NRCB Natural Resources Conservation Board
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ENVIRONMENTAL RISK SCREENING TOOL

Environmental risk screening tool for manure facilities at confined feeding operations

Version 1.2 – September 2011

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ENVIRONMENTAL RISK SCREENING TOOL

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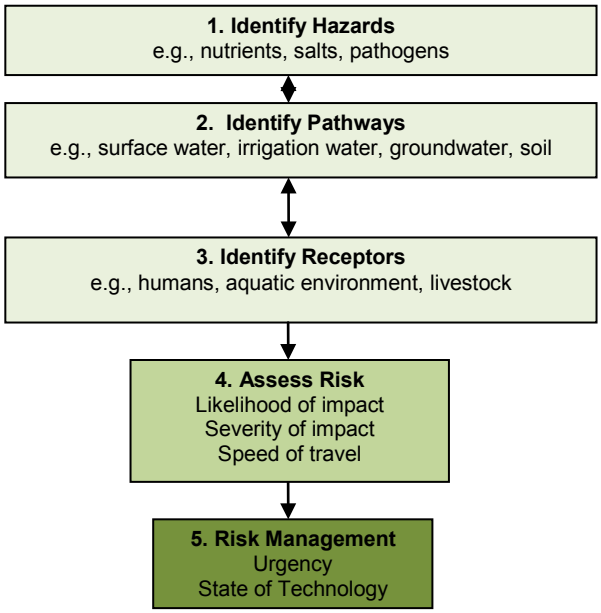
BACKGROUND

The purpose of the *Agricultural Operation Practices Act (AOPA)* and its regulations is to ensure that the province's livestock industry can grow to meet the opportunities presented by local and world markets in an environmentally sustainable manner. *AOPA* and its regulations can be prescriptive in some areas, giving the regulator and operator little flexibility. Other parts of the legislation provide more flexibility to evaluate and oversee management of potential environmental risks.

A Policy Advisory Group (PAG) was established by the Government of Alberta in 2006 as a mechanism to provide stakeholder advice to the NRCB for the effective delivery of *AOPA*. PAG observed that *AOPA* and its regulations provide some certainty because they establish regulatory standards for confined feeding operations (CFOs) but are less specific on how to apply the standards. An area requiring further attention was the NRCB's determination of the environmental risk of facilities at CFOs. To help guide the development of policy and *AOPA* technical guidelines relating to the determination of environmental risk, PAG endorsed a risk management framework. Essential components of the framework are summarized in the figure below.

Risk Management Framework



The PAG supported the formation of a Working Group (see Appendix 1 for membership) to develop a tool that could be used by NRCB staff to assess environmental risk at confined feeding operations and manure storage facilities. The tool follows on from the risk management framework endorsed by PAG, using its key principles to look at potential environmental risk at facilities in a manner that will improve the consistency and transparency of what is currently being practiced by NRCB staff.

DESCRIPTION OF THE ENVIRONMENTAL RISK SCREENING PROCESS

The risk screening process that is based on the accepted risk management framework consists of two components:

1. Collection and documentation of information about facilities (e.g. earthen manure storage, catch basin) at an operation. NRCB staff will consult published information (e.g. soils maps, geology/hydrogeology maps) and collect information from on-site visits in conducting their work. The results of the published information search and site visit will be documented in a Site Information Form (Appendix 2). The Site Information Form was initially created to provide a consistent approach for NRCB compliance inspectors by ensuring that they collect similar data when completing a site inspection. The form provides a snapshot of what facilities are currently on the site, the condition of those facilities during the inspection and the published information available for the site.

2. Information from the Site Information Form is used by NRCB staff to screen environmental risks at a CFO facility using the environmental risk screening tool (Appendix 3). Scoring individual facilities (e.g. liquid earthen manure storage, catch basin) rather than an entire operation, allows for focusing of corrective action on the specific facility.

The environmental risk screening tool uses a numeric scoring system to screen risk at a facility. In order to assess facilities in a consistent manner, a number of evaluation factors are used in the hazard potential and pathways sections. A numeric value is assigned to each factor that reflects the level of potential environmental risk. Total hazard potential scores are added to each of the groundwater and surface water pathway scores, then each of those totals are multiplied by an exposure potential multiplier to determine the risk potential of the facility to groundwater and surface water. Risks to groundwater and surface water are considered separately for a facility, rather than having a single total score for the facility. Using a total score for a facility may result in an incorrect risk screening (e.g. the overall score for a facility would be neutral if the groundwater risk is high and the surface water risk is low). Scoring groundwater and surface water separately allows for focusing corrective action on the specific pathway at risk or facility causing the risk.

The information required to complete the site information form, and thus to score all of the factors for a facility, may not always be available. Also, there may be instances where important information about a facility is not captured by factors covered in the form. To address a lack of information or the availability of important information not reflected in the risk factors, the environmental risk screening tool has a special considerations section in the pathways sections. However, in order to reduce the level of subjectivity in scoring facilities, the scoring for the “special considerations” is limited to about 10 percent of the total score for the section.

During development of the tool, NRCB staff carried out extensive desktop and field testing using information from actual CFO facilities. The testing was intended to assess the performance of the tool, identify areas for improvement and to train NRCB staff on how to use the tool.

In addition to training, the NRCB foresees conducting internal audits on 10 percent of the facilities scored in order to ensure consistency in the use of the tool.

The screening tool will be reviewed periodically to ensure that it reflects advances in science and management practices. Also, enhancements may become apparent over time as the tool is used.

WHEN THE ENVIRONMENTAL RISK SCREENING TOOL WILL BE USED

The NRCB has always assessed environmental risk as part of its review of applications and its complaint response as required under *AOPA*. The environmental risk screening tool does not replace the legislated requirements of *AOPA*. NRCB staff currently use risk assessment techniques in conducting the following *AOPA* activities.

1. **Existing facilities**

   - For determining whether an application for an expansion of animal numbers and/or construction of a manure collection or storage facility meets the requirements of the Act. Sections 20(1.2) and 22(2.2) of *AOPA* require that an approval officer determine whether or not existing facilities may cause a risk to the environment. The tool would assist officers in determining "risk to the environment" at existing facilities. The mitigation of any identified risk would be consistent with the mitigation of risk on new facilities: For example, the requirement for leak detection.
   - Assess existing facilities regarding a potential risk to the environment through complaints or through other NRCB risk based programs. Section 30(2) of *AOPA*, allows inspectors to collect the information required for the risk screening and Section 39(1) indicates that if a person is creating a risk to the environment, enforcement action may occur. The screening tool should not and will not be used in response to every complaint. Complaints are extremely variable and the majority involve minor compliance issues (e.g. odour) that are addressed through education and voluntary action. The screening tool would NOT be used in these instances.

2. **New facilities**

   To screen environmental risk at new CFOs (i.e. Greenfield sites) to assess the need for:

   - a leak detection system (*Standards and Administration Regulation*, Section 18)
   - secondary containment around a liquid manure storage (*Standards and Administration Regulation*, Section 11(2))
   - monitoring of groundwater quality from water wells within 100m of facilities (*Standards and Administration Regulation*, Section 7(2b))
   - surface water run-on, runoff control requirements (*Standards and Administration Regulation*, Section 6)
   - catch basin(s) (*Standards and Administration Regulation*, Section 19)

The intent of the risk screening process is to improve consistency and to add clarity and transparency to the manner in which NRCB staff conduct the above activities.

NRCB ASSESSOR COMPETENCIES

NRCB staff completing the Site Information Form and conducting the environmental risk screening:

1. are familiar with Alberta legislation and policy documents related to the confined feeding operation industry
2. are knowledgeable of the technical areas relevant to confined feeding operations, including:
   - water/wastewater management
   - manure handling and storage
3. have a working knowledge of how to collect information about physical conditions at a site using published information
4. have access to professional advice on complex issues (e.g., determination of protective layer thickness)
5. are able to be objective in using the risk tool

GUIDANCE ON COMPLETING THE SITE INFORMATION FORM

The Site Information Form (Appendix 2) can be completed manually or electronically. The form can be tailored to different operations by adding or deleting facility sections, depending on what exists or is proposed on the site. Facilities that can be found at an operation include runoff control catch basins, liquid manure storages and solid manure storages. The completed form should be supplemented by photos taken of the site at the time of the site visit. In order to complete the form, various published information (e.g. water well logs, surficial geology maps, topography maps) are required and are discussed in the following sections.

Instructions for completing sections of the Site Information Form are provided below:

1. General

- CFO name – name of operation
- Legal land location – quarter section, township, range and meridian of the subject property
- Date of site visit – date of inspection
- Staff completing assessment – list who was involved in completing the form
- Who was interviewed – list who was interviewed in obtaining information for completing the form

2. Permit and Manure Information

- Permit available – Does the operation have either a municipal or NRCB issued permit or no available permit? If the permit is available, enter the number of the permit on the form.
- Livestock type & quantity – animal category, type and quantity confined on the property (use *AOPA* category and type names) (if existing facility, use grandfathered capacity)

- Manure type – Indicate whether manure produced at the operation is liquid or solid or both. If it is both, check both boxes.
- Annual Manure Production – The weight of manure generated (in tonnes) at the operation is calculated using *AOPA*'s Manure Characteristics and Land Base Code (if the manure from the operation is separated into different facilities, or if manure from different animals is combined, note this is on the form).

3. Solid Manure Storage

"Solid manure means manure that is 20% or more solid matter and that does not flow when piled."

This section should be completed for feedlot pens, solid manure storage pads and barn floors. If there is no solid manure storage at the site, or if it is not being assessed, check 'Not Applicable'.

- Facility name – As there may be more than one of this type of facility on a site, indicate the name of the facility (e.g. south feedlot pens, southeast solid manure storage).
- Liner type – Indicate the known type of liner. For example, compacted clay liner, protective layer, concrete, synthetically lined, steel, no liner, unknown, as well as whether or not it has been engineered (provide details, if available).
- Liner thickness – If there is a constructed liner or protective layer, indicate its thickness, otherwise, indicate unknown on the form.
- Measured hydraulic conductivity of liner – Note the measured hydraulic conductivity if documented, otherwise enter unknown on the form. If the liner is concrete, also indicate unknown in this section.
- Runoff control – Is there a system that contains or diverts the liquid that drains as surface flow (rainwater and meltwater) out of the solid manure storage?
- Run-on control – Is there a system that diverts surface water flow around the solid manure storage?
- Storage Dimensions – Indicate the length and width of the storage.
- Storage area – Calculate the area of the storage. If the storage area is not symmetrical, calculate the area for several parts and add them up to obtain a cumulative total. If there are walls around the storage site, note the height of the walls.
- Depth below grade – Indicate the depth of the solid manure storage measured from the natural grade to the top of the liner or the base of the storage. Consult with the operator as to his/her knowledge of the depth.
- Condition of liner – Note the visible condition of the liner. If the liner is in poor shape, note the nature of the problem (e.g. cracks). If the storage could not be inspected (e.g. full of livestock or full of manure) indicate uninspectable.
- Year Storage Built – Note the year the storage was built (this information may be available from documentation or the operator).
- Notes – Document any additional information that helps understand the solid manure storage.

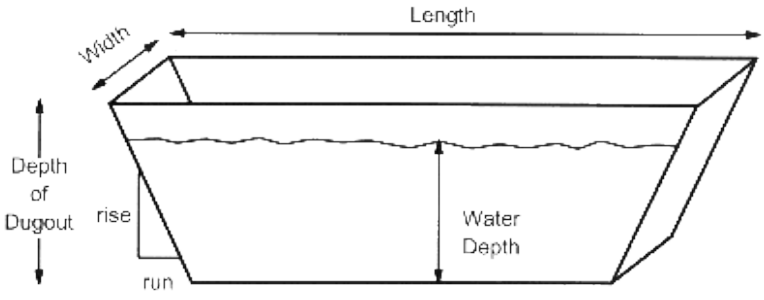
4. Catch Basin

"Catch basin means an excavation or a diked or walled structure that is designed to intercept and store runoff"

This section should be completed if there is an existing catch basin(s) that collects the runoff from a feedlot or solid manure storage pad. If there is no catch basin at the site, or if it is not being assessed, check 'Not Applicable'.

- Facility name – As there may be more than one of this type of facility on a site, indicate the name of the facility (e.g. south catch basin, east catch basin).
- Liner type – Indicate the known type of liner. For example, compacted clay liner, protective layer, concrete, synthetically lined, no liner, unknown, as well as whether or not it has been engineered (provide details, if available).
- Liner thickness – If there is a constructed liner or protective layer, indicate its thickness. Otherwise, indicate unknown on the form.
- Measured hydraulic conductivity of liner – Note the measured hydraulic conductivity, if documented, otherwise enter unknown on the form.
- Storage Dimensions – indicated the length, width, depth and inside side slopes of the catch basin.
- Depth below grade – Indicate the depth of the catch basin measured from the natural grade to the top of the liner or the base of the catch basin. Do not include the height of berm (if there is one). Consult with the operator as to his/her knowledge of the depth.
- Capacity – In order to calculate capacity, measure:
  - the length and width of the top of the catch basin to calculate the area
  - water (total) depth (measured depth from the top of the berm to the bottom of the catch basin minus the 0.5 metres of freeboard)
  - slope (the number of metres in the horizontal (run) direction for each metre in the vertical (rise) direction (e.g. run/rise = 4 m/1 m.)

Catch Basin Capacity



Capacity can be calculated by using the Dugout/Lagoon Volume Calculator available on Ropin' the Web at http://www.agric.gov.ab.ca/app19/calc/volume/dugout.jsp or, alternatively, use the catch basin calculator developed by Alberta Agriculture.

- Runoff potential – Indicate how much runoff would be generated by the solid manure storage's drainage area in one day rainfall that has a 1 in 30 year probability, by taking the measured storage area and using the following calculation found in Schedule 2 of the *Standards and Administration Regulation* of *AOPA*:

  One Day Rainfall (mm) = Drainage Area × One Day Rainfall × Runoff Coefficient

  The one day rainfall can be estimated using one day rainfall data from the nearest city/town located to the operation, available from Table 2 of the Schedule 2 of the *Standards and Administration Regulation of AOPA.*

  The runoff coefficient can be obtained from Table 1 in Schedule 2 of the *Standards and Administration Regulation* of *AOPA*, by selecting the coefficient associated with the range of one day rainfall with a 1 in 30 year probability.

  Note if the catch basin is collecting runoff from other areas adjacent to the solid manure storage.

- Condition of liner – Note whether the visible condition of the liner is good (therefore suitable as a liner). If the liner is in poor shape, note the nature of the problem (e.g. cracks). If the liner is not inspectable, indicate uninspectable.
- Year Storage Built – Note the year the catch basin was built (this information may be available from documentation or the operator).
- Notes – Document any additional information that helps understand the catch basin.

5. Liquid Manure Storage

"Liquid manure means manure that is in a predominantly liquid state or manure to which water has been added."

This section should be completed if there is an existing liquid manure storage that holds liquid manure that was produced in a barn facility. If there is no liquid manure storage at the site, or if it is not being assessed, check 'Not Applicable'.

- Facility name – As there may be more than one of this type of facility on a site, indicate the name of the facility (e.g. south EMS, north EMS).
- Liner type - Indicate the known type of liner. For example, compacted clay liner, protective layer, concrete, synthetically lined, steel, no liner, unknown, as well as whether or not it has been engineered (provide details, if available).
- Liner thickness – If there is a constructed liner or protective layer, indicate its thickness, otherwise, indicate unknown on the form.
- Measured hydraulic conductivity of liner – Note the measured hydraulic conductivity if documented, otherwise, enter unknown on the form.
- Runoff control – Is there a system that contains or diverts the liquid that drains as surface flow (rainwater and melt water) out of the liquid manure storage (i.e. is there adequate freeboard)?
- Run-on control – Is there a system that diverts surface water flow around the liquid manure storage?
- Depth below grade – Indicate the depth of the liquid manure storage measured from the natural grade to the top of the liner or the base of the storage. Do not include the height of berm. Consult with the operator as to his/her knowledge of the depth.

- Condition of liner – Note whether the visible condition of liner is good (therefore suitable as a liner). If the liner is in poor shape, note the nature of the problem (e.g. cracks). If the storage was not inspectable as it was full of manure, indicate uninspectable.
- Year Storage Built – Note the year the storage was built (this information may be available from documentation or the operator).
- Notes – Document any additional information that helps understand the liquid manure storage.

6. Monitoring Wells and Borehole Logs

If there are no monitoring wells on site or they are not located around a facility being assessed, indicate 'No Monitoring Wells'.

If there are no borehole logs on site, indicate 'No Borehole Logs'.

- Number of monitoring wells – Indicate the number of monitoring wells that are found.
- Number of borehole logs – Indicate the number of borehole logs that are found.
- Facility(s) monitored – Indicate what facility(s) has monitoring wells around it.
- Reference for borehole logs – Indicate what documents the borehole logs were associated with.

7. Location and Method of Sealing of Water Wells (within 400 m)

A site plan should be prepared showing all the locations of the water wells within 400m of the facilities (an aerial photo can be used). The reference point should also be indicated. If there are no wells within 400 m, 'Not Applicable' should be checked.

Well site locations can be estimated by identifying residence locations, but then should be confirmed by a site visit.

- Reference point – Document the location of a reference point on the site that will be used for determining the distance to water wells.
- Well I.D. – A water well search should be conducted on Alberta Environment's Groundwater Information System available at http://www.envinfo.gov.ab.ca/GroundWater/ . When in the website:
  - Enter the facilities land location and search, a list of well IDs will appear.
  - To obtain an individual water well report, click on the well ID.
  - To obtain a reconnaissance report (a list of water wells, their land locations and other available information on the wells), click on 'Generate Report'.

  It is important to note that not all water wells may be in the Alberta Environment Information System (e.g. old wells). A site inspection or information from the operator may provide information on these wells. Also, some of the water wells noted on the Alberta Environment Information System may have been decommissioned (i.e. filled in, no longer useable), but the decommissioning is not documented. If they are documented on the information system, they usually state "abandoned" on the well log. Abandoned or decommissioned wells, whether or not they are in the Alberta Environment Information System, should not be included in the site information form.

If the 'Type of Work' on a water well drillers log is indicated as chemistry, this may be a water sample that was taken from an existing well and not an indication of another well on the quarter section. However, if no other well logs exist for the quarter section, it could be an indication that there is an existing well that was never entered into Alberta Environment's system.

Alberta Environment's Information System includes well inventory and federal well survey logs reported approximately from the early 1900s to the Second World War. Generally, these well reports include much less information on depth, completion and water volumes than more recent well reports. Many of these wells are shallow, and were either hand dug or drilled using horse powered drilling. These wells generally provided suitable volumes of water for pre World War II residential use of washing and cooking but may not meet today's UGR volume requirements for residential water use. If a well inventory or federal well survey water well is still in use, then it should be entered on the site information form. If a well inventory or federal well survey water well is no longer in use at a site, it should be considered a decommissioned well (whether documented or not) and should not be included on the site information form.

Indicate the well identification number from the water well drilling log in Alberta Environment's Information System. If a well log was not filed with Alberta Environment, assign a name to the well on the log in the file and indicate same name on the table.

- Distance to well(s) – Note the distance to any water wells within 400 metres of a manure storage facility or catch basin.
- Well Sealing Method – Indicate how the water wells located within 400 m of the facility are constructed and sealed (e.g. driven seal). This information can be obtained from well completion information in water well drilling logs. If the water well drilling log does not contain any well sealing details, then indicate that well sealing method is unknown. Wells where the annulus is sealed with bentonite or cement are considered the standard or baseline.
- Depth to top of open interval – The depth to the top of the open interval (e.g. open hole, slotted casing or well screens) can be determined by using well completion information. The depth to the top of the open interval is the distance from ground surface to the top of the open hole, slotted casing or well screens.

  If the bottom of the seal in a water well is shallower than the top of the screened, slotted or open hole portion of the well, and if the geologic materials between the bottom of the seal and the top of the screened, slotted or open hole portion of the well contribute substantially to well yield, then the depth to the bottom of the seal should be considered the depth to the top of the open interval.
- Location of well(s) from the reference point – In ideal situations, water level elevation information from site-specific groundwater monitoring wells completed at approximately the same depth should be used to determine the direction of shallow groundwater flow. In situations where this information is not available, the land surface topography can be a good general indicator of shallow groundwater flow direction, since water table slope often mimics surface topography. Topographical information is readily available from topographical maps (MTS 1:50,000 preferred). If after looking at topography information from maps and from a site visit, you are still uncertain about whether or not a water well is upslope or down slope of a facility, choose the most conservative approach when scoring the facility, which is "unknown".

Note the position of the water well(s) with reference to the facilities being assessed as follows (choose the closest facility requiring scoring for the purposes of the site information form):

- Unknown – Choose 'Unknown' if it cannot be determined whether or not a water well is conclusively located upslope or downslope from the facility being assessed, or is located cross slope.
- Down slope – Well is conclusively located down slope from the facility being assessed.
- Upslope - Well is conclusively located upslope from the facility being assessed.
  - There may be situations where a producing water well may be at risk even if it is determined to be upslope of the facility. Pumping of the well results in a cone of depression that could extend beneath the facility and draw contaminated water toward the well. The size of a cone of depression is dependent on many factors including the pumping rate of the well and hydraulic properties of the aquifer. If not choosing 'Unknown', the use of special consideration points is recommended in cases where a pumping well is located upslope but relatively close to the facility.

8. Uppermost Groundwater Resource (UGR)

- Reference(s) for uppermost groundwater resource (UGR) – Indicate what sources of information were used to determine the UGR. For example, indicate the well I.D.s of the well logs used (could include information from decommissioned, chemistry and well inventory logs) or information on other boreholes in the area of the facility that were used.
- Depth to UGR – The UGR is defined by *AOPA*. The depth to the UGR should be determined using site-specific information when available (e.g. borehole logs or monitoring well completion information in geotechnical or hydrogeological reports).

  If the site-specific geological information shows that there may be a shallower aquifer located above the aquifer used on site, then the water well drillers logs from wells located within 1.6 km (1 mile) of the facilities property boundary (quarter section) need to be reviewed. Since the UGR definition within *AOPA* does not specify where the aquifer underlying the site must be used as a water supply, it was determined to mean within a reasonable distance from the location of the manure storage. The distance specified for the purposes of the ERST is 1.6 km (1 mile) of the facilities boundary (quarter section). The uppermost aquifer within 1.6 km (1 mile) currently in use must be correlated to the site specific information to call this identified uppermost aquifer on site the UGR.

  When site-specific information is not available, the depth to the UGR can be estimated using regional hydrogeology maps and/or information from water well drillers logs from wells located within 1.6 km (1 mile) of the facilities property boundary (quarter section).
- Predominant geology of the UGR – Using the most site-specific information available, indicate the predominant geology of the UGR (e.g. sandstone, coal). If the material is very heterogeneous (multiple layers of different geologic materials), then the geologic unit that has the highest hydraulic conductivity should be considered.
- Subsoil Texture of the UGR – Subsoil texture refers to the predominant grain size distribution. Using the "Estimating Subsoil Texture" table in Appendix 4, information about the geology of the UGR can be used to estimate the subsoil texture (i.e. fine,

medium, coarse or very coarse). For example, a gravel UGR would be assigned a "very coarse" subsoil texture using the table. For reference, a hydraulic conductivity scale is also included in the table to allow for estimating of hydraulic conductivity. If a shale UGR has been identified, the shale should be considered as fractured.

9. Protective Layer (PL)

- Reference(s) for protective layer (PL) – Indicate what sources of information were used to determine the PL. For example, indicate the well I.D.s of the well logs used (could include information from decommissioned, chemistry and well inventory logs) or information on other boreholes in the area of the facility that were used.
- Thickness of PL – Protective layers are geologic units that generally have a low hydraulic conductivity (e.g. unfractured glacial till) overlying a UGR. These layers can be identified by examining water well drillers logs or site specific geotechnical information. At a facility where a liner has been constructed, use the native subsoil under the facility when determining the protective layer thickness – not the liner thickness. If multiple layers are considered, only the layers of similar geology should be lumped together as the ERST is simplified to consider only the dominant protective layer. The groundwater section of the ERST is only addressing the risk to the UGR below the site and not contemplating lateral movement of potential manure constituents.
- Predominant geology of the PL – Using the most specific site information; indicate the geology of the protective layer. If the material is very heterogeneous (i.e. multiple layers of different geologic materials), then the dominant geologic unit that has the lowest hydraulic conductivity should be considered.
- Estimated subsoil texture of the PL – Subsoil texture refers to the predominant grain size distribution. Using the "Estimating Subsoil Texture" table in Appendix 4, information about the geology of the PL can be used to estimate the subsoil texture (i.e. fine, medium, coarse or very coarse). For example, a clay PL would be assigned a "fine" subsoil texture using the table. For reference, a hydraulic conductivity scale is also included in the table to allow for estimating of hydraulic conductivity. If the material is a glacial till with high clay content, choose a subsoil texture that is finer in the range. If the glacial till is sandier, then choose a subsoil texture that is coarser in the range. If the glacial till is weathered, it likely contains fractures, therefore choose a subsoil texture that is coarser in the range. If a layer of clay or glacial till contains amounts of silt, sand or gravel that are likely to be dominant for transport of groundwater, then the appropriate range for that material should be used. At a facility where a liner has been constructed, use the native subsoil under the facility when determining the subsoil texture of the protective layer.
- PL measured From (e.g. surface, at specific depth) and To – the chosen protective layer is not always a geologic unit found at the surface. Indicate what depth the unit starts 'From' and ends 'To'. There may be multiple layers that are used – indicate these separately in additional notes. If multiple layers are considered as one unit, enter the top of the unit as 'From' and the bottom of the unit as 'To'.

10. Infiltration Potential and Surface Water Runoff

- Average annual precipitation – Estimate the annual total precipitation using the "Annual Total Precipitation of Alberta, 1971 to 2000" (Alberta Agriculture) map in Appendix 4.

- Soil texture at surface – The most site specific information should be used for determining soil texture. This may or may not be different than the subsoil texture. The soil texture can be classified as coarse, medium or fine by using AGRASID, available on the web at http://www2.agric.gov.ab.ca/app77/imf.jsp?site=agrasid. On the website, locate the township then "show the layers" and select "soil information" then "more info". Soil polygon information is provided that can be used to determine the texture. If you have field analysis for the site location, use a texture triangle to determine the soil texture. If you have county assessment analysis, that data is likely more site specific than AGRASID.

11. Location of Surface Water Bodies (within 800 m)

Complete this section for all the surface water bodies within 800 metres of the site.

- Reference point – Choose a location on the site as a reference point for determining the distance to surface water bodies.
- Name of water body – Indicate the proper name of the body of water. If not known, label it on the aerial photo for the site and refer to the name on the form.
- Type of water body – Indicate the type of surface water (including intermittent) using the following:
  - (i) Slough – a natural topographic depression less than 8 ha in area that contains surface water
  - (ii) Creek – a natural stream normally smaller than and often a tributary to a river
  - (iii) River – Rivers are generally larger than creeks. Rivers flow year round, in years of normal precipitation and when there are no significant water diversions. Watercourses that have bank full channel widths greater than 15 metres may be broadly classified as rivers.
  - (iv) Lake – a natural topographic depression greater than 8 ha in area that contains surface water
  - (v) Dugout – a man-made topographic excavation intended to collect water for agricultural use
  - (vi) Irrigation Canal – a man-made canal used to convey water from natural water bodies for agricultural use
- Distance to water bodies – Indicate the distance to the nearest body of water within 800 metres of the facility. The distance should be measured to the reference point indicated. Water bodies can be identified using aerial photos, Alberta Environment's Flood Hazard Map located at http://www.envinfo.gov.ab.ca/FloodHazard/, county maps and field observations during a site visit. Document the location on the site plan. If there are no water bodies within 800 m, 'Not Applicable' should be checked.
- Location of surface water from the reference point – Indicate whether the water body is located upslope, down slope or unknown from the facilities being assessed.
- Runoff from the facility – Indicate whether the runoff from the facility is dispersed (flows overland uniformly from the facility to the water body) or is channelled (definite path formed from the facility to the water body). If the manure storage facility is within 30 m of a body of water, channelled flow should be chosen, as there is not enough distance for adequate dispersion of the runoff to occur to meet the dispersed criteria.

- Vegetated during runoff event – Indicate whether or not there is vegetation in the pathway between the facility and the body of water (not including riparian vegetation) at the time of the highest annual runoff event for the site. Refer to the table in Appendix 4 to determine the timing of the highest annual runoff event for the site. This could be during a rainfall event or snowmelt. If the ground is frozen during the highest runoff event, assume no vegetation. If there is less than 50 percent cover, assume no vegetation
- Approximate Slope to Surface Water (%) – Determine the percentage slope between the facility and the nearest water body by using available information (the percentage slope is the elevation difference between the facility and the water body, divided by the distance between the two, multiplied by 100). Using the same procedure as soil texture at surface (using AGRASID), the limiting slope can be determined. Be aware that the limiting slope may not be representative of the slope between the facility and the nearest water body. Using topography maps, topography layers can be used to estimate slope over the distance between a facility and a water body. A measured estimate can also be done on-site.
- Site Elevation Above Flood Plain – Determine if the facility has an elevation greater than 1 metre above a 1 in 25 year flood plain or, if unknown, the highest known flood level. This likely will have to be estimated based on landowner's and municipality's knowledge and through a site visit. Alberta Environment's Flood Hazard Map located at http://www.envinfo.gov.ab.ca/FloodHazard/ may include flood plain information for the site you are looking at, but the information must be used with caution as only a limited number of water bodies in the province have been mapped
- Additional notes - Document any information observed on-site that is addressed by the factors above.

GUIDANCE ON COMPLETION OF THE ENVIRONMENTAL RISK SCREENING TOOL

The environmental risk screening tool (Appendix 3) is designed to be completed for each facility (solid manure storage, liquid manure storage, catch basin) at a CFO. Information from the Site Information Form should be used to complete the tool.

The tool consists of three sections: Hazard Potential, Pathways and Exposure Potential. Each section contains factors that are important for assessing a hazard, and for determining potential pathways for the hazards to impact a receptor. A numeric scoring system is used for each factor that reflects the level of environmental risk. In many cases, the factors are related so a matrix approach is used. Use of the matrix approach is demonstrated in the following example.

Example – Determining the score for Uppermost Groundwater Resource factor

☐ An uppermost groundwater resource has a depth of 34m and a subsoil texture of coarse

Steps:

- Find the row that includes the depth of 34m (see bolded row).

	Subsoil Texture		
Depth to UGR (m)	Fine - Medium	Coarse	Very Coarse
>30	**1**	**4**	**7**
8 – 30	2	5	8
<8	3	6	10

- Find the column that includes the subsoil texture of coarse (see underlined column)

	Subsoil Texture		
Depth to UGR (m)	Fine-Medium	Coarse	Very Coarse
>30	**1**	**4**	**7**
8 - 30	2	5	8
<8	3	6	10

- The risk number that is bolded and underlined (4) is the score for this section of the Groundwater Pathway

HAZARD POTENTIAL

1. Manure type

Liquid manure tends to have greater environmental risk than solid manure as the manure constituents are in an aqueous state and thus more mobile in the environment. Feedlot runoff (catch basin contents) is also in an aqueous state but tends to have a lower concentration of manure constituents than liquid manure. The liner requirements in *AOPA* reflect the environmental risk associated with liquid manure, solid manure and runoff water (i.e. liner requirements are most stringent for liquid manure systems and least stringent for solid manure storage).

For the facility being assessed, the appropriate score should be assigned based on whether the facility stores solid manure, runoff water with manure constituents (i.e. catch basin

contents) or liquid manure. When scoring the surface water section of the ERST, the manure type for solid manure storages should always be "runoff water with manure constituents" because runoff water is the main carrier of manure contaminants from solid manure. This runoff water has the potential to impact surface water quality.

2. Annual manure amount

The potential for environmental impact at a site generally increases with the amount of manure. The weight of manure generated (in tonnes) at the facility is calculated using *AOPA*'s Manure Characteristics and Land Base Code. The higher score is based on 80 percent of the manure production generated at a 50,000 head beef feeder feedlot (70,000 tonnes of manure).

Sum the two criteria scores to obtain a hazard potential score. For solid manure storages, a separate hazard potential score for groundwater and surface water will be obtained.

PATHWAY

1. Groundwater

The groundwater section of the tool should be scored as a high risk, if the water well is directly located within the manure storage area. The reason is that the well bore may act as a conduit for manure constituents and result in groundwater contamination.

To help score the first two factors in this section of the ERST, some information needs to be transferred from the site information form. Some calculations are required, and it is useful to provide a sketch to visualize the relationship of the manure facility to the geology and hydrogeology of the site.

The depth of storage below grade (A), depth to the top of the protective layer (B) and depth to the bottom of the protective layer (C) are all to be entered here from the site information form. The thickness of protective layer (D) is the smaller thickness of: 1) depth to the bottom of the protective layer (C) minus the depth to the top of the protective layer (B), or, 2) depth to the bottom of the protective layer (C) minus the depth of storage below grade (A). Enter the smaller value of these two numbers as thickness of protective layer (D). This number (D) is used on the matrix to determine the Protective layer between bottom of facility and UGR.

The depth to UGR below grade (E) is to be entered here from the site information form. The depth to UGR from the bottom of the facility (F) is determined by depth to UGR below grade (E) minus depth of storage below grade (A). This number (F) is used on the matrix below to determine the Uppermost Groundwater Resource. If this number (F) is negative, then the storage is constructed into the UGR and 'Protective layer between bottom of facility and UGR' should receive a score of 20 points.

- **Uppermost groundwater resource (UGR)**

  A UGR with a coarser subsoil texture has the potential to transport manure nutrients. The likelihood of aqueous manure constituents reaching the UGR decreases with increasing depth to the UGR. When scoring this section, the UGR should be calculated from the bottom of the facility.

- **Protective layer between bottom of facility and UGR**

A thicker protective layer overlying a UGR provides greater protection than a thinner protective layer. Also, a protective layer with a finer subsoil texture will provide greater protection than a protective layer with a coarser subsoil texture. When scoring this section, the protective layer should be calculated from the bottom of the facility.

If the facility is constructed into the UGR, then score 20 points for this section.

- **Liner type**

  Liner type refers to the type of liner constructed to contain manure and provide protection to groundwater at a confined feeding operation. Facilities with appropriate liners have lower potential to impact groundwater quality than facilities with poor or no liners. If a liner is constructed of compacted soil, concrete, steel, synthetic or other materials and has been demonstrated to meet the requirements of *AOPA* through an application, decision and subsequent follow up (or other documented equivalency), the liner score is one for that facility.

  If a liner was not required to be constructed for the facility because the protective layer requirements of *AOPA* have been demonstrated to meet the requirements of *AOPA* through an application, decision and subsequent follow up (or other documented equivalency), then the liner score is one for that facility.

  If a liner was constructed of concrete or steel prior to 2002, and there are no documented specifications on the construction, and no visible issues with the condition of the concrete or steel identified during the site visit, then the liner score is two for that facility.

  If a liner was constructed of compacted soil or synthetic materials prior to 2002, and there are no documented specifications on the construction (e.g. completion reports, compaction densities), then the liner score is 15 for that facility, unless information is provided to prove that *AOPA* requirements are met.

  If the liner for the facility clearly does not meet the requirements of *AOPA* for a new facility of the same type (e.g. hole in the ground EMS, visually cracked concrete), then the liner score is 20 for that facility.

- **Water Well Risk Scoring**

  The distance of the well from the facility and the depth to the top of the open interval (e.g. open hole, slotted casing, screened zone) in the well are important factors for assessing the potential for water containing manure constituents to impact groundwater quality in a well. Poorly sealed water well(s) can be a conduit for manure constituents from a facility at a confined feeding operation to enter a UGR. Wells that are located close to a facility, have an open interval near the surface and are poorly sealed tend to be most at risk. Each well within 400 metres of the facility should be scored. Using the matrix, find the corresponding value, and then depending on the type of seal the well has, add the corresponding points.

  - If the well is completed with bentonite, add no points to the matrix score.
  - If the well annulus is filled with cuttings, add three points to the matrix score.
  - If the well has a drive shoe seal, add five points to the matrix score.
  - If the well has no seal or the nature of the seal is unknown, add eight points to the matrix score.

Indicate the well I.D.s and the corresponding scores in the table provided. If there are more than four wells, you may have to add extra pages. If there is more than one well within 400 metres, choose the score for the well with the highest risk (highest score) as the "highest risk water well".

If the nearest water well is more than 400m away from the facility, then the score is zero. A score of one should be assigned if the water well is conclusively upslope of the facility and within 400 metres.

- **Infiltration potential**

  Rainfall amount and soil texture are important factors in assessing infiltration potential. A higher infiltration potential has the probability of accelerating the movement of manure constituents through subsoil. Soil type and the total precipitation information are found on the Site Information Form.

- **Special considerations**

  The score for this portion of the tool is to account for considerations that cannot be accounted for in the other factors in this section. The allowable range is -8 to +8 with a total score for this section not to go over or under the total score range. Score zero if there are no special considerations.

  Some possible factors that could be considered in special considerations are:

  - Pumping rate of nearby water well (concern is that even if the well is upslope, a cone of depression may develop which could draw in contaminated water). Additional points should only be added on wells that were considered upslope.
  - Presence of any springs that have the potential to be impacted by the CFO
  - Water well in a pit
  - Certainty of information (i.e. deduct points if high quality information is available and used for scoring, is not intended to be used for low quality of information)
  - Additional points may be added if there are multiple wells that score high in the water well risk scoring criteria.

  If points have been added or subtracted for special considerations, indicate on the form the special consideration(s) used.

  Sum all the criteria scores to obtain a groundwater pathway score.

2. Surface Water

If a surface water body has been identified as upslope of the facility or if the surface water body is not located within 800 metres of the facility, the surface water pathway section should be scored as low risk. The first water body encountered down slope of a facility should be assessed using the tool.

The potential for large quantities and concentrations of manure constituents to be released to surface water bodies over a short period of time will be affected by whether or not the site is located one metre or more above a 1 in 25 year flood plain or not. This is consistent with AOPA. If the facility is located less than one metre above the 1 in 25 year flood plain, then the surface water pathway section should be scored as high risk.

- **Likelihood of Runoff Reaching a Water Body**

The likelihood of runoff water containing manure constituents reaching a water body increases with increasing slope of the land and the horizontal distance to water bodies. The slope of land for the facility to the water body and the horizontal distance to the water body are available from the Site Information Form.

- **Surface water runoff**

  Runoff has the potential to transport manure constituents into water bodies. Runoff potential increases with increasing annual precipitation and fine-grained soil texture (less permeable soils will allow greater runoff). Soil type and the total precipitation information are available from the Site Information Form.

- **Surface water run-on control**

  The effectiveness of a runoff control system is determined by the amount of water run-on that is prevented from entering a site. For example, if all run-on water is controlled, and the runoff control is designed for the facility area, then the environmental risk will be low. If there is no run-on control and no runoff control, then there is increased potential for manure impacted runoff to enter the environment.

  If all the upslope (run-on) water has been diverted around a facility by natural or constructed means, a score of zero should be assigned. If most (more than 80 percent) of the upslope water has been diverted (partial berming or ditching), then select a score of one. If no upslope water has been diverted, a score of five should be assigned.

- **Manure impacted area runoff control**

  The amount of runoff that is controlled impacts the potential for manure constituents to enter into the environment.

  If the facility being assessed is fully covered (like a barn) and there is no runoff generated, assign a score of zero. If all the runoff generated at the facility is controlled (i.e. properly sized catch basin, liquid manure storage with adequate freeboard) or if the runoff is treated (e.g. natural biological processes in a wetland) prior to leaving the operator's property then assign a score of four. If between 80 – 99 percent of the runoff is controlled, then assign a score of ten. If less than 80 percent of the runoff is controlled, assign a score of 20.

- **Runoff flow path between facility and receiving body of water**

  Vegetation is known to slow down, disperse and utilize surface water runoff leaving a site. This can reduce or prevent manure constituents in runoff from entering a body of water. An important consideration in runoff uptake by vegetation is whether the runoff consists of dispersed or channelled flow. The risk of environmental impacts tends to be greater in channelled flow situations, especially where there is little or no vegetation cover.

- **Special Considerations**

  The score for this portion of the tool is to account for considerations that cannot be accounted for in the other factors in this section. The allowable range is -5 to +5 with a total score for this section not to go over or under the range. Score zero if there are no special considerations.

  Some of the possible factors that may be considered in special considerations are:

  - Is there secondary containment at the site?

- Is there adequate amount of freeboard?
- Has the liquid earthen manure storage been constructed above grade?
- Certainty of information (i.e. deduct points if high quality of information is available and used in the scoring, is not intended to be used for low quality of information).

If points have been added or subtracted for special considerations, indicate on the form the special consideration(s) used.

Sum all the criteria scores to obtain a surface water pathway score.

EXPOSURE POTENTIAL

The exposure potential allows for an assessment of risk to the environment associated with a facility. The hazard potential scores are added to the groundwater and surface water pathway scores separately and multiplied by the Exposure Potential Multiplier, to obtain a potential risk rating for the facility. In the tool, the exposure potential section is located after the groundwater pathway and surface water pathway sections, for ease of use.

All facilities will fall into one of the following three risk levels:

- Low Potential Risk to the Environment – The facility does not pose a risk to the environment.
- Moderate Potential Risk to the Environment – The facility may pose a risk to the environment.
- High Potential Risk to the Environment – The facility likely poses a significant risk to the environment.

1. Groundwater

In agricultural areas, groundwater is commonly used for human consumption and watering livestock, etc. Most groundwater is not treated prior to use because it tends to be of good quality.

The likelihood of adverse effects from manure impacting water quality in a water well is dependent on several factors including the proximity of the well to the facility at the confined feeding operation. The consequences of adverse effects are dependent on several factors including the extent to which an aquifer is used in an area. Impacting a regional aquifer that has many users is more consequential than impact on a localized aquifer with few users. The severity of consequence is expressed through the use of multiplication factors.

- Multiplication Factor 1.0 - If there are no water wells completed within 400 metres of the confined feeding operation facility being assessed, but an aquifer has been identified below the site of the confined feeding operation facility, then the exposure potential factor of 1.0 would be used. In no case should a multiplication factor of less than 1.0 be used.
- Multiplication Factor 1.1- If there are one or more water wells located within 400 metres of the confined feeding operation facility, but greater than 100 metres from the confined feeding operation facility, then the exposure potential factor of 1.1 would be used.

- Multiplication Factor 1.2 - If there are one or more water wells located within 100 metres of the confined feeding operation facility, then the exposure potential factor of 1.2 would be used.

If you checked off the check box at the beginning of the Pathway, Groundwater section, for a water well directly located within the manure storage area, then check the box here as well.

2. Surface water

In agricultural areas, surface water is often used for human consumption, watering livestock, irrigation etc. Alberta Health recommends that surface water be treated prior to consumption by humans. For other uses, surface water should be tested at regular intervals to determine the continued suitability of the surface water for its intended purposes.

The nature of the surface water body and amount of use are important factors in determining exposure potential. A small slough on private land may have less exposure potential to receptors and so the nearby CFO facility being assessed would receive a lower multiplication factor. An inter-provincial river that is fish bearing, used for human recreation, wildlife habitat, irrigation and supplies water to a city via a water treatment plant has a higher exposure potential to receptors so the nearby CFO facility would receive a higher multiplication factor.

The following multiplication factors are used to reflect the severity of consequence:

- Multiplication Factor 1.0 - If the highest use surface water body (with the greatest number of types of users) located within 800 metres of the confined feeding operation facility being assessed is a small slough or creek on private land but not a common body of water, then the exposure potential factor of 1.0 would be used.
- Multiplication Factor 1.1- If the highest use surface water body (with the greatest number of types of users) located within 800 metres of the confined feeding operation facility being assessed is a common body of water with little human use (within 10 miles downstream), then the exposure potential factor of 1.1 would be used.
- Multiplication Factor 1.2 - If the highest use surface water body (with the greatest number of types of users) located within 800 metres of the confined feeding operation facility being assessed is a high use common body of water (recreation, water supply, etc.), then the exposure potential factor of 1.2 would be used.

If you checked off one of the three check boxes at the beginning of the Pathway, Surface Water section, then check that same box here as well.

SUBSURFACE CONNECTION TO A WATER BODY METHOD

The NRCB identified that there are certain situations where neither the groundwater nor surface water pathway address the risk that may occur on a site. An example is where there is a permeable subsurface connection (for example through a sand seam) to a nearby water body. It was found that the tool could be used to address this situation by using the following process:

- Assume that the saturated subsurface seam (i.e. sand) is a groundwater resource (only for the purposes of using the tool). Therefore you can determine depth to UGR and subsoil texture of that UGR, and thickness of protective layer and subsoil texture of that layer.
- Liner type is scored as usual.
- Substitute distance to water well with distance to surface water body, as the surface water body is the endpoint (receptor) instead of the water well.
- Substitute depth to top of open interval with depth to the subsurface seam.
- For completion of water wells we assume no seal.
- Infiltration potential score as usual.
- For exposure potential you again substitute the distance to surface water body with the distance to a water well (e.g. if the surface water body is located within 100 metres, use a multiplier of 1.2).

CONCLUSION

The NRCB, as required by *AOPA*, has always assessed environmental risk as part of its review of applications and as part of its complaint response. This environmental risk screening tool formalizes these procedures. The result will be enhanced consistency, greater transparency and improved documentation of these assessments.

The environmental risk screening tool has been developed to be consistent with the risk management framework accepted by PAG and allows for the consistent approach to the screening of environmental risk at confined feeding operation facilities.

It is envisaged that the tool will be reviewed in the future to ensure it continues to address the *AOPA* risk assessment requirements and that it is meeting the tool's intended purpose.

APPENDIX 1: RISK TOOL WORKING GROUP MEMBERS

Natural Resources Conservation Board

Andrea Hiba Brack
Andy Cumming
Barb Hazelton
Jim McKinley
Kevin Seward
Scott Cunningham
Walter Ceroici (Chair)

Intensive Livestock Working Group

Carrie Selin

Alberta Beef Producers

Rich Smith

Alberta Agriculture and Food

Karen Yakimishyn
Wayne Inkpen
Deanne Madsen

Alberta Environment

Janet McLean
Keith Leggat

APPENDIX 2: SITE INFORMATION FORM FOR MANURE FACILITIES AT CONFINED FEEDING OPERATIONS

SITE INFORMATION FORM FOR MANURE FACILITIES AT CONFINED FEEDING OPERATIONS

VERSION 1.2 – September 2011

(Information on how to complete this form is available in a companion document.)

CFO name:		Legal Land Location:	
Date of Site Visit:	Staff completing assessment:		
Who was interviewed:			
Permit and Manure Information			
Permit Available: ☐ Yes ☐ No	If Yes note permit #:		
Livestock Type & Quantity:			
Manure type: ☐ Liquid ☐ Solid	Annual Manure Production (tonnes):		
Solid Manure Storage ☐ Not Applicable		Facility Name:	
Liner Type:	Runoff control: ☐ Yes ☐ No	Run-on Control: ☐ Yes ☐ No	
Liner Thickness (m):	Storage Dimensions (m): L: W:	Storage Area (m^2):	Depth below grade (m):
Measured Hydraulic Conductivity of liner (cm/s):	Condition of liner: ☐ Suitable ☐ Unsuitable ☐ Uninspectable		Year Storage Built:
Notes:			
Catch Basin ☐ Not Applicable		Facility Name:	
Liner Type:	Storage Dimensions (m): L: W: D: Slope:		
Liner Thickness (m):	Depth below grade (m) :	Capacity (m^3):	Runoff Potential (m^3):
Measured Hydraulic Conductivity of liner (cm/s):	Condition of liner: ☐ Suitable ☐ Unsuitable ☐ Uninspectable		Year Storage Built:
Notes:			
Liquid Manure Storage ☐ Not Applicable		Facility Name:	
Liner Type:	Runoff control: ☐ Yes ☐ No	Run-on Control: ☐ Yes ☐ No	
Liner Thickness (m):	Depth below grade (m):		
Measured Hydraulic Conductivity of liner (cm/s)	Condition of liner: ☐ Suitable ☐ Unsuitable ☐ Uninspectable		Year Storage Built:
Notes:			
Monitoring Wells and Borehole Logs	☐ No monitoring wells ☐ No borehole logs	# of monitoring wells: # of borehole logs:	
Facility(s) monitored and/or reference for borehole logs:			

Location and Method of Sealing of Water Wells (within 400 m) ☐ Not Applicable

Reference Point:

Well I.D.	Distance to Well(s) (m):	Well Sealing Method:	Depth to top of open interval (m):	Location of well(s) from the reference point:
				☐ Unknown ☐ Upslope ☐ Down slope
				☐ Unknown ☐ Upslope ☐ Down slope
				☐ Unknown ☐ Upslope ☐ Down slope
				☐ Unknown ☐ Upslope ☐ Down slope

Uppermost Groundwater Resource (UGR) ☐ Not Applicable

Reference(s) for UGR (ie. Well I.D., borehole #'s):

Depth to UGR (m):	Predominant Geology**:**	Subsoil Texture:

Protective Layer (PL) ☐ Not Applicable

Reference(s) for PL (eg. Well I.D. borehole #'s):

Thickness of PL:	Predominant Geology:	Subsoil Texture:
PL measured From (eg. surface, at specific depth):		To:

Infiltration Potential and Surface Water Runoff

Average Annual Precipitation (mm):	Soil Texture at surface:

Location of Surface Water Bodies (within 800 m) ☐ Not Applicable

Reference Point:

Name of water body:	Type of water body:	Distance to water bodies (m):	Location of surface water from the reference point:
			☐ Unknown ☐ Upslope ☐ Down slope
			☐ Unknown ☐ Upslope ☐ Down slope

Runoff from facility: ☐ Dispersed ☐ Channelled	Vegetated during runoff event: ☐ Yes ☐ No
Approximate Slope to Surface Water (%):	Site Elevation Above Flood Plain:

Additional Notes:

APPENDIX 3: ENVIRONMENTAL RISK SCREENING TOOL FOR MANURE FACILITIES AT CONFINED FEEDING OPERATIONS

Environmental Risk Screening Tool for Manure Facilities at Confined Feeding Operations
Version 1.2 – September 2011
(Information on how to complete this form is available in a companion document.)

Facility Name: _____ Legal Land Location: _____ CFO name: _____

Screening Completed By: _____ Date Completed: _____

NOTE- Each facility should be scored individually

HAZARD POTENTIAL

Manure Type

Solid Manure*	4	
Runoff water with manure constituents (e.g., catch basin contents)	10	
Liquid Manure	20	Score: ☐

Annual Manure Amount (tonnes)

>60,000	8	
40,000 to 60,000	5	
20,000 to <40,000	2	
<20,000	1	Score: ☐

Total Hazard Potential Score (maximum 28): ☐

*When scoring surface water for solid manure facilities, choose manure type of runoff water with manure constituents.

PATHWAY

GROUNDWATER

General comments and overall scoring criteria

☐ *If there is a water well directly located within the manure storage area, score the groundwater section as high risk.*

If the above condition does not exist, continue scoring the groundwater section.

To help score the next two factors, complete the following and provide a sketch if possible:

Depth of storage below grade _____(A)
Depth to top of Protective Layer below grade _____(B)
Depth to bottom of Protective Layer below grade _____(C)
Thickness of Protective Layer _____(D)
Depth to UGR below grade _____(E)
Depth to UGR from the bottom of the facility _____(F)

Uppermost Groundwater Resource (UGR)

	Subsoil Texture		
Depth to UGR (m) (from the bottom of the facility)	Fine - Medium	Coarse	Very Coarse
>30	1	4	7
8 - 30	2	5	8
<8	3	6	10

Score: ☐

Protective Layer(s) (PL) Between Bottom of Facility and UGR

- *Score is 20 if the storage is constructed into the UGR*

	Subsoil Texture		
Thickness of Protective Layer(s) (m)	Fine	Medium	Coarse – Very Coarse
>10	1	3	8
5 - 10	4	6	12
2 - <5	6	9	16
<2	8	12	20

Score: ☐

Liner Type

Meets AOPA liner or protective layer requirements	1
Concrete liner – no specs	2
May meet AOPA requirements	15
Does not meet AOPA requirements	20

Score: ☐

Water Well Risk Scoring

Complete the table below for each water well within 400 m of the reference point identified. If the well is upslope of the facility, the well should be given a score of 1.

The "Highest Risk Water Well" is the well with the highest score.

	Distance to Water Well (m)			
Depth to top of open interval in water well (m)	≥100 to 400	60 to 99	30 to 59	<30
>100m	1	2	3	4
30-100m	5	6	7	8
<30m	9	10	12	15

- *If well annulus filled with cuttings, add 3 points*
- *If well has a drive shoe seal, add 5 points*
- *If well has no seal or the nature of the seal is unknown, add 8 points.*

Well I.D.				
Score				

Highest Risk Water Well (highest score from wells scored above): Score:

Infiltration Potential

Predominant Soil type	Average Annual Precipitation (mm)		
	<400	400-600	>600
Fine	1	2	
Medium	3	4	
Coarse	5	6	8

Score: ☐

Special Considerations (Allowable range of -8 to +8 with a total score for this section not to go over or under the allowable range). *Score is 0 if there are no special considerations*

Special consideration examples:

- Pumping rate of nearby water well (concern is that even if the well is upslope, a cone of depression may develop which could draw in contaminated water)
- Presence of any springs that have the potential to be impacted by the CFO.
- Water well in pit
- Certainty of information (ie. remove points for high quality of information, is not intended to be used for low quality of info)
- Additional points may be added if there are multiple wells that score high in the water well risk scoring criteria

Score: ☐

If a special consideration(s) is used, describe:

Total Groundwater Pathway Score (maximum score 81): ☐

EXPOSURE POTENTIAL

GROUNDWATER

- ☐ If no water wells are completed within 400m of the confined feeding operation facility being assessed, use an exposure potential factor of **1**
- ☐ If one or more water wells located within 400m of the confined feeding operation facility, but greater than 100m from the confined feeding operation facility, use an exposure potential factor of **1.1**
- ☐ If one or more water wells located within 100m of the confined feeding operation facility, use an exposure potential factor of **1.2**

Hazard Potential Score ____ + Groundwater Pathway Score ____ = ____ × Exposure Potential Multiplier ____ = Risk Score ____

Risk Level	**Hazard Potential Score + Groundwater Pathway Score (maximum score – 109)**
High Potential *Risk to the Environment*	**>90**
Moderate Potential *Risk to the Environment*	**70 – 90**
Low Potential *Risk to the Environment*	**<70**

If you checked off the following in the groundwater section, indicate here as well.

- ☐ *If there is a water well directly located within the manure storage area, score the groundwater section as high risk.*

PATHWAY

SURFACE WATER

General comments and overall scoring criteria

- ☐ *If body of water is known to be upslope of the facility, score the surface water section as low risk.*
- ☐ *If no water body within 800 m, score the surface water section as low risk.*
- ☐ *If the facility is located less than 1 m (in elevation) above the 1 in 25 year floodplain level, score the surface water section as high risk.*

If none of the above conditions exist, continue scoring the surface water section.

Likelihood of Runoff Reaching a Water Body

	Slope of land from facility to water body (%)			
Horizontal Distance to Water Body	<4	4 - <6	6 - 12	>12
>100m	1	2	3	4
30-100m	2	3	4	5
<30m	3	4	5	6

Score: ☐

Surface Water Runoff

	Average Annual Precipitation (mm)		
Predominant Soil type	<400	400-600	>600
Coarse	1	2	
Medium	3	4	
Fine	5	6	8

Score: ☐

Surface Water Run-on Control

All upslope surface water diverted around the facility	0
Most upslope surface water diverted (>80% - 99%)	1
Minimal upslope surface water diverted (<80%)	5

Score: ☐

Manure Impacted Area Runoff Control

No yard runoff (e.g., covered facility)	0
All runoff controlled	4
Most runoff controlled (>80% - 99%)	10
Minimal control of lot runoff (<80%)	20

` Score: ☐

Runoff Flow Path between Facility and Receiving Body of Water

	Vegetation Cover	
Type of Yard Runoff Flow	> 50% Vegetated	< 50% Vegetated or Frozen
Dispersed flow	1	4
Channelled flow	7	15

Score: ☐

Special Considerations (Allowable range of -5 to +5 with a total score for this section not to go over or under the range). *Score is 0 if there are no special considerations*

Special consideration examples:

- Secondary containment
- Amount of freeboard
- Above ground earthen storage
- Certainty of information (ie. remove points for high quality of information, is not intended to be used for low quality of info)

Score: ☐

If a special consideration(s) is used, describe:

_____

Total Surface Water Pathway Score (maximum score 54): ☐

EXPOSURE POTENTIAL

SURFACE WATER

- ☐ If highest use surface water body (with the greatest number of types of users) located within 800m of the confined feeding operation facility being assessed is a small slough or creek on private land but not a common body of water, use an exposure potential factor of **1**
- ☐ If highest use surface water body (with the greatest number of types of users) located within 800m of the confined feeding operation facility being assessed is a common body of water with little human use (within 10 miles downstream), use an exposure potential factor of **1.1**
- ☐ If highest use surface water body (with the greatest number of types of users) located within 800m of the confined feeding operation facility being assessed is a high use common body of water (recreation, water supply, etc.), use an exposure potential factor of **1.2**

Hazard Potential Score* ____ + Surface water Pathway Score ____ = ____ × Exposure Potential Multiplier ____ = Risk Score ____

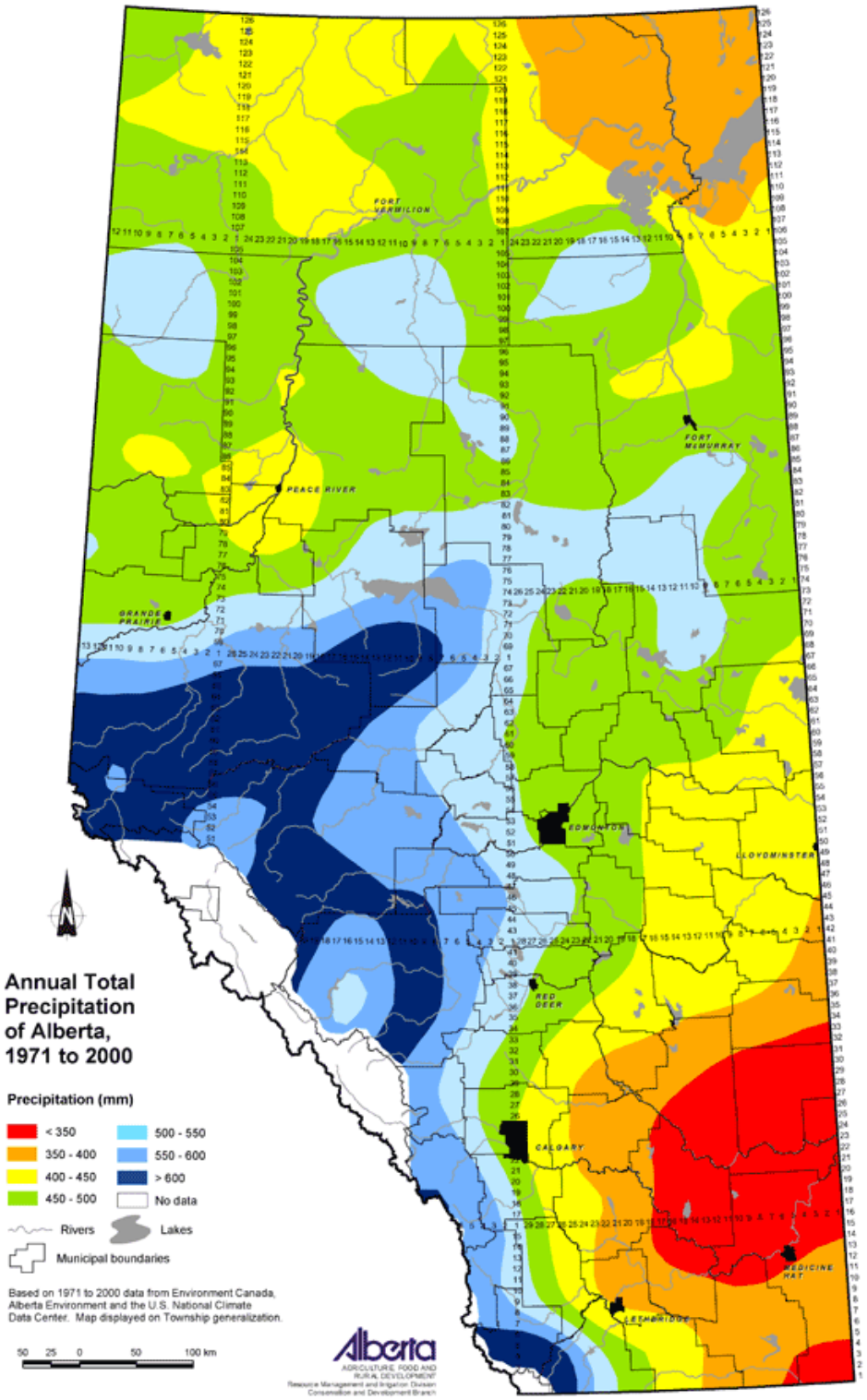
* When scoring the surface water section of the tool choose runoff water with manure constituents for solid manure facilities.

Risk Level	**Hazard Potential Score + Surface Water Pathway Score (maximum score – 82)**
High Potential *Risk to the Environment*	**> 58**
Moderate Potential *Risk to the Environment*	**44 – 58**
Low Potential *Risk to the Environment*	**<44**

If you checked off the following in the surface water section, indicate here as well.

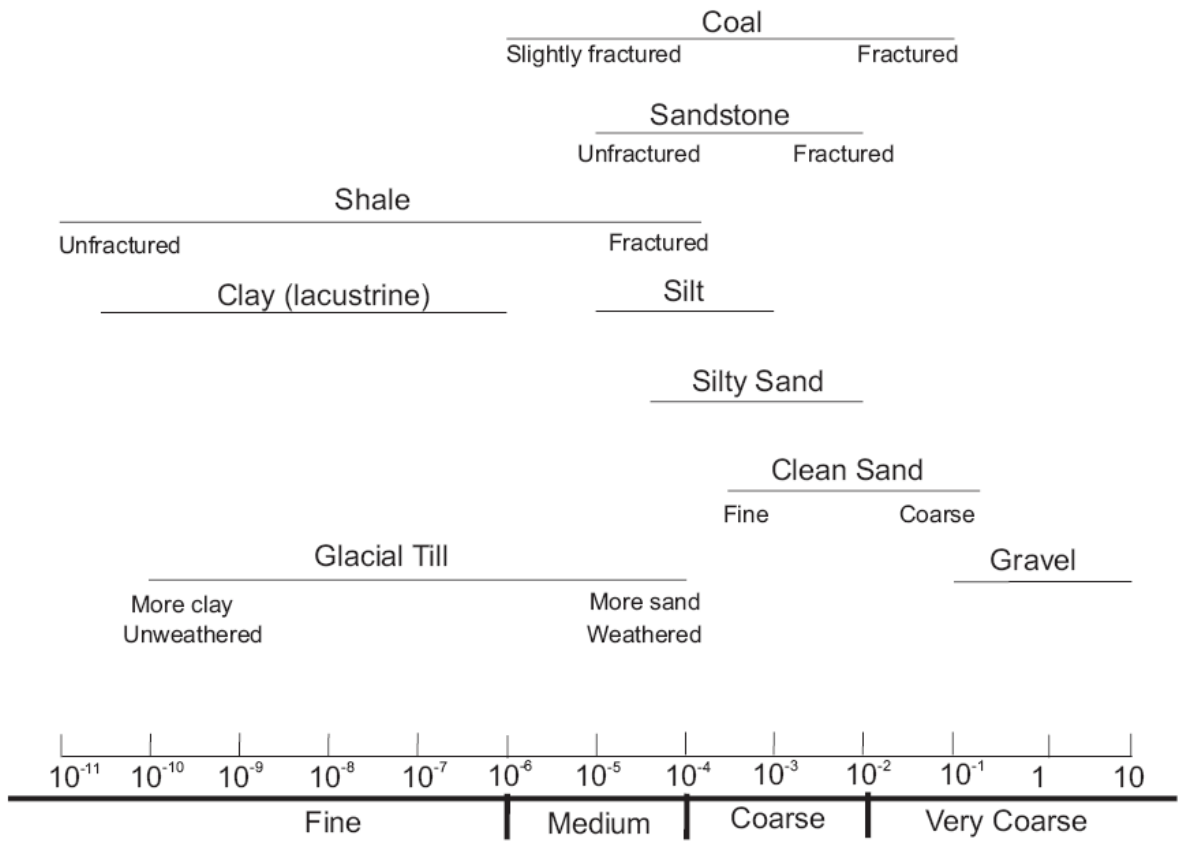
- ☐ *If body of water is known to be upslope of the facility, score the surface water section as low risk.*
- ☐ *If no water body within 800 m score the surface water section as low risk.*
- ☐ *If the facility is located less than 1 m (in elevation) above the 1 in 25 year floodplain level, score the surface water section as high risk.*

APPENDIX 4: REFERENCE MATERIALS



HIGHEST ANNUAL RUNOFF EVENT

Municipality	Highest Probability Runoff Event	Municipality	Highest Probability Runoff Event	Municipality	Highest Probability Runoff Event
Acadia	Summer	Lakeland	Spring	Smoky Lake	Spring
Athabasca	Spring	Lamont	Spring	Smoky River	Spring
Barrhead	Spring	Leduc	Spring	Special Area 2	Summer
Beaver	Spring	Lesser Slave River	Spring	Special Area 3	Summer
Big Lakes	Spring	Lethbridge	Summer	Special Area 4	Summer
Bighorn	Spring	Mackenzie	Spring	Spirit River	Spring
Birch Hills	Spring	Minburn	Spring	Starland	Summer
Bonnyville	Spring	Mountain View	Summer	Stettler	Spring
Brazeau	Spring	Newell	Summer	Strathcona	Spring
Camrose	Spring	Northern Lights	Spring	Sturgeon	Spring
Cardston	Summer	Northern Sunrise	Spring	Taber	Summer
Clear Hills	Spring	Opportunity	Spring	Thorhild	Spring
Clearwater	Spring	Paintearth	Summer	Two Hills	Spring
Cypress	Summer	Parkland	Spring	Vermilion River	Spring
Fairview	Spring	Peace	Spring	Vulcan	Summer
Flagstaff	Spring	Pincher Creek	Summer	Wainwright	Spring
Foothills	Summer	Ponoka	Spring	Warner	Summer
Forty Mile	Summer	Provost	Spring	Westlock	Spring
Grande Prairie	Spring	Ranchland	Summer	Wetaskiwin	Spring
Greenview	Spring	Red Deer	Spring	Wheatland	Summer
Kneehill	Summer	Rocky View	Summer	Willow Creek	Summer
Lac. Ste. Anne	Spring	Saddle Hills	Spring	Woodlands	Spring
Lacombe	Spring	St. Paul	Spring	Yellowhead	Spring



Estimating Subsoil Texture

(Hydraulic Conductivity(cm/s) scale included as a guide)

(Developed for use with the NRCB's Risk Screening Tool for sites in Alberta and not intended to replace published information)

APPENDIX 5: GLOSSARY

Annulus – the space between the well pipe and the surface of the bore hole.

Aqueous – containing, dissolved in, or consisting mostly of water.

Aquifer – a saturated permeable geologic unit that can transmit significant quantities of water under ordinary hydraulic gradients.

Berm – an embankment or wall used to contain material or to protect a facility from other materials entering into it.

Catch Basin – means an excavation or a diked or walled structure that is designed to intercept and store runoff.

Channel – a long narrow passage or tube, along which a liquid can flow.

Common body of water – means the bed and shore of an irrigation canal, a drainage canal, a reservoir, a river, a stream, a creek, a lake, a marsh, a slough or another exposed body of water, but does not include:

- A reservoir, lake marsh or slough that is completely surrounded by private land controlled by the owner or operator and has no outflow going directly beyond the private land to a drainage canal, reservoir, river, permanent stream or creek, lake or potable water source that is being used for human or livestock consumption.
- An irrigation canal or a drainage canal that is completely surrounded by private land controlled by the owner or operator and has no outflow going beyond the private land.
- A roadside ditch.
- A wastewater system as defined in the *Environmental Protection and Enhancement Act.*
- A storm drainage system as defined in the *Environmental Protection and Enhancement Act.*
- A temporary stream on private land controlled by the owner or operator that has no outflow going beyond the private land directly to a drainage canal, reservoir, river, permanent stream or creek, lake or potable water source that is being used for human or livestock consumption.

Compaction Density – density is a standard physical term defined as the weight (mass) per unit volume of a substance. When soil is compacted, it is denser; therefore the result required would be the density after compaction.

Cone of Depression - pumping from a well in a water table aquifer lowers the water table near the well. This area is known as a cone of depression. The land area above a cone of depression is called the area of influence. Groundwater flows towards the well into the cone of depression.

Confined Feeding Operation – means fenced or enclosed land or buildings where livestock are confined for the purpose of growing, sustaining, finishing or breeding by means other than grazing and any other building or structure direction related to that purpose but does not include residences, livestock seasonal feeding and bedding sites, equestrian stables, auction markets, race tracks or exhibition grounds.

Creek – a natural stream normally smaller than and often a tributary to a river.

Decommissioned – to have removed from service.

Dispersed – to be distributed over a wide area.

Drive Shoe - A beveled coupling or short section of hardened casing, which is located at the base of the string of casing to allow the casing to be driven. Drive shoes are commonly used in cable tool drilling.

Dugout – a man-made topographic excavation intended to collect water for agricultural use.

Erosion – the gradual wearing away of soil by physical breakdown, chemical solution and transportation of material as caused e.g. by water, wind or ice.

Flood Plain - an area of low-lying land across which a river flows that is covered with sediment as a result of frequent flooding.

Freeboard – means the vertical distance between the full storage level of a structure and the upper edge of the structure.

Glacial till – till is unsorted glacial sediment. Glacial till is that part of glacial drift which was deposited directly by the glacier. It may vary from clays to mixtures of clay, sand, gravel and boulders.

GPS – Global Positioning System is a worldwide navigation system that uses information received from orbiting satellites.

Grandfathered Capacity - The capacity of grandfathered confined feeding operations is determined by the physical capacity of structures that existed on January 1, 2002 to confine livestock.

Groundwater – the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

Groundwater Resource – means an aquifer below the site of a confined feeding operation or a manure storage facility

- ♦ That is being used as a water supply for the purposes of domestic use, or
- ♦ If no aquifer referred to in subclause (i) exists,

- An aquifer that has a sustained yield of 0.76 litres per minute or more and a total dissolved solids concentration of 4000 milligrams per litre or less as determined by well records, well drilling logs, hydrogeological maps, hydrogeological reports or other evidence satisfactory to an approval office or the Board, and
- If there is more than one aquifer that meets the requirements of paragraph (A), the aquifer that an approval officer or the Board considers to be the best suited for development as a water supply for the purposes of domestic use.

Hazard - a state that may result in an undesired event, the cause of risk.

Heterogeneous – means inconsistent, with a non-uniform composition.

Hydraulic Conductivity – the ability of the soil to transmit water in liquid form through pores.

Infiltration – the downward entry of water into the soil.

Irrigation Canal – A man-made canal used to convey water from natural water bodies for agricultural use.

Lacustrine – material deposited in lake water and later exposed by either the lowering the water level or by the elevation of the land.

Lake – a natural topographic depression greater than 8 hectares in area that contains surface water.

Liner – means, with respect to a manure storage facility or manure collection area, a layer constructed out of natural or manufactured materials that restricts the migration of the contents of the manure storage facility or manure collection area.

Liquid Manure – means manure that is in a predominantly liquid state or manure to which water has been added.

Manure - means livestock excreta, associated feed losses, bedding, litter, soil and wash water, but does not include manure to which the Fertilizers Act (Canada) applies.

Manure Facility – means a facility for the storage of manure, composting materials, compost and water containing manure constituents (eg. catch basin).

Monitoring Well – a permanent well installed at a site to obtain data on groundwater levels used to establish groundwater flow directions and gradients and to obtain representative groundwater samples for chemical analysis.

Pathway - the route by which hazards travel from sources to receptors.

Percentage Slope – the elevation difference divided by the distance (RISE/RUN), multiplied by 100.

Protective Layer – means, with respect to a manure storage facility or manure collection area, one or more layers of naturally occurring materials that, individually or in the aggregate, restrict the migration of the contents of the manure storage facility or manure collection area.

Receptor – living beings or resources that may be exposed to and affected by hazards (e.g. humans, plants, animals, or environmental resources).

Riparian – an area of land adjacent to a stream, river, lake or wetland that contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas.
River – rivers are generally larger than creeks. Rivers flow year round, in years of normal precipitation and when there are no significant water diversions. Watercourses that have bank full channel widths greater than 15 m may be broadly classified as rivers

Runoff – means liquid that drains as surface flow out of an agricultural operation or part of an agricultural operation and includes rainwater and meltwater.

Run-on – means liquid that drains as surface flow onto an agricultural operation or part of an agricultural operation and includes rainwater and meltwater.

Runoff Potential – the amount of runoff that may be generated by a one day rainfall with a 1 in 30 year probability.

Sandstone – sedimentary rock (otherwise known as bedrock), formed mainly from quartz sand.

Scouring – a process by which running water removes loose fragments.

Shale – sedimentary rock (otherwise known as bedrock), formed from clay.

Slough – a natural topographic depression less than 8 hectares in are that contains surface water.

Slumping – material that has sunken.

Soil Texture – the relative proportions of the various soil separates in a soil.

Subsoil Texture – refers to the predominant grain size distribution of the formation that has been identified.

Solid Manure – means manure that is 20% or more solid matter and that does not flow when piled.

Weathering - the disintegration and decomposition of rocks and minerals by natural processes such as the action of frost or percolating ground water.

Wetland - a marsh, swamp, or other area of land where the soil near the surface is saturated or covered with water, especially one that forms a habitat for wildlife.

Contact the Natural Resources Conservation Board at the following offices. Dial 310.0000 to be connected toll free.

Edmonton Office
Sterling Place
4th Floor, 9940 - 106 Street
Edmonton, AB T5K 2N2
T (780) 422.1977 F (780) 427.0607

Calgary Office
19th Floor, 250 - 5 St. SW
Calgary, AB T2P 0R4
T (403) 297.8269 F (403) 662.3994

Fairview Office
Provincial Building
#213, 10209 - 109 Street
P.O. Box 159
Fairview, AB T0H 1L0
T (780) 835.7111 F (780) 835.3259

Lethbridge Office
Agriculture Centre
100, 5401 - 1 Avenue S
Lethbridge, AB T1J 4V6
T (403) 381.5166 F (403) 381.5806

Morinville Office
Provincial Building
#201, 10008 - 107 Street
Morinville, AB T8R 1L3
T (780) 939.1212 F (780) 939.3194

Red Deer Office
Provincial Building
#303, 4920 - 51 Street
Red Deer, AB T4N 6K8
T (403) 340.5241 F (403) 340.5599

NRCB Response Line: 1.866.383.6722
Email: info@nrcb.gov.ab.ca
Web Address: www.nrcb.gov.ab.ca

Copies of the *Agricultural Operation Practices Act* can be obtained from the Queen's Printer at www.qp.gov.ab.ca or through the NRCB website.