FACTSHEET

AGRICULTURAL ENGINEERING

ORDER NO. 07-035

AUGUST 2007

AGDEX 751

Ontario Ministry of Agriculture, Food and Rural Affairs

ASSESSING THE POTENTIAL FOR GROUND WATER CONTAMINATION ON YOUR FARM

(Replaces OMAFRA Factsheet *Assessing the Potential for Ground Water Contamination on Your Farm,* Order No. 97-017*)*

Robert P. Stone, James P. Myslik

INTRODUCTION

Good water quality is a high priority for all rural residents. Since drinking water is usually obtained from ground water sources, every effort should be made to protect these ground water sources from contamination. Potential contaminants from agriculture such as pesticides, milking centre washwater, manure and silage leachate can pose a threat to ground water quality if not properly managed.

Figure 1. All rural residents want a safe drinking water supply.

Reducing the risk of contamination from your property takes careful planning. A first step in planning is knowing what you've got and what risk it poses. The potential for ground water contamination once a contaminant enters the soil varies from farm to farm and depends on many factors.

This Factsheet discusses the key factors affecting contaminant movement towards the ground water as well as provides a simple risk assessment procedure so that you can more effectively plan corrective actions and management practices.

GROUND WATER CONTAMINATION

The quality of ground water is degraded when water carries contaminants downward infiltrating through the soil to the ground water without being adequately filtered or naturally treated. Once a ground water aquifer is contaminated, all water wells drawing water from that aquifer are at risk of being polluted. A contaminated water well can result in health problems and a costly cleanup process.

Factors Affecting the Movement of Contaminants to the Ground Water

The potential for ground water contamination and subsequent water well pollution depends on many factors. The following three key factors are the focus of this Factsheet:

1. soil texture
2. depth to bedrock
3. depth to ground water

1. Soil Texture

The texture of the soil is the most important determining factor in measuring the ease and speed with which water and contaminants can move through the soil to ground water. Coarse textured soils such as sands have large pore spaces between the soil particles, allowing water to quickly percolate downward to the ground water. There

is minimal time in which filtration and/or natural treatment of the water can take place. Conversely, in fine textured soils such as clays, the movement of water and contaminants through the soil is very slow. These fine textured soils act as a natural filter, allowing bacteria and other soil organisms to break down contaminants before they reach the ground water. Fine textured soils provide much better natural protection for ground water than coarse grained soils.

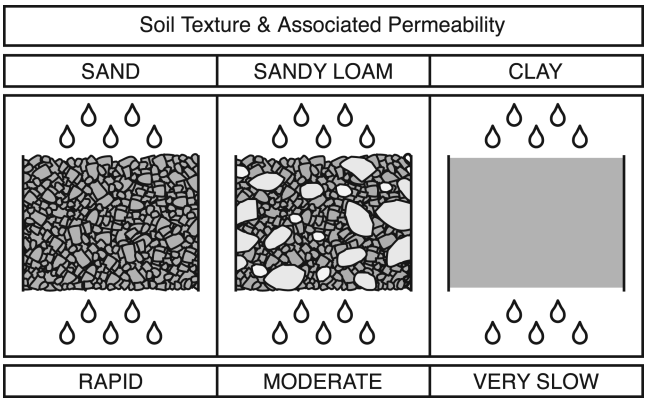

Figure 2. Soil texture and associated permeability.

2. Depth to Bedrock

Open fractures in the bedrock allow a rapid movement of water and contaminants to the ground water. If the depth of soil over the bedrock is shallow, there is little opportunity for the soil or soil organisms to treat the water as it moves through this shallow layer of soil to the bedrock. Once the water and contaminants reach the bedrock, movement to the ground water is often very swift.

3. Depth to Ground Water

The treatment of contaminated water primarily takes place in soil above the water table (the unsaturated zone of soil). A high water table results in a short travel time for water and contaminants to move through this unsaturated soil before reaching the ground water, therefore, there is little opportunity for the treatment of water to occur. Water table depths can fluctuate dramatically depending on the season of the year. The water table is usually the highest in the spring or fall.

ASSESSING THE POTENTIAL FOR GROUND WATER CONTAMINATION

On the farm, there are many potential sources of contaminants. They are usually classified as point sources where potential contaminants are concentrated or stored in one spot (e.g., manure piles, fuel storages, etc.) or non-point sources where the potential contaminants are spread out over a greater area (e.g., pesticide or fertilizer applied to fields). Regardless of the source, some farms or areas of farms may be much more susceptible to ground water contamination if contaminants enter the ground. Table 1 is a simple approach to estimate the potential for ground water contamination. Please note that this assessment method is only intended to be a guide to what might happen taking into account the three factors previously discussed — soil texture, bedrock, and depth to ground water. The primary consideration is the relative speed with which contaminants might move through the soil. It is assumed that the soil profile is uniform and not layered.

Table 1. Potential for Ground Water Contamination[1]

Hydrologic Soil Group (Soil Texture)	Depth to Ground Water			
	Less than 0.9 m (3 ft)	0.9–4.5 m (3–15 ft)	4.6 –13.5 m (16–45 ft)	Greater than 13.5 m (45 ft)
Bedrock (within 0.9 m) (3 ft)	1	1	1	1
Muck/Organic	1	—	—	—
Rapid (Sand)	1	1	1	2
Moderate (Loam)	1	1	2	3
Slow (Clay Loam)	1	2	3	4
Very Slow (Clay)	1	3	4	4

1 – High; 2 – Moderate; 3 – Low; 4 – Very Low are ratings of the potential for ground water to become contaminated if there is a spill or leak of a contaminant.

To determine a site's potential for ground water contamination, find the texture of your soil in the first column and move horizontally to the appropriate "Depth to Ground Water" column.

The following guidelines may be helpful in using Table 1:

1. If bedrock or ground water is within 0.9 m (3 ft) of the soil surface or the soil type is muck/organic, the potential for ground water contamination will always be "high".

2. To determine the "hydrologic soil group" (soil texture) for the soil at the site either:

   - obtain the soil texture from soil maps, conduct a field evaluation, etc. and select one of the four soil types listed (i.e., sand, loam, clay loam, clay) that most closely matches the soil on your farm.
   - consult OMAFRA Publication 29, *Drainage Guide for Ontario* or the Ontario Environmental Farm Plan "County Soil Summary Sheet" available through the OMAFRA office or the Environmental Farm Plan program representative (Ontario Soil

and Crop Improvement Association) assigned to your area.

3. The following methods may be used to determine ground water depth (water table):

   - digging a post hole in early spring often reveals the depth to the water table where a high water table exists. The depth to the water level in a dug well is a good indicator but do not use the static water levels in drilled wells. Static water levels in drilled wells usually do not reflect the water table location
   - if the water table cannot be found, use the 0.9 – 4.5 m (3–15 ft) "depth to ground water".

To obtain a more accurate assessment of the potential for ground water contamination on your farm, you should look for varying hydrogeological conditions such as changes in soil texture, bedrock types and depth to ground water and carry out enough site inspections to account for these variances. Further, always assess the farmstead area around the farm buildings separately from the field areas.

The potential for contamination of a specific water well on your farm can be further assessed by considering the separation distance from the potential contaminant source to the water well. The greater the separation distance, the less chance that the contaminant will affect the well, either through ground water flow or by surface flow. By locating in Table 2 your site's potential for ground water contamination (from Table 1), the minimum recommended separation distances between potential contaminant sources and water wells can be obtained.

In Table 2, potential contaminant sources may include point sources around the farmstead such as manure storages, fuel storages, septic systems, pesticides storages, etc. or non-point sources like manure or pesticide application on fields.

NUTRIENT MANAGEMENT ACT (NMA), 2002

New and expanding facilities on farms in Ontario that are phased-in under the NMA, 2002, must meet the minimum setback distance requirements of Regulation 267/03, as amended.

Table 2. Recommended Minimum Separation Distances Between Potential Contaminant Sources and Water Wells[1]

Potential for Ground Water Contamination (from Table 1)	Separation Distance Between Potential Contaminant Source and Water Wells	
	Drilled Wells	**Dug or Bored Wells**
1 High	Greater than 90 m (300 ft)	Greater than 90 m (300 ft)
2 Moderate	24–90 m (76–300 ft)	47–90 m (151–300 ft)
3 Low	15–23 m (50–75 ft)	30–46 m (100–150 ft)
4 Very Low	At least 15 m (50 ft)*	At least 30 m (100 ft)*

* Indicates the minimum separation distance required between the type of water well and a potential source of contamination to be consistent with water well construction regulations under *the Ontario Water Resources Act* (Reg. 903).

MEASURES TO COUNTERACT A HIGH POTENTIAL FOR GROUND WATER CONTAMINATION

A high or moderate ground water contamination potential is an indication of the speed that contaminants could move downward to the water table if a spill or leak occurred. The result could be a rapidly contaminated aquifer and a potentially polluted water well on your property and your neighbours'. If this high risk exists on your property, special care should be taken not to have leaks or spills of contaminants. Regular inspection, maintenance, and water testing of the water well should be done. Containment of manure, livestock yard runoff, milking centre washwater, etc. is necessary to reduce leaching down to ground water. As for field areas, manure and fertilizer must be applied at the proper rate to meet the crop's requirements and at the proper time of year to maximize the use of the nutrients, otherwise, valuable nutrients could infiltrate down to ground water.

For more information see Best Management Practices (BMP's) booklets:

Manure Management
Nutrient Management
Water Management
Water Wells

This Factsheet was written by **Robert P. Stone**, P.Eng., Engineer, Soil and **James P. Myslik**, P.Eng., Water Management, Food Safety and Environment Division, OMAFRA. Original reviewers were **Ted Taylor** and **Brent Kennedy**, OMAFRA.

Do you know about Ontario's new Nutrient Management Act?

The provincial *Nutrient Management Act* (*NMA*) and the Regulation 267/03 regulates the storage, handling and application of nutrients that could be applied to agricultural crop land. The objective is to protect Ontario's surface and groundwater resources.

Please consult the regulation and protocols for the specific legal details. This Factsheet is not meant to provide legal advice. Consult your lawyer if you have questions about your legal obligations.

For more information on the NMA call the Nutrient Management Information Line at 1-866-242-4460, e-mail *nman.omafra@ontario.ca* or visit *www.omafra.gov.on.ca*.

Factsheets are continually being updated so please ensure that you have the most recent version.

Agricultural Information Contact Centre
1-877-424-1300
ag.info.omafra@ontario.ca

www.ontario.ca/omafra

POD
ISSN 1198-712X
Également disponible en français
(commande n° 07-036)

PROTECTING OUR ENVIRONMENT
Ontario

012101007035