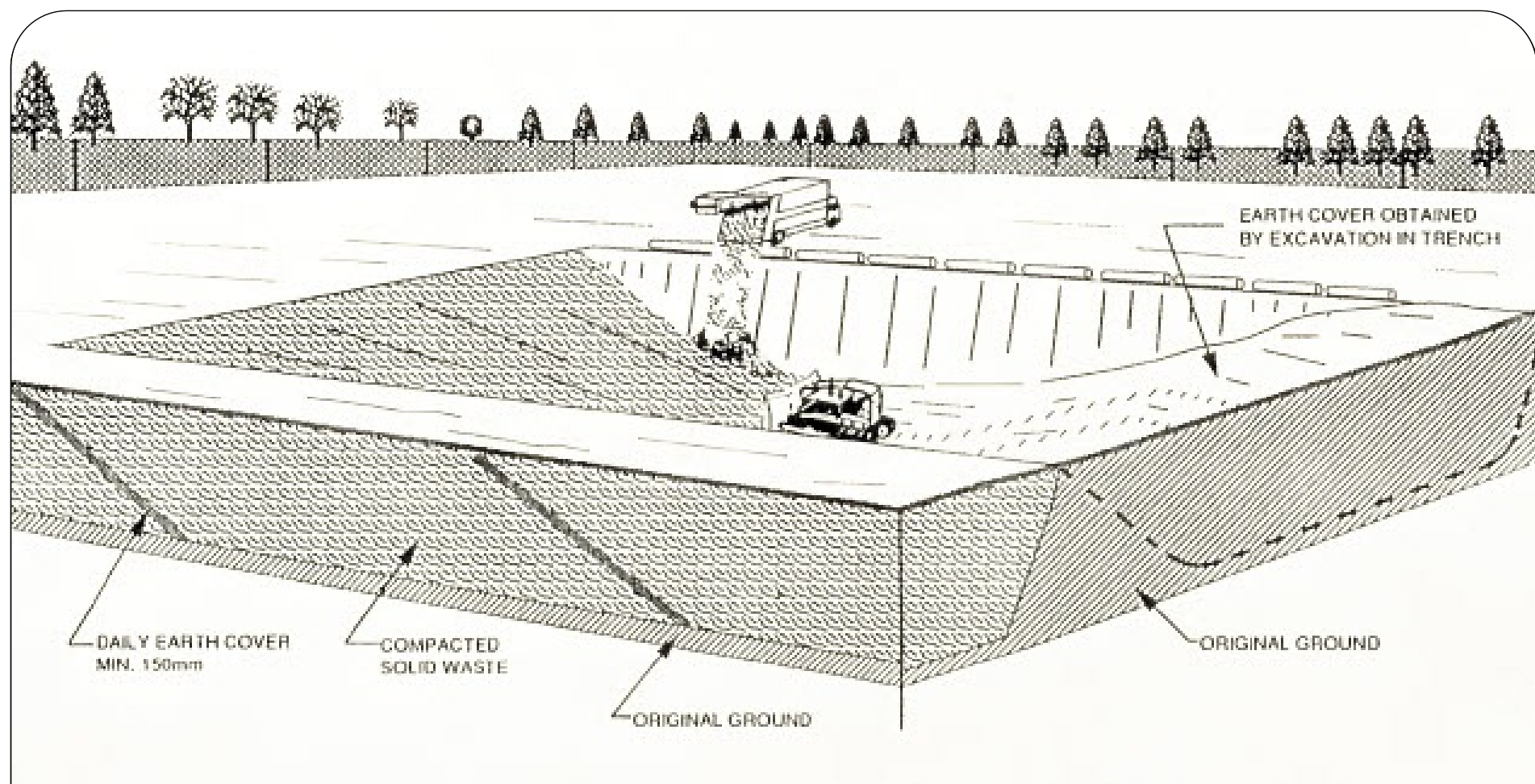
Natural Attenuation Landfill

Waste can be placed in the following ways:

- Above existing ground (area method)
- Below ground in trenches (trench method)
- Combination of both (modified area method)



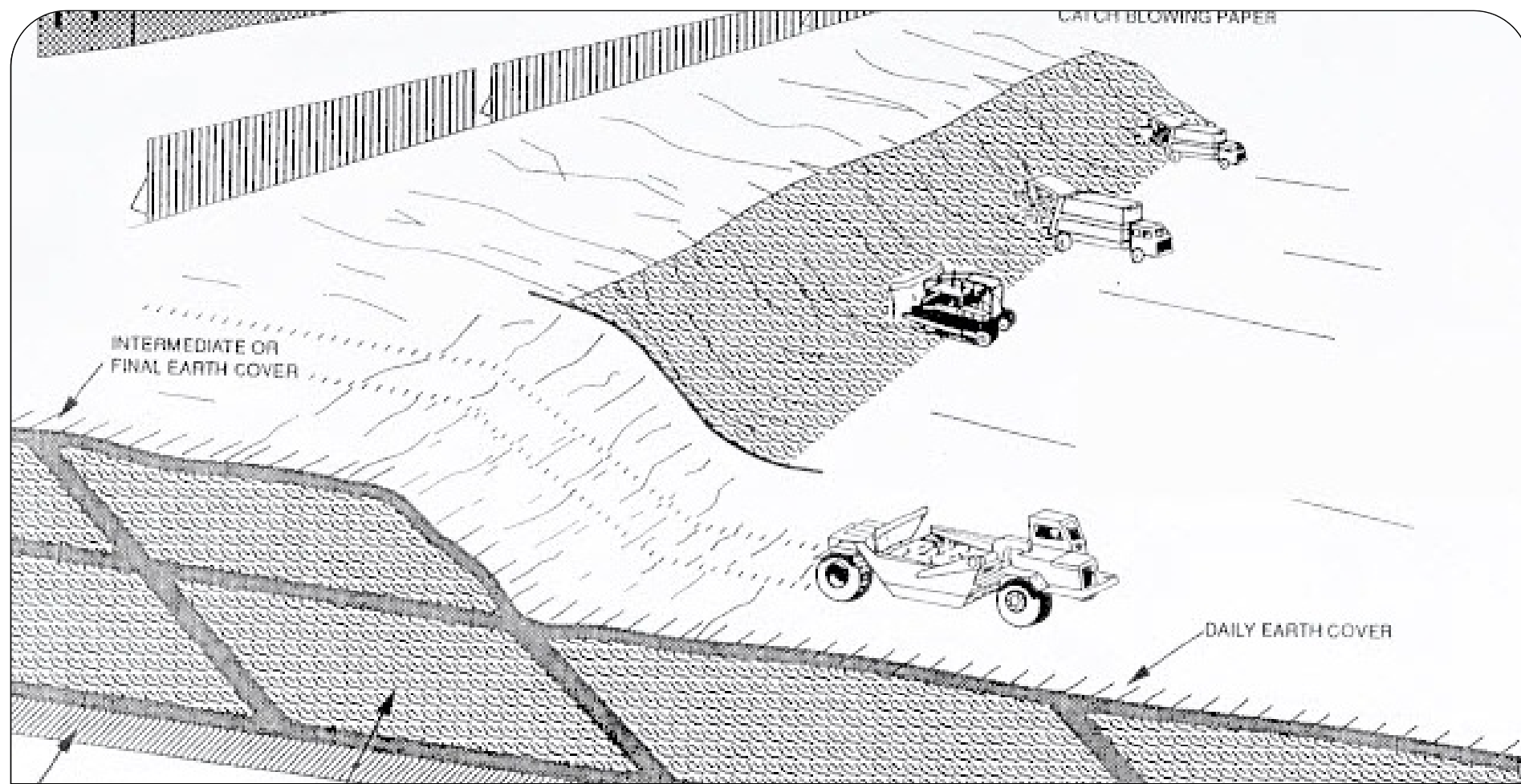
Modified Area Method



Trench Method: Advantages and Disadvantages



Cell Structure



Area Method: Advantages and Disadvantages

Methods of Waste Placement

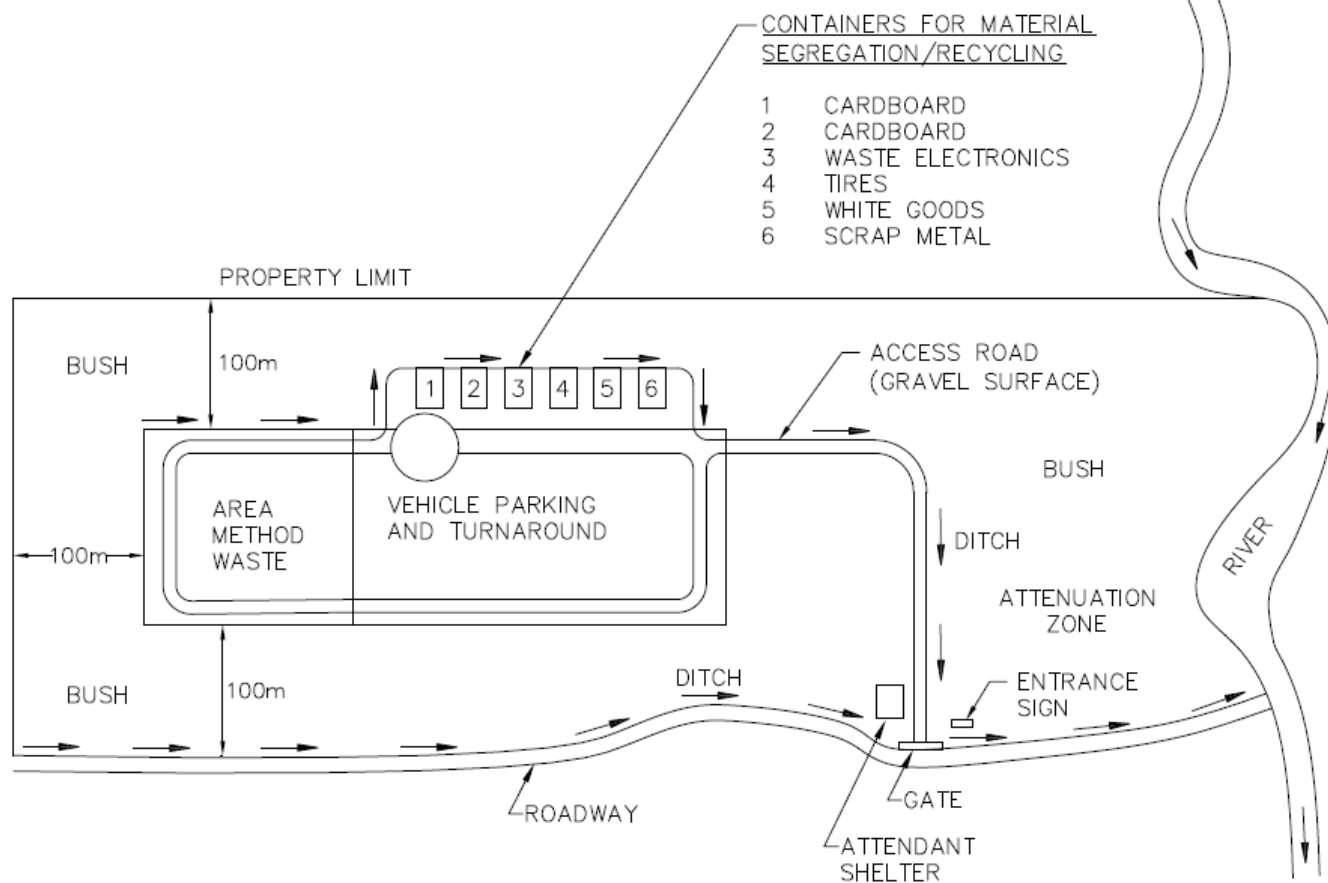
Trench Method



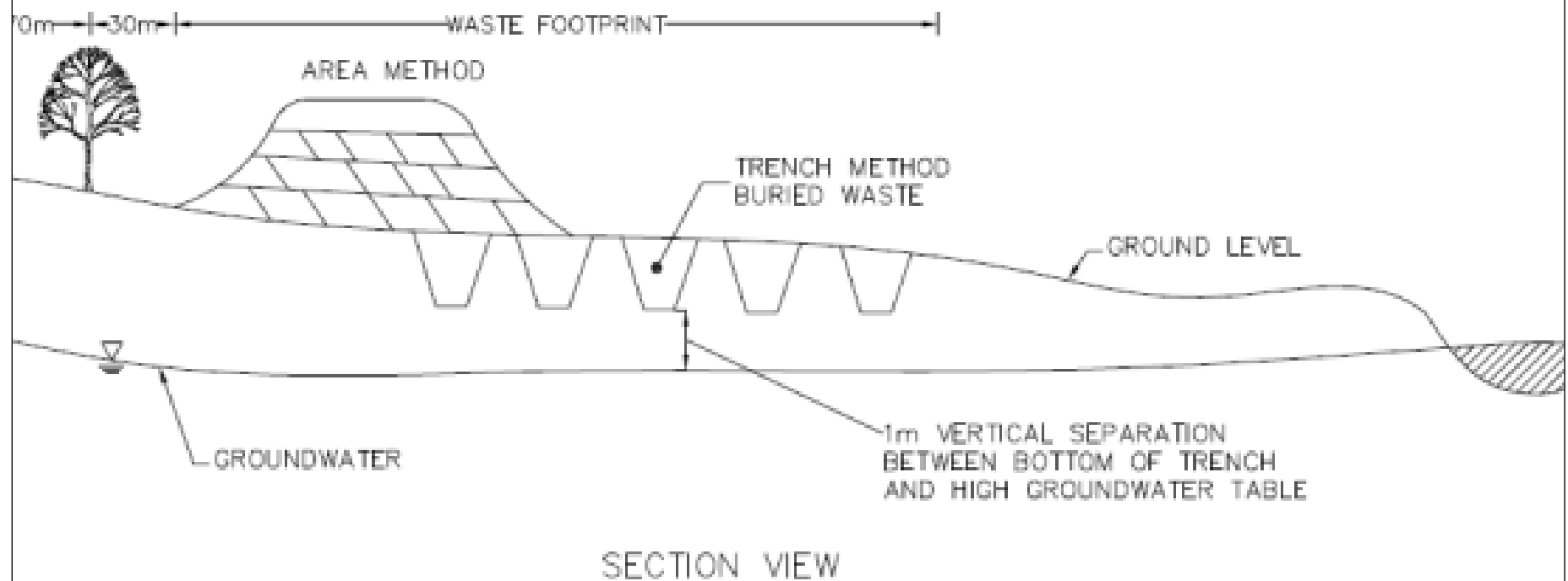
Area Method



Each method has its own advantages?



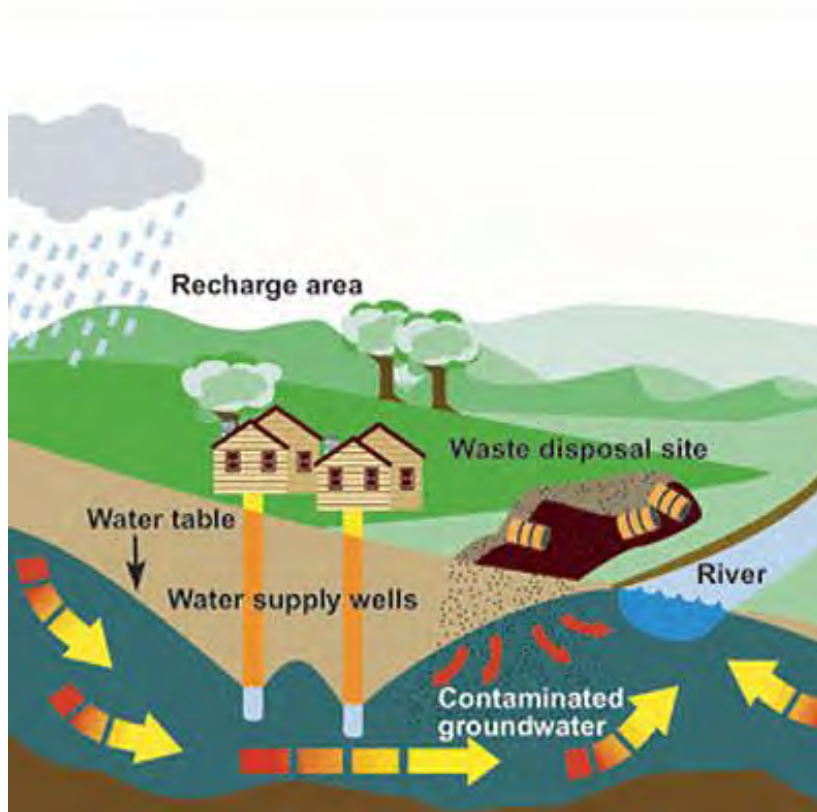
Typical Natural Attenuation Landfill
Plan View - Layout



Typical Natural Attenuation Landfill
Site Layout - Section View

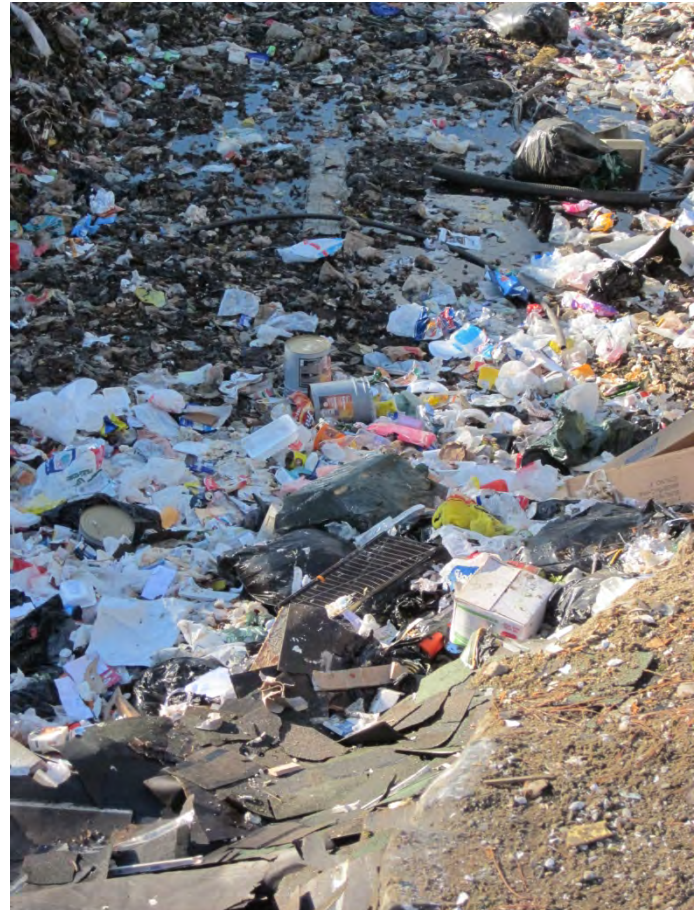
Natural Attenuation Landfill

What are potential impacts from a landfill?



Potential Landfill Impacts

- Contaminate surface water
- Contaminate groundwater
- Landfill gas
- Litter, odours, noise
- Disease-causing pests
- Public & worker health & safety





Surface Water

Runoff from landfills, if improperly diverted, can enter naturally occurring streams, lakes, or other waterways. This causes harm to local ecosystems and human health through the spread of bacteria, toxic chemicals, and heavy metals.



Groundwater

Leachate from landfills can seep underground and contaminate the underlying groundwater. Depending on how the groundwater is being used, there could be serious long-term health hazards that affect the community. Any plants, animals, birds or fish that depend on that groundwater source can also be threatened by the contamination.



Landfill Gas

Decomposition of organic wastes in landfills causes the formation of landfill gas, which is mostly methane and carbon dioxide. Landfill gas migrates through waste and the surrounding soil, and if a buildup of gas occurs, can asphyxiate humans, animals and vegetation, and can even cause explosions.

Typical Factors to Consider in Siting

- Keep receptors such as residences or other buildings away from waste
- Maintain separation distance to water wells, streams, lakes and highways
- Keep waste above groundwater table
- Waste slopes to prevent failure
- Deposit waste on gently sloping ground
- Waste to be screened from roadway
- Soils with moderate hydraulic conductivity
- Site to accommodate large buffer zone



Hydrogeological Assessment

Confirm groundwater flow direction and velocity, depth to ground-water table, groundwater quality and impact to surrounding receptors.



Screened from public view by berms, trees
or other shrubbery



Apply sufficient daily cover to minimize infiltration, reduce wind-blown debris and minimize exposure to wildlife and humans



Soil beneath waste

Soils with moderate hydraulic conductivity such as clays or silts are preferred.

Managing Surface Water

- Maximum slope of 25% on fill area
- Slope of 2% away from waste on approach
- Install diversion structures to prevent clean water draining into waste
- Protect soil stockpiles from wind
- Construct settling pond or ponding area to allow suspended solids to settle out from runoff
- Maintain healthy vegetation on side slopes to minimize erosion



Slope on Final Cover not to exceed 25%

Abundant vegetation prohibits erosion.



Provide 2% slope away from waste on approach



The active face should have a slope draining away from the waste so water doesn't infiltrate



Diversion structures should carry water away from the active face.



Soil stockpiles should be protected against erosion.



Landfill Runoff

Runoff is directed to flat area with vegetation.

Water will infiltrate into ground within 1-2 days.

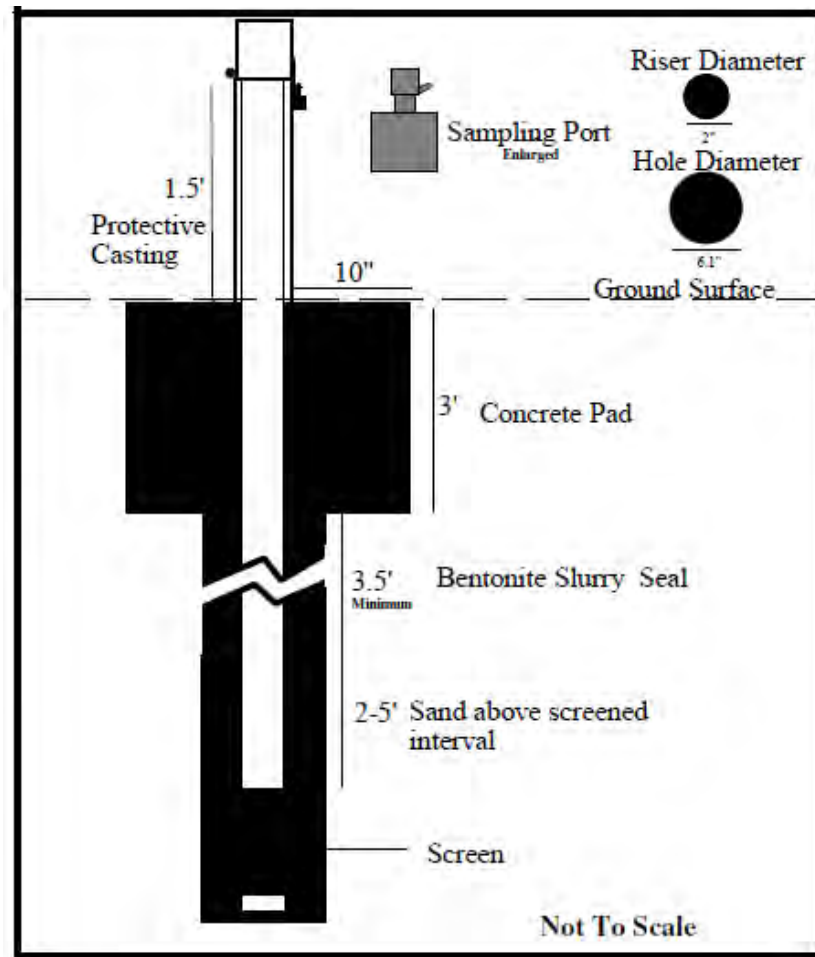
Ideal Conditions for Landfill Gas

- 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 wide on all sides to allow for natural venting.

Typical Landfill Gas Monitor Installation





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.

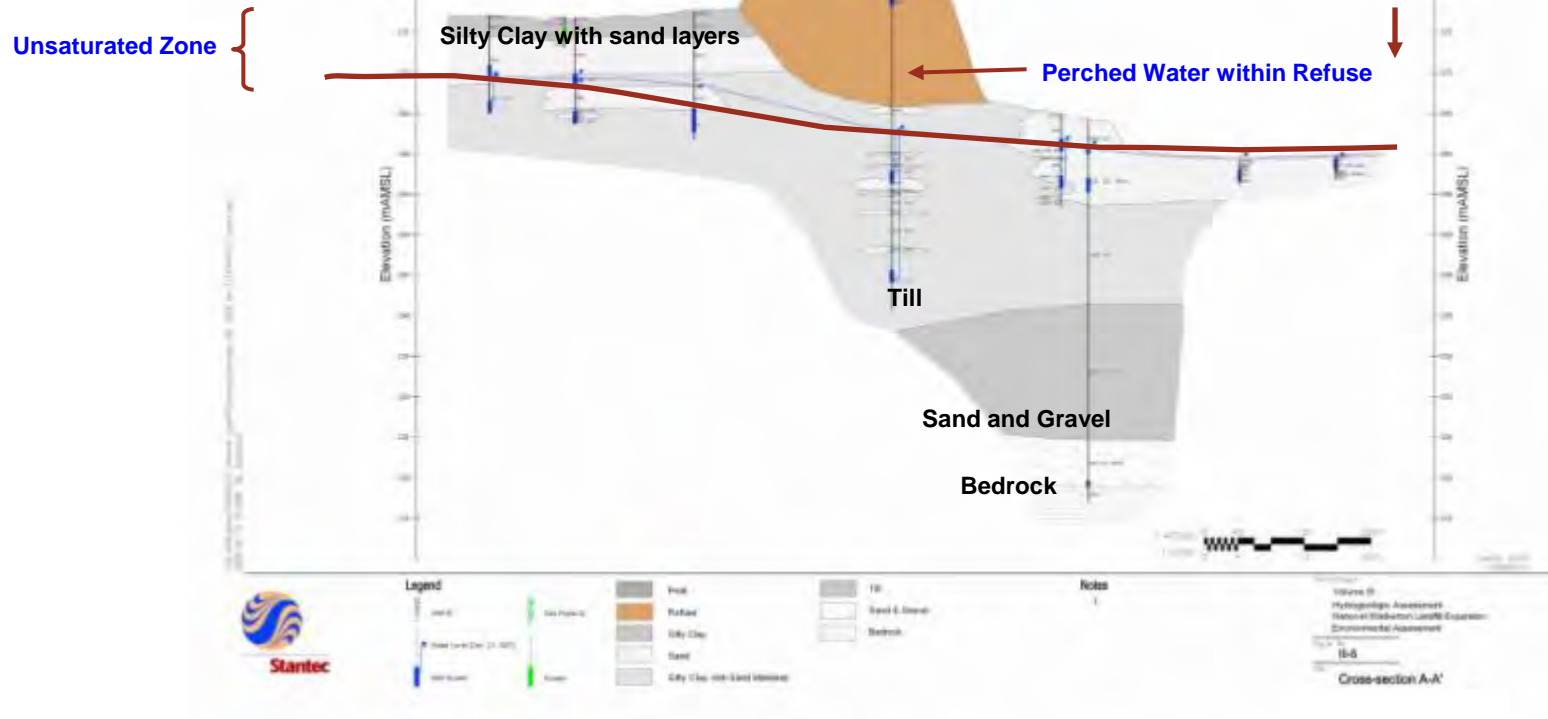
Ideal Conditions for Groundwater

- 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

Waste Placed Above Water

East

Sand





**Natural attenuation
landfills, seeps
containing iron
discharge from the
waste pile.**

- Leachate formed when water contacts waste
- May spread harmful bacteria
- Can contain toxic chemicals
- May carry heavy metals
- Depletes waterways of oxygen

Leachate

Typical water quality indicators for leachate:

- pH (5.3 – 8.5, typical 6)
- Electrical conductance (e.g. chloride 100 – 3,000)
- BOD (5-day BOD 2,000 – 30,000)
- COD (3,000 – 45,000)
- TSS (200 – 1,000)
- Ammonia (10 – 800)

Some other parameters include boron, iron, cadmium

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 features are missing ?

Ideal Conditions for Buffers

- Minimum of 30 metres but preferably 100 metres.
- Buffers provide a zone for the installation of mitigative measures, if needed.
- Contaminant attenuation Zone can reach 500 metres or more
- Maintain a separation distance from adjacent land owners.

Ideal Conditions for Signs

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

Signs





Entrance Signs

Gates and Fences

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



Page Wire Gate at Entrance



Fence for Recycling Bins



Fence for Municipal Hazardous & Special Waste



Fences for Material Storage

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



Electric Fence to deter bears and other wildlife

Ideal Drainage Features:

- Slope of 1 to 2% on ditch bottom
- Ditch back slopes to be 2H:1V or shallower depending on soil type
- Keep ditch back slopes vegetated to prevent erosion
- Diversion channels should keep water from flowing into waste – also used to lower groundwater level



Drainage ditch along toe of newly shaped final slope before seeding.

Segregation of Materials

- Most common materials include;
- Scrap metal
- Blue box materials
- Cardboard/boxboard
- White goods
- Leaf and Yard waste
- Tires



Material segregation – various methods



Waste Segregation at Landfill



Roll off containers for larger volumes

Scrap Metal Options

- Many First Nations already divert scrap metal from their landfills
- Typically have separate stockpile located at landfill that gets picked up by local scrap metal recycler
- White goods included however refrigerants/freons must be removed by an MOE certified technician.
- Revenue is generated however price fluctuates with commodity prices
- www.ontarioscrap.com provides list of companies operating in Ontario by region



Composting

- One way to recover value from waste and reduce disposal requirements: recover nutrients.
- Options: backyard, neighbourhood, centralized
- Leaf & Yard waste OK for landfill.
- Kitchen waste is a food source for animals so it needs to be buried. If waste is being transferred off site, need to use closed lid containers.



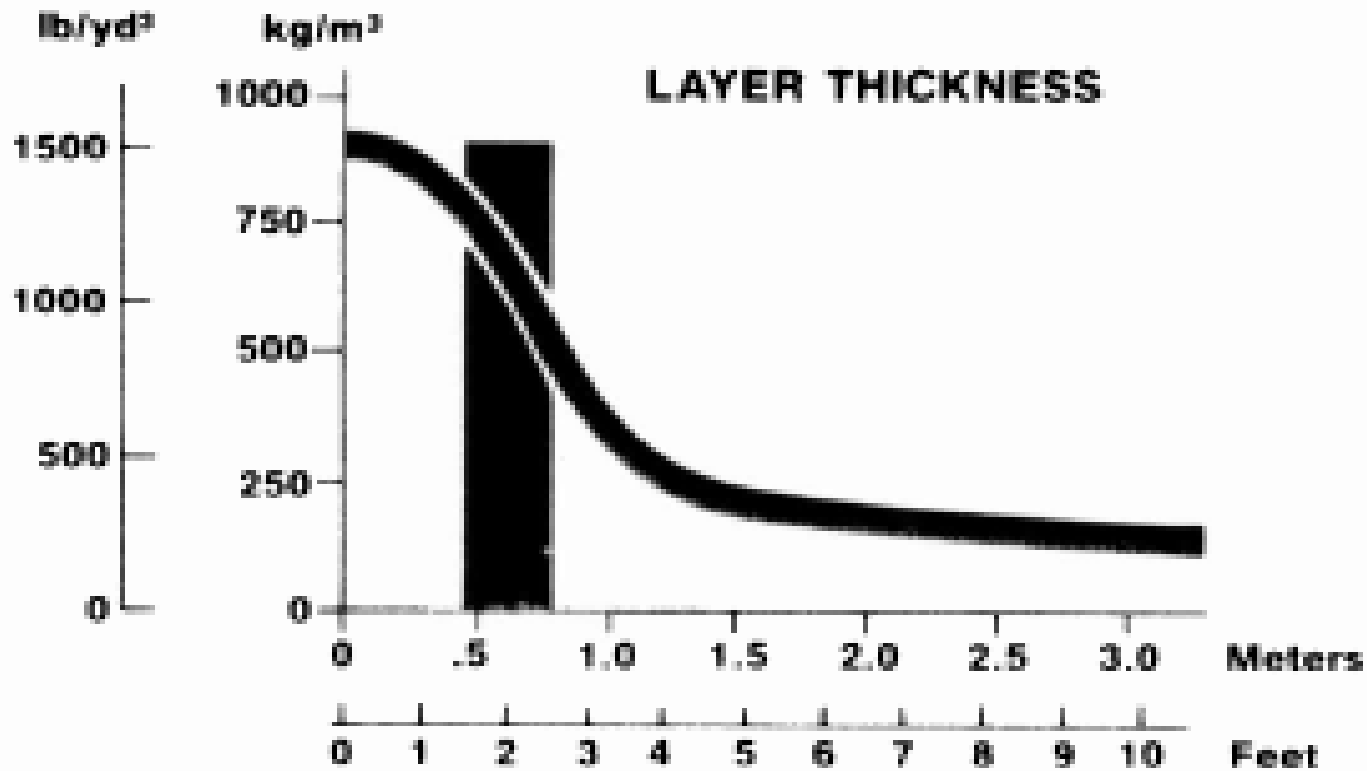
Ideal Conditions for Fill Area

- Active face size – at small sites, should be able to accommodate 5 or more vehicles at any one time
- Access road to face is in good condition – no protrusions to puncture tires
- Built against existing cells to assist with compaction
- Ground sloping away from the face for drainage

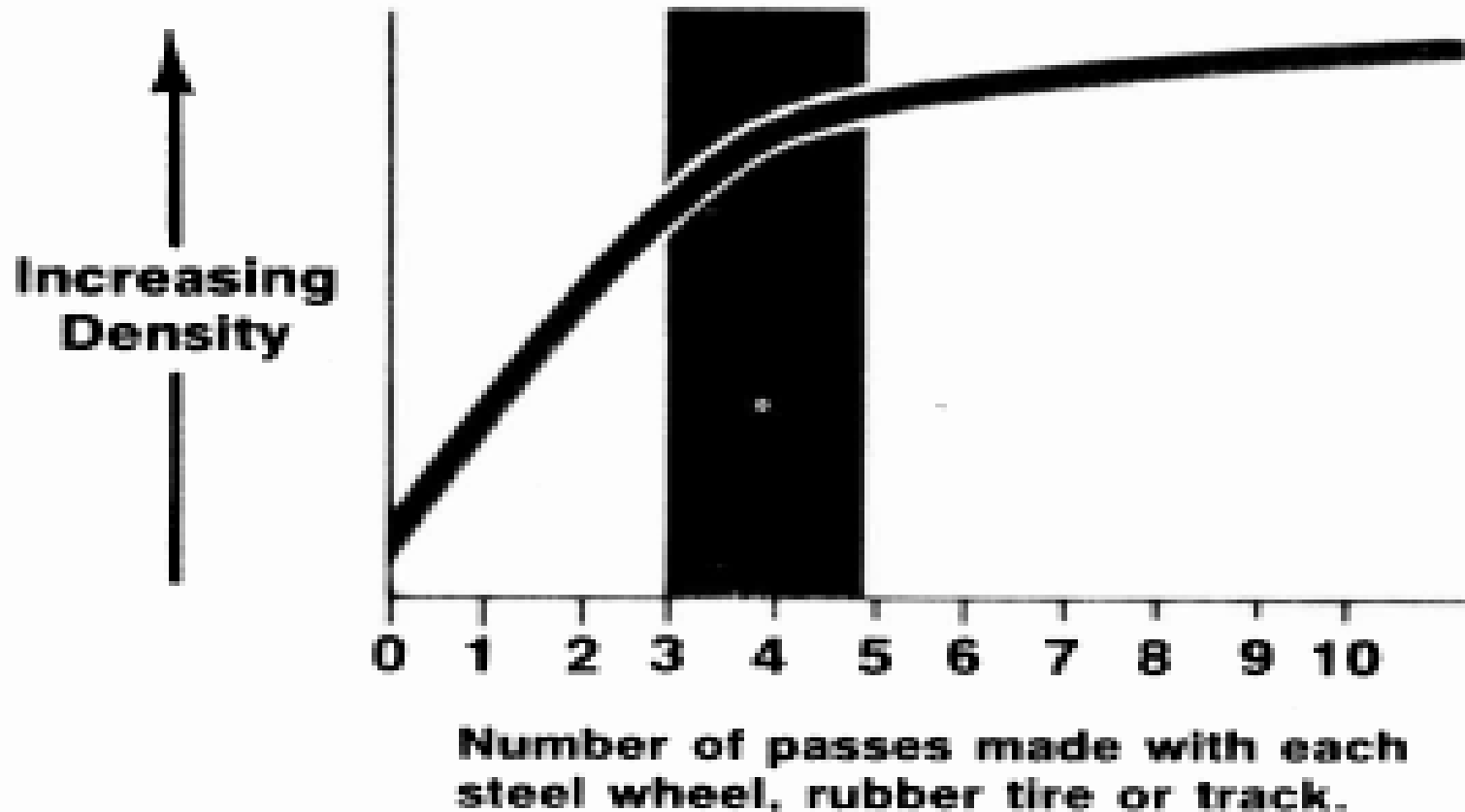


If the active face is not well defined, waste is simply deposited anywhere.

Optimum Lift Thickness



Optimum Number of Passes





Compaction

Crawler Tractor Specifications



Compactor Specifications



Equipment

Type of equipment	Function	Cost
Landfill compactor	Spreading and compacting solid waste, moving waste into the active cell, and applying daily cover. Most efficient when on flat surface Should not be operated on a slope steeper than 4H:1V for safety	New \$500,000
Crawler tractor or Bulldozer	Same functions as compactor but tracks of dozer used instead of steel wheels . Most common equipment at most sites. More versatile than compactor and is readily available from any excavation company.	New \$ 275,000
Track loaders	Best suited to trench method because it can excavate daily cover.	New \$200,000
Excavators/backhoe	Used for reshaping waste sideslopes, drainage ditches, moving material stockpiles.	New \$150,000

Best Practices for Daily Cover

- Applied on weekly or daily basis on large suites to control odours, vermin, vectors and other nuisance predators
- Minimum cover thickness is between 100 mm and 150mm (6 inches)
- Soil stockpiles should be kept near active face
- Use one part soil cover to four parts waste



Cell, Compaction and Cover Equipment



Daily Cover

Alternate Daily Cover

- Mix soil with other products on a 1:2 or 1:3 ratio
- Leaf & Yard Waste
- Shredded C&D waste
- Chipped or grounded wood products
- Asphalt shingles

Shredded wood waste



Hydrocarbon-Impacted Soil

- Some landfills reserve an area for treating hydrocarbon contaminated soil.
- Soil to be analyzed to determine whether it is hazardous (pH, flashpoint, benzene, lead, TPH)
- Spread soil in layers up to 300 mm thick over a flat portion of the waste pile
- Rework soil every few days to evaporate the volatile hydrocarbon
- After several weeks, most of the hydrocarbon has evaporated and the soil can be used for daily cover.

Safe Burning Practices

- Supervise fire until extinguished
- Have the correct equipment to extinguish fire should weather conditions change
- Fire should only be done in small manageable stockpiles and setback from trees (30m or more)
- Do not burn over previous waste
- Schedule burning when landfill is closed
- Have a contingency plan
- Inspect all wood before burning to ensure no containers that can explode are hidden



**Burning:
Do you allow
burning at
your site?**



Why Garbage Should Not Be Burned

Best Practices for Controlling Vermin

- Cover waste at least weekly – schedule covering to follow days when site is open
- Maintain fences in good condition to keep large (wild or domestic) animals away
- Encourage residents to do backyard composting to minimize organics at the landfill
- Bury dead animals (most sites prohibit dead animal carcasses).
- Use a pest control specialist to implement a bait program to control rats



Do you have
issues with
animals at
your site?

Integrated Wildlife Management

Near airports
Gulls become
troublesome



Winter Control

- Contingency plan for emergency dumping if roads are snowed in or impassable during spring thaw.
- Equipment not starting due to cold
- Alternate sources of daily cover
- Traction control due to ice
- Responding to vehicles sliding into ditch



**Spring
Conditions**



Contingency Plans – access to active face or other temporary dumping location



Winter Operations – traction may be more difficult with other types of equipment.



Cover Material in the Winter

Site Closure



Best Practices for Closure

- Follow guidelines for final slope
- Close progressively
- Apply a final cover
- Continue to monitor



Vegetation growth of final cover – control erosion

Managing the Landfill

- ✓ Procedures for accepting waste
- ✓ Signs as detriment to entry
- ✓ Staffing and Supervision
- ✓ Facilities – vandalism, landfill gas
- ✓ Inspections
- ✓ Housekeeping
- ✓ Monitoring and Reporting
- ✓ Health and Safety



Unacceptable Waste and Load Inspection



USE OF THIS
DUMP IS FOR
ON RESERVE
RESIDENTS ONLY

Illegal Dumping
Who has problems with illegal
dumping?

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 SURVEILLANCE
DUMP IS MONITORED**

Chippewas of Geamindagan

Signs



Staffing

- near entrance gate
- near dump face



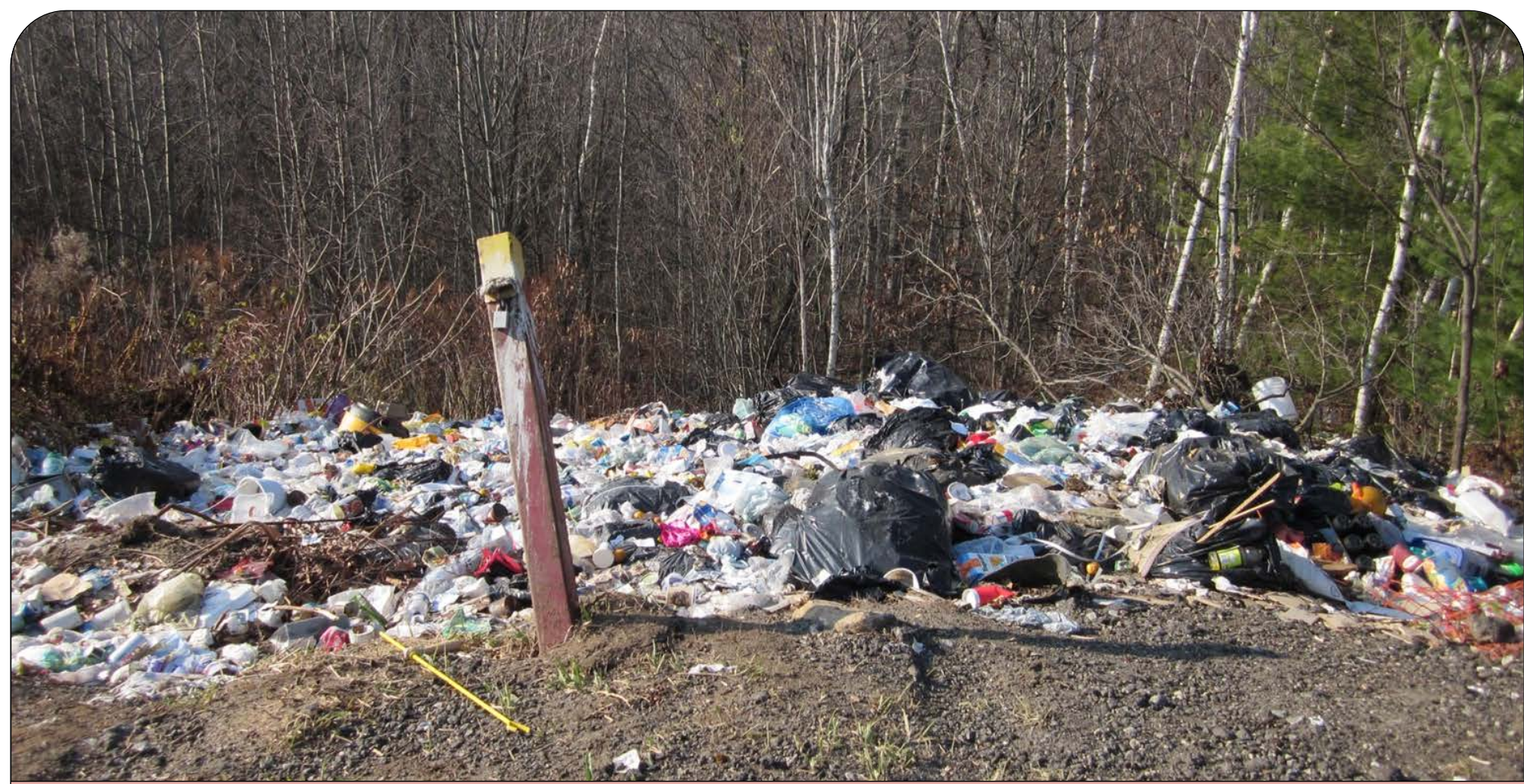
Facilities – includes shelter for custodian, weigh scales, storage shed for equipment, roll off and other containers



Litter Control



Other Considerations (Housekeeping)



Daily Site Inspection



TRANSFER STATION INSPECTION REPORT

Service Area- City of Clarence-Rockland

COPIES

Project Name: Transfer Station Inspection Report

Date: 12/11/2009

Weather: Wed/Sunny — Sat/Sunny — Sun/Sunny

Site Supervisor: Pierre Villemaire

Reviewed by: [Signature]

Date: Dec 8 2009

Item	Objective	Observation Wednesday	Observation Saturday	Observation Sunday	Other Observations/Action Required /Additional Comments
Entrance	Is site locked during non-operating hours?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	Does entrance have a neat appearance?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Gate	Access restricted through padlock & limited # of keys?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	Gate in good condition?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
	Any evidence of forced entry?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Main Entrance Sign	Sign to display; Name of site; C of A Number, Operation authority and their telephone number; Hours of operation; Emergency telephone number; Waste types accepted; warning against unauthorized access and dumping outside of site	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Hours of Operation	Hours are posted on entrance sign?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Supervision	Number of staff on site	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3	
Fence	Completed monthly inspection of fences?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Transportation	Road Surface appropriate for uses vehicles?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Custodian Shelter	Condition of Shelter: Information/signs provided for safety and emergency procedures, telephone locations and emergency contact names and numbers; fire	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

Daily Operations Checklist



Health and Safety



Training - Workplace Hazardous Materials Information System (WHMIS), First Aid and CPR training, Health and Safety training, current with tetanus vaccine

Monitoring & Reporting

- ✓ Typical groundwater monitor
- ✓ Water Level determination
- ✓ Equipment used in monitoring
- ✓ Example of a field form to record pH, temperature, sample type & lab testing
- ✓ Typical parameters for sampling
- ✓ Example for groundwater lab results
- ✓ Example for surface water lab results
- ✓ Fluctuations in parameter concentrations



Monitoring and Reporting



Groundwater casing is locked to prevent contamination



Groundwater Monitor without casing



Reel emits a sharp sound when tip of probe reaches water – technician reads level on tape.



Equipment Used in Sampling Water

Monitoring Locations





Monitoring Surface Water

Indicate to:
(if different from above)

Sample ID	* Date/Time Collected	Sample Matrix i.e. Water, Soil, Paint	* Sample Type (see Codes below)	* MOE Reportable? Y = Yes N = No	# of Containers	** Service Required R = Rush S = Standard	QUOTE 100747	TEMP		Criteria Required (i.e. Reg. 170, Reg. 153, CCME, PWDO etc.) Include sub-categories if appropriate	Laboratory Identification
BH96-1	May 12/10	W	RW	N	6	S	✓	7.6	7.20		
BH96-2/1	↓	↓	↓	↓	↓	↓	↓	8.4	7.24		
BH96-2/2		↓	↓	↓	↓	↓	↓	7.3	7.07		
BH96-3		↓	↓	↓	↓	↓	↓	7.7	7.53		
BH96-4		↓	↓	↓	↓	↓	↓	7.6	8.44		
BH07-015		↓	↓	↓	↓	↓	↓	7.4	7.45		
BH07-01D		↓	↓	↓	↓	↓	↓	8.6	7.41		
GW-DUP		↓	↓	↓	↓	↓	↓	7.6	8.44		
* HEAVY METAL FIELD FILTERED											

Sample Type Codes for Drinking Water Systems: **RW** = Raw Water, **RWFC** = Raw Water For Consumption, **TW** = Treated Water at point of entry to distribution, **DW** = Distribution/Plumbing Water
 "MOE Reportable" refers to the requirements under the SDWA for immediate reporting of results, which are indicators of adverse water quality, to the Owner/Operator, MOE, and MOH Medical Officer.

Sampled By: Print: <i>P. J. J.</i> Sig: <i>[Signature]</i>	Date/Time: <i>May 12/10</i>	Relinquished By: Print: _____ Sig: _____	Date/Time: _____	Comments <i>include QA & QC DATA IN Report</i>	Cooler Temp (°C) on Receipt <i>9.0</i>
Work Authorized By (signature): Print: _____ Sig: <i>[Signature]</i>	Date/Time: _____	Received By Lab: Print: <i>[Signature]</i> Sig: _____	Date/Time: <i>May 12/10</i>		
* Indicates a required field. If not complete, analysis will proceed only on verification of missing information. A quotation number is required, if one was provided. ** There may be surcharges applied to "Rush" service. Please check with lab prior to submission of samples for rush analysis to confirm availability and pricing.					

Page ____ of ____

AFCOCR.2

Copies: White - Laboratory, Yellow - With Report, Pink - Sampler

Field form identifies location, sample type, temperature, pH, other comments.

Laboratory Parameters for Surface and Ground Water

QUANTITY	PARAMETER	UNIT PRICE	EXTENDED COST
66	Package Price, Includes:	172.00	11,352.00
66	ICP 28 Element Scan		
66	Cr(VI) - water		
66	ANION Scan - 6		
66	Alkalinity		
66	Hardness - Calculation		
66	BOD5		
66	COD		
66	DOC		
66	TKN - water		
66	N-NH3 - water		
66	TDS - (COND-CALC)		
66	TSS		
66	Hydrogen Sulfide		
66	Turbidity		
			Sub Total: 11,352.00
			GST (7%): 794.64
			Total Cost: 12,146.64

Groundwater impacts ?

Parameters

Alkalinity

Chloride

Ammonia

Total Kieldahl

Nitrogen(TKN)

Boron

Iron

Chain of Custody Number:			Matrix:				
LAB ID:			838833	838834	838835	838836	838837
Sample Date:			2010-10-20	2010-10-20	2010-10-20	2010-10-20	2010-10-20
Sample ID:			BH96-1	BH96-2/2	BH96-3	BH96-4	BH07-1D
PARAMETER	UNITS	MRL					
Alkalinity as CaCO3	mg/L	5	446	279	309	81	238
Chloride	mg/L	1	97	4	<1	2	<1
Conductivity	uS/cm	5	1180	524	775	184	442
Fluoride	mg/L	0.1	<0.10	0.10	0.14	0.16	0.14
Hydrogen Sulphide	mg/L	0.01	1.40	<1	<1	1.70	<10
N-NH3 (Ammonia)	mg/L	0.02	2.17	4.99	<0.02	0.04	0.39
N-NO2 (Nitrite)	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10
N-NO3 (Nitrate)	mg/L	0.1	<0.10	<0.10	0.29	<0.10	<0.10
Sulphate	mg/L	1	46	<1	104	13	6
Total Dissolved Solids (COND - CALC)	mg/L	5	767	341	504	120	287
Total Kjeldahl Nitrogen	mg/L	0.1	3.27	5.74	<0.10	<0.10	0.68
Turbidity	NTU	0.1	100	>100	86.0	>100	>100
Hardness as CaCO3	mg/L	1	515	265	306	94	231
Calcium	mg/L	1	165	83	65	26	58
Magnesium	mg/L	1	25	14	35	7	21
Potassium	mg/L	1	6	6	6	<1	3
Sodium	mg/L	2	59	8	65	<2	8
Aluminum	mg/L	0.01	0.01	0.07	0.05	0.17	0.08
Antimony	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.001	<0.01	<0.001	<0.001	<0.001	<0.01
Barium	mg/L	0.01	0.06	0.19	0.03	0.01	0.02
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	mg/L	0.01	0.23	0.07	0.04	<0.01	0.02
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	0.005	0.005	0.002	0.003	0.004
Cobalt	mg/L	0.0002	0.0049	0.0043	0.0088	0.0110	0.0011
Copper	mg/L	0.001	<0.001	<0.001	0.001	0.001	<0.001
Hexavalent Chromium (Cr(VI))	mg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	0.03	10.8	66.3	0.05	0.14	0.34
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Surface Water Impacts?



Chain of Custody Number:

Matrix:

			LAB ID:	838840	838841	838842	838843	838844
			Sample Date:	2010-10-20	2010-10-20	2010-10-20	2010-10-20	2010-10-20
			Sample ID:	SW-1T	SW-3	SW-5	SW-7	SW-8
PARAMETER	UNITS	MRL						
Cadmium	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001		0.006	0.001	0.001	0.001	0.002
Cobalt	mg/L	0.0002		0.0015	0.0003	0.0003	0.0003	0.0004
Copper	mg/L	0.001		0.001	<0.001	<0.001	0.002	0.002
Hexavalent Chromium (Cr(VI))	mg/L	0.05		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	0.03		23.3	1.50	0.39	0.30	0.54
Lead	mg/L	0.001		<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.01		0.83	0.21	0.31	0.03	0.07
Mercury	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.005		<0.005	<0.005	<0.005	<0.005	<0.005
Nickel	mg/L	0.005		0.006	<0.005	<0.005	<0.005	<0.005
Selenium	mg/L	0.001		<0.001	<0.001	<0.001	<0.001	<0.001
Silver	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium	mg/L	0.001		1.54	0.219	0.725	0.457	0.438
Thallium	mg/L	0.0001		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Titanium	mg/L	0.01		<0.01	<0.01	<0.01	0.01	0.02
Vanadium	mg/L	0.001		0.011	0.002	0.003	0.003	0.004
Zinc	mg/L	0.01		<0.01	<0.01	<0.01	<0.01	0.01
Alkalinity as CaCO3	mg/L	5		1040	232	368	228	228
Biochemical Oxygen Demand	mg/L	1		12	<1	4	<1	1
Bromide	mg/L	0.25		0.38	<0.25	<0.25	<0.25	<0.25
Chemical Oxygen Demand	mg/L	5		90	10	45	35	60
Chloride	mg/L	1		99	26	19	21	23
Conductivity	uS/cm	5		2260	563	809	551	554
Dissolved Organic Carbon	mg/L	0.5		34.9	5.7	11.6	10.1	10.6
Fluoride	mg/L	0.1		0.13	<0.10	0.12	0.15	0.15
Hydrogen Sulphide	mg/L	0.01		<0.01	0.01	0.01	<0.1	<0.1
N-NH3 (Ammonia)	mg/L	0.02		56.8	0.03	0.65	0.02	0.03
N-NO2 (Nitrite)	mg/L	0.1		<0.10	<0.10	<0.10	<0.10	<0.10
N-NO3 (Nitrate)	mg/L	0.1		1.10	0.12	0.16	2.85	2.85
O-PO4 (Ortho-Phosphate)	mg/L	0.03		<0.03	<0.03	0.14	0.11	0.12
Sulphate	mg/L	1		91	28	50	24	23
Total Dissolved Solids (COND - CALC)	mg/L	5		1470	366	526	358	360
Total Kjeldahl Nitrogen	mg/L	0.1		63.3	0.18	1.15	0.74	0.93
Total Phosphorus	mg/L	0.01		0.05	0.01	0.07	0.06	0.19
Total Suspended Solids	mg/L	2		127	3	13	10	46
Turbidity	NTU	0.1		>100	9.1	6.0	14.6	27.0
Hardness as CaCO3	mg/L	1		799	272	396	256	252
Calcium	mg/L	1		236	81	124	73	73
Magnesium	mg/L	1		51	17	21	18	17
Potassium	mg/L	1		63	1	11	3	3
Sodium	mg/L	2		99	10	17	13	12
Aluminum	mg/L	0.01		0.02	0.06	<0.01	0.30	0.45
Antimony	mg/L	0.0005		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	0.001		<0.01	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.01		0.36	0.03	0.08	0.05	0.06
Beryllium	mg/L	0.001		<0.001	<0.001	<0.001	<0.001	<0.001
Boron	mg/L	0.01		0.99	0.01	0.40	0.04	0.04

Parameters

Iron

Alkalinity

Conductivity

Ammonia

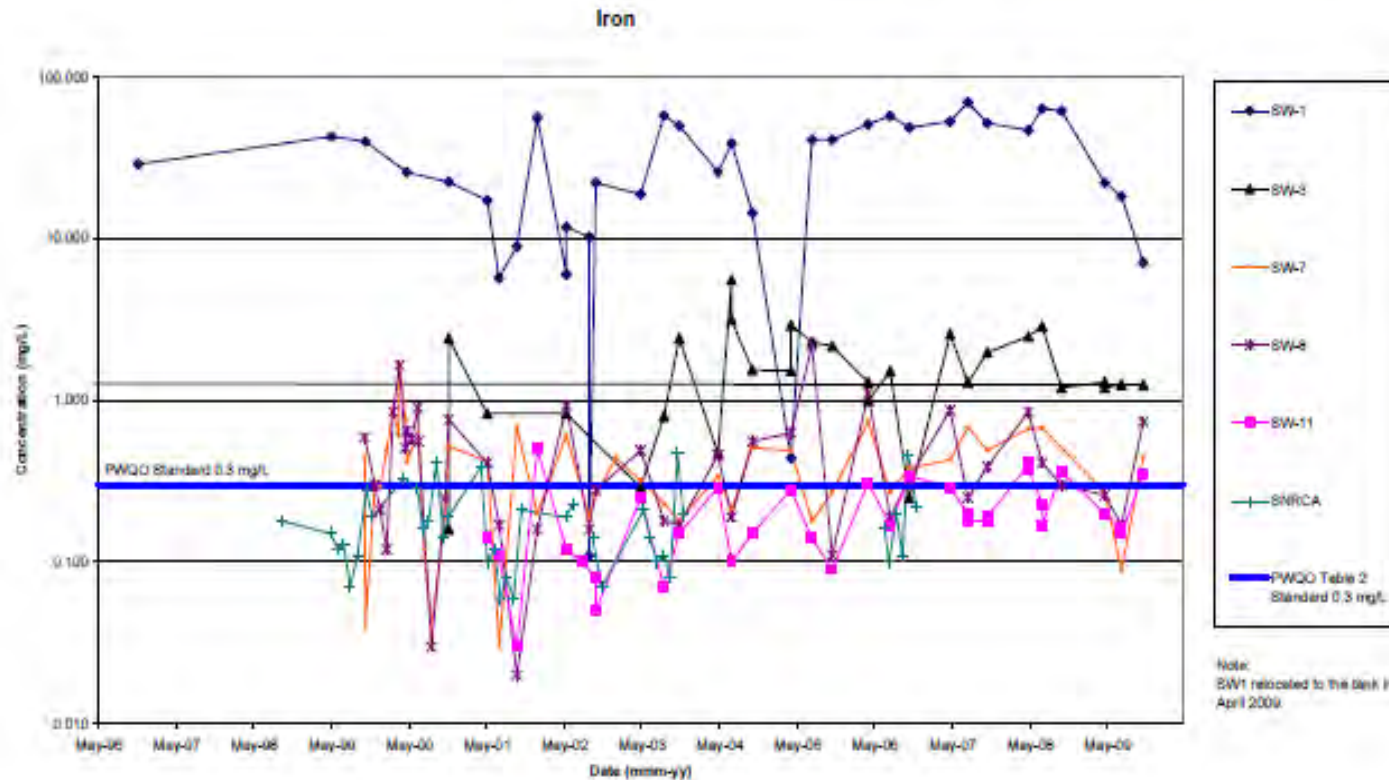
Dissolved Solids

TKN

Suspended Solids

Boron

Iron as a Leachate Indicator



Waste Diversion Initiatives

- ✓ Waste Electronics and Electrical Equipment
- ✓ Ontario Used Tire Program
- ✓ Municipal Hazardous & Special Waste
- ✓ Used Oil

Ontario's WEEE Program

- Ontario program commenced April 2009 (revised in 2010)
- Waste Electronics & Electrical Equipment (WEEE) includes: Household appliances, IT equipment, Telecom equipment, and Audiovisual equipment
- Full EPR = no longer charge for individual to dispose of waste electronics
- IFO = Ontario Electronics Stewardship (OES)



WEEE at Rural Landfill



Ontario's Used Tires Program

- Ontario program commenced Sept. 1, 2009
- Includes all motor vehicle tires, off road, and industrial tires
- Full EPR = no longer charge for individual to dispose of used tires
- IFO = Ontario Tires Stewardship (OTS)
- First Nations program options:
 - **Register with OTS as a Collector**
 - **Register as Generator only** – OTS hauler pick up of band operations generated tires at no charge
 - **Return to retailer**



Ontario's Municipal Hazardous or Special Waste (MHSW)

- These items contain toxic ingredients and should be used and disposed of with caution
- Ontario's MHSW Program requires companies that manufacture and market these products to take stewardship responsibility = full EPR
- Consultations currently on a revised program.
- IFO = Stewardship Ontario
- Materials include: paints, solvents, oil filters, empty oil containers, dry cell batteries, anti-freeze, fertilizers, pesticides, and pressurized containers such as propane tanks



MHSW Options

- Two main options:
 - MHSW Day or Depot
 - Direct members to “Return to Retailer”
- To support your program ban MHSW from landfill and educate about proper disposal (e.g. don't pour it down drains!)
- If you are operating or would like to operate an MHSW collection program: Register with Stewardship Ontario to act as collection agent for Phase 1 MHSW
 - No reimbursement of collection costs
 - Pick up of Phase 1 MHSW at no charge or reimbursement of contracted post-collection costs



When in doubt, don't throw it out
Make the Drop

Used Oil Options

- There is no Ontario program
- Diversion options include
 - Collect and have removed from FN by a licensed recycler
 - Collect and burn as a fuel in a suitable furnace
 - Direct individuals to drop off at service station
- Some First Nations have a used oil recycling tank at their landfill or public works garage which is picked up at no or a minimal charge by an oil recycling company.



Landfill Bans

Other material to consider banning:

- Polychlorinated Biphenyls (PCBs)
- Bulk Liquid Wastes (possible exceptions: sewage sludge, grease)
- Septage materials pumped from a septic tank (in Ontario acceptable if meets “slump test” not USEPA Paint Filter Liquids Test)
- Refrigerant Containing Waste
- Radioactive Waste (household smoke detectors) – return them to the retailer e.g. Home Depot)
- Blood borne Pathogen Waste (check with your EHO)
- Asbestos (sealed in yellow bags, buried immediately)
- Other possible materials: Batteries, Sludges, Ashes

Report to Council/Community

- Monthly summary of operational issues at the landfill
- Prepared by the person responsible for waste management
- Should include any of the following:
 - Labour problems with employees
 - Incidents where an injury occurred
 - Mechanical breakdown with equipment
 - Issues with suppliers of material (daily cover)
 - Significant improvements needed to building
 - Complaints or illegal dumping