Regulating
ANAEROBIC DIGESTION
In the ALR

DISCUSSION PAPER AND MINISTER’S BYLAW STANDARDS

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Executive Summary

This discussion paper was prepared by the BC Ministry of Agriculture (AGRI) and outlines a set of criteria that can be used by local governments to regulate anaerobic digestion in the Agricultural Land Reserve (ALR).

The demand for on-farm anaerobic digesters is expected to increase in the next 5 years. This demand is fueled by evolving climate change policies, consumer demand for renewable energy, and the appetite of farmers to integrate new technologies into their businesses.

This paper focuses on the issue of on-farm anaerobic digestion systems. The major areas of concern have been identified as the volume of “non-agricultural” and “off-farm” feedstock that will be allowed in digesters. From those topics, have emerged concerns about feedstock storage, record keeping, and nutrient management planning. The most sensitive issues are the implementation and enforcement of nutrient management plans for AD facilities and land receiving digestate.

The criteria that are presented in this document reflect analysis by AGRI and Agricultural Land Commission (ALC) staff as well as current approaches being taken by local governments. This paper provides the basis for developing a standard that can be used by local governments to establish land use policy or regulations related to anaerobic digestion. Although the emphasis of the criteria is on anaerobic digestion in the South Coastal region of B.C., local governments that are outside that region may use the information as they see appropriate. The standards are intended to assist local governments in addressing the demand for anaerobic digesters without compromising the long term productivity of agricultural land.
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Introduction

This discussion paper outlines a set of criteria for regulating the operation of anaerobic digesters (AD)\(^4\) on farmland in the Agricultural Land Reserve (ALR) and serves as a basis for further discussion with local governments and the agriculture industry to ensure the criteria effectively deals with the issue of AD from a land use regulation perspective. The criteria that have been developed reflect analysis undertaken by Ministry of Agriculture (AGRI) and Agricultural Land Commission (ALC) staff as well as current approaches being used to regulate AD.

The criteria are intended to address the needs of the agriculture industry while protecting the agricultural land base from non-farm related activities and the potential for increased nutrient loading. The criteria can also be modified by local governments to meet local agricultural needs. Criteria presented in this discussion paper are focused on on-farm AD.

Before the criteria are presented, the criteria development process is outlined, background on the issue is provided, and current policy, guidelines and regulations are described.

\(^4\) Other terms such as ‘anaerobic digestion’, ‘digesters’, ‘biogas production’ or ‘livestock waste to energy facility’ are used by different agencies. For the purposes of this paper, these terms are considered to be interchangeable with AD. Please see Part 4, Definitions for a complete definition of the term *anaerobic digestion*. 
Part 1 - Criteria Development Process

The intent of this process is to develop criteria that can be used by local governments to establish land use policy or regulations to address the construction and operation of anaerobic digesters in the ALR. Following consultation with stakeholders, these criteria, if approved by the Minister, may become standards and be incorporated into the “Guide for Bylaw Development in Farming Areas”.

1. Purpose & Goals

The purpose of establishing the criteria is to meet the agriculture industry’s demand for economical anaerobic digestion systems in a manner that minimizes the impact on agricultural land and addresses local government concerns. These criteria will:

1. meet the needs of the agriculture industry;
2. minimize the impact of AD in the agricultural area;
3. minimize loss and/or fragmentation of agricultural land due to AD;
4. minimize the risk of AD on farm land being used for non-farm purposes;
5. minimize the risk of excess nutrients being applied to farm land from AD digestate; and
6. foster a more cohesive process for approving AD projects.

2. Scope

The criteria considered in this paper only address the issues of regulating the use of AD on farm land. The paper does not address regulating AD projects not being conducted on farm land. The criteria attempt to meet the needs of farmers who wish to construct anaerobic digestion facilities, and at the same time, discourage the establishment of industrial-scale anaerobic digesters in the ALR. The primary demand for anaerobic digesters is currently located in the Lower Mainland where livestock densities are high, agricultural land is limited and constraints on waste disposal are increasing. Agricultural land in this area is currently under excessive nutrient pressure and the criteria were developed to prevent this situation from worsening and causing environmental impacts to surface and ground water. The criteria have been developed for farm operations located in the ALR to clearly identify which AD projects are considered a permitted use in the ALR and should not require rezoning by the local government.

The goal is to develop a set of criteria for AD that, if met, will ease the regulatory process for producers to adopt the technology while ensuring that farm land is being used appropriately. Should a proposed AD project fall outside of this set of criteria, a rezoning application and a non-farm use application to the ALC may be required before the project will be allowed on farm land. AGRI recognizes that other agencies’ regulations and requirements (Public Health Act, Environmental Management Act, etc.) must still be met and that the establishment of an anaerobic digester in the ALR must be consistent with the ALC Act and policy.

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b Under the Local Government Act (Part 26, Division 8, Section 916), the minister responsible for the Farm Practices Protection (Right to Farm) Act can establish bylaw standards to guide the development of zoning and farm bylaws. Development of provincial standards is intended to promote consistency in the regulation of, and planning for, farming. However, provision has been made under Section 916 (3) to allow the standards to differ, if necessary, to respond to BC’s diverse farming industry and land base.
3. **Stakeholders**

The following groups will be involved in the criteria development process:

- AGRI staff;
- ALC staff;
- Ministry of Environment (ENV) staff;
- British Columbia Agriculture Council (BCAC) and industry associations;
- Local governments and their Agricultural Advisory Committees; and
- Anaerobic digestion proponents, technology providers and contractors.

4. **Objectives of the Process**

The objectives of the development process are to:

1. create a set of criteria for review by stakeholders;
2. consult with stakeholders; and
3. develop standards that local governments can adopt and apply as policy or regulation.

5. **Methods to Develop the Criteria**

5.1 **Key Steps**

Four key steps will be undertaken to develop the criteria:

1. Review relevant literature including AGRI and ALC policies and MoE draft “On-Farm Anaerobic Digestion Waste Discharge Authorization Guideline”;  
2. Examine how the Ontario Ministry of Agriculture, Food, and Rural Affairs (OMAFRA) has addressed the issue;  
3. Review existing local government regulations and policies; and  
4. Consult with stakeholders

5.2 **Process to Date**

Current policies and regulations dealing with AD were examined and used in the development of the criteria. Ontario is an early adopter of nutrient management regulations in Canada. Discussions were undertaken with the Ontario Ministry of Agriculture, Food and Rural Affairs for their perspectives on issues surrounding AD. This information was then considered by a committee comprised of AGRI and ALC staff who worked together to draft the criteria currently listed in Part 4 of this document.

These criteria and discussion paper are now ready be distributed to the stakeholders for their review and feedback. There will also be provisions for public input through the Ministry website.

Once stakeholder input has been received and reviewed, a decision will be made whether further consultation is required. Once the consultation process is completed and the feedback analyzed, the discussion paper will be revised. The revised discussion paper and criteria will be sent to the Minister of Agriculture for final approval. Once approval has been received, the criteria may be incorporated into the “Guide for Bylaw Development in Farming Areas”. Local governments
would then be encouraged to amend their zoning bylaws to be consistent with the Minister’s Bylaw Standard.

Part 2 – Background

6. Anaerobic Digestion

Anaerobic digestion (AD) systems create an environment where the microbes in animal manure consume the nutrients of other materials to grow and produce methane gas. Methane gas is captured from the system and either upgraded to natural gas quality or converted to electricity by a combustion engine. AD operations can obtain revenue from the sale of either natural gas or electricity to utility companies. AD operators may receive higher prices for the ‘green’ energy they produce than for the conventional energy they purchase for use on their farms. In order to increase revenue from energy sales, “non-agricultural” feedstock is often fed into AD systems to increase methane production. The most sought after “non-agricultural” feedstock is material that digests easily and has a high energy density, such as fats, oils and greases or food processing wastes. Figure 1 shows that non-agricultural wastes yield higher amounts of biogas per tonne than farm wastes; it provides an idea of how biogas production can be increased by using “non-agricultural” feedstock.

![Figure 1 Biogas potential of various substrates (Data derived from Effenberger, 2011)](image-url)

Demand for AD is growing among BC livestock producers because it is a manure treatment option that could generate renewable energy and increase farm income. AD has the potential to be an economical and environmentally-conscious manure management tool. Animal manure treated by AD typically...
demonstrates reduced odours, pathogens, and weed seed viability. Systems are designed to capture and use methane gas; a renewable fuel but also a potent greenhouse gas.

The adoption of AD technology on farms in B.C. could also improve the potential for nutrient recovery from animal manures. In regions of B.C. where soil nutrient loading from the land application of manure poses an environmental risk, AD systems could facilitate the adoption of nutrient extraction technology.

Despite the benefits outlined above, uptake of AD technology in BC has been limited to two on-farm systems to date, both located in the Lower Fraser Valley. The limited uptake of AD by livestock producers in BC has been blamed on economic, policy, and regulatory barriers. Economic barriers are a function of methane gas production and the price utility companies are willing to pay for that energy versus the capital and operational costs of the system. Policy barriers have emerged with regard to bringing “off-farm” or “non-agricultural” feedstock on to farms where AD facilities are proposed. Regulatory barriers exist because AD is a new technology on BC farms and it is challenged to fit under existing land use regulations not designed with AD in mind.

7. **Opportunities for Anaerobic Digestion in BC**

Finding economical ways to manage manure in an environmentally responsible manner is a challenge for livestock producers in BC and anaerobic digestion of manure is seen as an improvement over conventional manure treatment options, because of the potential financial returns. Making AD economical is challenging in the conventional energy market. The following is a list of existing and proposed renewable energy pricing programs in BC that may make the economics of AD more favorable in the future.

**7.1 BC Hydro Standing Offer Program**

BC Hydro implemented a Standing Offer Program (SOP) to encourage the development of small and clean or renewable energy projects throughout British Columbia. The program was developed to streamline the process for small developers selling electricity to BC Hydro, simplify the contract and decrease transaction costs for developers while remaining cost-effective for rate payers. The Standing Offer Program embodies the principles and policies set out in the [BC Energy Plan](#) and the [Clean Energy Act](#) (BC Hydro, 2011a)

Current SOP pricing applies to projects between 0.05 MW and 15 MW. A base price is set according to the regions defined by BC Hydro. Regional pricing varies from $94.86/MWh in the Peace River region to $103.69/MWh in the Lower Mainland (2010). BC Hydro published [Standing Offer Program Rules](#) for 2011 that fully explain eligibility, payment price and application process. (BC Hydro, 2011b)

Anaerobic digestion projects are considered renewable energy projects and qualify for the SOP.

**7.2 Proposed Feed-In-Tariff Regulation**

The British Columbia Ministry of Energy is considering the development of a [Feed-In Tariff (FIT)](#) Regulation under section 16 of the [Clean Energy Act](#). The Regulation would require BC Hydro to establish a FIT program in accordance with the [Clean Energy Act](#), and would set out eligibility criteria for participation in a FIT along with other key aspects of the program.
Feed-In Tariff programs are designed to encourage the development of renewable generation through energy contracts, guaranteed access to the grid, and payment of rates that would enable generators to recover their costs over a reasonable period of time. The proposed program would provide an opportunity for electricity generation projects using emerging technologies to prove their performance while earning revenue from their power production, and would focus on small-scale electricity generation rather than large-scale projects. (BC Hydro, 2011c)

The FIT program would differ from BC Hydro’s SOP because it would set energy prices based on project size, technology, inputs, and performance rather than on location alone. The proposed FIT Regulation has not been passed by government and with recent changes in the legislature, the future of this regulation is uncertain. An original launch date was set for late 2011 or early 2012, but it has been unclear as to how energy prices for anaerobic digestion projects would be structured under the proposed FIT program.

7.3 Voluntary Pricing Programs

Some renewable energy projects, including anaerobic digestion, struggle to attract a high enough return on investment at current (SOP) or uncertain (FIT) energy prices. There is often a gap between the costs of producing renewable energy and the price government programs and utility companies are willing to pay for it. To fill this gap, Voluntary Pricing Programs (VPPs) have been created. In BC, two VPPs are currently being developed for the anaerobic digestion industry. FortisBC has launched a “Make-Yuk-Useful” campaign for consumers to voluntarily purchase renewable natural gas and Cow Power BC that will be launched in 2012 to invite consumers to purchase renewable electricity; both renewable natural gas and renewable electricity can be generated from AD.

VPPs allow consumers to support renewable energy projects by paying a premium on their energy bill. The premium is then passed on to the renewable energy project owner. The
purchaser becomes an owner of a portion of the renewable energy project’s environmental attributes and can then use those attributes to create and/or promote a unique identity for their product and/or service. Similar market differentiation based on environmental benefit has a track record of success in BC.

Two examples of voluntary pricing programs currently operating in the North American energy market are CVPS Cow Powerc and Bullfrog Powerd.

7.4 Benchmarking the Feasibility of AD in BC
Growing interest in establishing anaerobic digestion projects in B.C. is evidenced by twelve agriculture and agri-food producers participating in a benchmarking feasibility study in 2011. The project proponents are interested in determining the economic, logistical, and technical feasibility of installing anaerobic digestion systems on their farms. They each contributed a portion of their own funds to take part in the study. The study is geographically and demographically diverse; taking into consideration various locations, types and sizes of farms. The study was capped at twelve diverse producers, but more than double that number were willing to participate in the study.

The results of the benchmarking study will help others interested in AD determine if the projects they are considering are likely to be feasible. The AD industry as a whole will benefit by knowing what type and size of projects fit the B.C. marketplace and where. In addition, the study is expected to reveal what policy and regulatory conditions are necessary for anaerobic digestion projects to succeed in the future. The report is expected to be released in December 2011 and will be available on the ARDCorp Renewable Agri-Energy Initiative project page.

The final benchmarking report will discuss how increasing the percentage of “off-farm” and/or “non-agricultural” feedstock relates to the utility energy price needed to make projects feasible. The study is expected to show that an increase in “non-agricultural” feedstock to 50% would achieve economic feasibility at electricity prices 30-50% lower than would be required with only 25% “non-agricultural” feedstock. Information about the assumptions and variables used to calculate these values will be made available when the study is published.

8. Regulatory Challenges of Anaerobic Digestion in BC
AD has risen to a greater level of importance for many local governments due to increased interest and demand by farmers and technology providers. Early adopters of AD have shouldered many burdens but have also advocated strongly for the technology. Their determination to see AD on farm land has exposed policy and regulatory challenges at various levels of government and has brought perspective to the social and economic realities of AD.

The challenges of regulating AD on agricultural land are multi-faceted. The technology is typically seen as a benefit to agriculture, but it is very difficult to regulate AD because it is new to the landscape and it exists at the interface of many urban and agricultural issues.

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c http://www.cvps.com/cowpower/
d http://www.bullfrogpower.com/
The key challenges in regulating AD on agricultural land in B.C. are:

8.1 “Non-Agricultural” Feedstock
Adding “non-agricultural” feedstock increases the volume of methane that AD facilities are capable of producing. Increased methane volumes result in improved economics because more energy is produced at the same capital cost. “Non-agricultural” feedstock is sought after because it often contains high-energy materials such as fats, oils and grease or other food processing byproducts that have a high methane potential. It is also often seen as a benefit to divert these materials from municipal waste streams if they can be beneficially reused to produce renewable energy. Agricultural feedstock, such as manure, contains very little energy and is difficult to transport economically. Since manure is a necessary feedstock for AD, locating AD systems on farms is practical because it ensures that the system maintains a healthy supply of manure to operate both efficiently and economically.

The risks of bringing “non-agricultural” feedstock onto agricultural land are not well known. Social risks could include:

- the perception that agricultural land is a dumping ground for municipal wastes,
- the perception that feedstock and digestate could smell if they are not treated and stored appropriately,
- traffic to and from farms could increase and
- with any new technology the fear of change is also inevitable.

Environmental risks could include:

- increased nutrient loading in the lower Fraser Valley,
- contamination from foreign objects or impurities (i.e. heavy metals),
- unknown nutrient potential of effluent and
- issues around treatment and storage of feedstock and digestate.

Since AD will require importing “non-agricultural” feedstock onto farm land, the criteria should address the following two questions:

- What is the maximum amount of “non-agricultural” feedstock that an AD proponent is allowed to import and use in their AD facility?
- What safeguards can be implemented to decrease the social, environmental, and/or animal/human health risks of importing “non-agricultural” feedstock onto farmland?

Additional concerns regarding the importation of non-agricultural feedstock for anaerobic digestion on ALR lands include issues around urban waste management and disposal on agricultural lands, displacement of capacity of agricultural lands to deal with agricultural waste, and associated nutrient loading. Further questions are, how might tipping fees impact motivation for anaerobic digesters, what happens if feedstock supply is not maintained and digester and infrastructure are abandoned?

Appendix E presents the density of livestock on a per unit area basis calculations, to determine areas rich in livestock nutrients.
8.2 “Off-Farm” Agricultural Feedstock

“Off-farm” agricultural feedstock is similar to “non-agricultural” feedstock in that material is being imported from an outside source, but, in this case, it is other agricultural material. Examples of “off-farm” agricultural feedstock are manure from other farms and wastes from feeding or processing agricultural products. This situation could arise when multiple producers pool resources to construct a centralized AD facility. Situations may occur where it makes more economic sense to have one large digester and transport material than it does to build multiple small facilities.

In order to ensure that AD facilities are a benefit to agriculture, are an accessory land use to agriculture, and are being used for agricultural purposes, it may be necessary to indicate a minimum amount of agricultural feedstock that must be supplied from the farm hosting the AD facilities.

Criteria should address the following two questions:

- What is the minimum amount of “on-farm” agricultural feedstock that an AD proponent must supply from his/her farm to an AD facility built on his/her farm?
- What safeguards can be implemented to decrease the social, environmental, and/or animal/human health risks of importing “off-farm” agricultural feedstock?

8.3 Acceptable Feedstock

ENV has listed three schedules of feedstock classification in its draft of the On-farm Anaerobic Digestion Waste Discharge Authorization Guideline. Schedule A is a list of feedstock that is considered acceptable for use in on-farm AD facilities. Schedule B is a list of limited feedstock, meaning that pre-treatment by pasteurization is necessary before it can be used. Schedule C is a list of feedstock that is unacceptable for use in on-farm AD facilities.

The feedstock schedules are presented in Appendix A. The AD industry has raised a concern with regard to bio-solids and septic tank sludge being included in Schedule B of MOE’s draft guideline. Suggestions have been made that bio-solids and septic tank sludge be moved to Schedule C as disallowed feedstock for on-farm AD. Ministry of Agriculture staff believes it is more appropriate to align with the ENV guideline. The ENV is the regulating authority for waste discharges and requires AD facilities to obtain waste discharge permits if they are using “non-agricultural” feedstock in the digester.

8.4 Nutrient Management Plans

Managing nutrients on agricultural land is an ongoing challenge in areas where intensive livestock operations exist on a limited agricultural land area. Nutrients enter farms as animal feed and are applied to farm land by the spreading of animal manure. When crops are unable to use all the nutrients applied to farm land, the risk of environmental impact increases.

Importing “non-agricultural” or “off-farm” agricultural feedstock for digester operation complicates nutrient management issues on a regional scale in B.C. Farms contributing

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feedstock to the facility may be able to take their portion of the nutrients back in the form of digestate, but nutrients imported in “non-agricultural” feedstock contribute to regional nutrient concentrations. Farm land that may have previously balanced nutrients may be under pressure to accept digestate from a nearby AD facility.

The risk of excessive nutrient loading on farm land surrounding AD facilities is increased because transporting digestate away from the facility is costly. If budgets get tight, there is a risk that the facilities will avoid transportation costs by spreading digestate on nearby land. Repeatedly spreading digestate on nearby land may lead to excessive nutrient loading on those pieces of land. One way to address nutrient management issues on farm land is to require the development of Nutrient Management Plans (NMP) for AD facilities.

The Ministry of Agriculture encourages the use of NMPs as a tool for farmers who are using manure to supply crop nutrients. Currently, there is no formal compliance assessment process for NMPs. Under the Environmental Farm Plan (EFP) program, NMPs are voluntary although sometimes required for cross-compliance purposes. NMPs are prepared by qualified nutrient management planners who conduct farm specific assessments. Nutrient management planners make farm specific recommendations to producers on how to best manage their nutrient balance issues, taking into account which nutrients are limiting, what the crop needs and how the farm is managed.

Nutrient management plans are not currently mandatory or enforceable in British Columbia. In order to use NMPs as a regulatory tool for AD, some questions will need to be addressed:

- What is the definition of a NMP in the context of this discussion paper and subsequent bylaw standard?
- How can a NMP be enforced, logistically and monetarily?
- Is it necessary to select a limiting nutrient (Nitrogen or Phosphorus) for all AD NMPs?
- Is the NMP for the facility or for the land receiving digestate, or both?
- Does a defined, mandatory and enforceable NMP affect decisions on feedstock limits and project size and regional nutrient loading issues (Appendix E)?

Stakeholders are invited to comment on these and other questions they may have.

### 8.5 Storage of “non-agricultural” feedstock

In order to use “non-agricultural” feedstock at AD facilities, a certain volume of the feedstock needs to be stored on site. Anaerobic digesters require consistent and continuous feedstock loading to operate efficiently. Storing some “non-agricultural” feedstock on site will allow AD operators to adjust feedstock recipes, as needed, and will allow truck traffic to the facility to be managed.

There are nuisance and environmental risks of storing “non-agricultural” feedstock on farms. AD operators may not be familiar with safe handling and storage procedures for some of the imported material, so due diligence will be necessary to minimize the escape of odours and leachate from storage structures.
To ensure that “non-agricultural” feedstock is not stockpiled at AD facilities in favour of collecting tipping fees, it may be necessary to limit the volume of material that can be imported. A further stipulation could be that “non-agricultural” feedstock may only be imported when the digester is producing biogas that is being used downstream for energy production.

The criteria should answer the following questions:

- What is the maximum volume of “non-agricultural” feedstock that may be stored at the AD facility at any given time?
- How can the stockpile of “non-agricultural” feedstock be avoided?
- What measures are necessary to minimize the nuisance and environmental risks of storing “non-agricultural” feedstock on farms?

### 8.6 Steps to approve projects

AD project developers currently find the approval process to be onerous and unpredictable. Receiving approval from multiple different agencies and levels of government can be tricky and the process is not always clear. A snapshot of the current steps required to achieve project approval is provided in Appendix B. Communication between the regulating authorities has been a problem for the early adopters of AD, but this discussion paper is intended to foster a more cohesive process for approving projects in the future.
Part 3 – Current Policies and Regulations

This section summarizes the current ALC and AGRI policies related to AD. It also describes the draft On-farm Anaerobic Digestion Waste Discharge Authorization Guideline developed by the ENV.

9.1 Agricultural Land Commission
Legislation guiding the activities of the Agricultural Land Commission includes the Agricultural Land Commission Act (ALC Act) and the Agricultural Land Reserve Use, Subdivision and Procedure Regulation (ALRUSP Regulation). Neither of these statutes includes information about on-farm AD systems specifically because the technology was not being considered in B.C. when they were written. Section 25 of the ALC Act provides for applications for permission for non-farm use within the ALR.

In an attempt to reduce the regulatory burden for on-farm AD and allow farmers to benefit from the opportunities that anaerobic digestion provides, the ALC is considering a policy that outlines a set of criteria that, if met, would allow an anaerobic digestion project to be a permitted in the ALR without application. Projects that do not fit within the criteria of the policy will still be required to submit a non-farm use application, via the normal process, to local governments and the Commission. The ALC wishes to move to a policy to avoid having to deal with individual applications for AD where they meet the specified criteria.

9.2 Local Governments
Regional districts and municipalities have jurisdiction over various permits and processes that may be necessary for on-farm AD projects. These include:

- Bylaw development, adoption and enforcement;
- Land use zoning and regulation;
- Building regulations including building codes and building permits; and
- Business licenses.

Local governments are partners in the ALC Act process. If a non-farm use application is required, it is submitted to the local government first and the local government can reject it or it can forward the application to the ALC for decision.

A zoning amendment was required for the two AD projects located on farms in the Lower Fraser Valley. However, AGRI proposes that local governments amend their zoning bylaw to be consistent with the Minister’s Bylaw Standard.

It is important for on-farm AD project proponents to contact their local government early in their planning process to find out what steps they need to take.

9.3 BC Ministry of Agriculture
Section 916 of the Local Government Act states that the Minister of Agriculture may establish, publish, and distribute standards to guide local governments in the preparation of bylaws for
their farming areas. The Ministry’s Guide to Bylaw Development in Farming Areas contains the standards that have been adopted as official Minister’s Bylaw Standards.

The agriculture and AD industries have requested that the regulation of AD be simplified. AGRI staff have initiated this discussion paper to establish standards to guide local government bylaw development.

AGRI is also engaged with the ALC to achieve consistency between this Bylaw Standard and the proposed ALC policy. Neither the Minister’s Bylaw Standard nor the ALC’s policy will supersede current or future regulations set by the ENV.

### 9.4 BC Ministry of Environment

Under the Environmental Management Act, the ENV has responsibility for environmental risks that could result from on-farm AD projects. ENV is responsible for the regulations affecting anaerobic digestion. AD projects could currently fall under the following regulations:

- Waste Discharge Regulation (WDR) and
- Agricultural Waste Control Regulation (AWCR).

In consultation with AGRI, the ENV drafted the On-farm Anaerobic Digestion Waste Discharge Authorization Guideline. The document includes a description of which regulations apply for different types of AD facilities based on feedstock type and volume. The table in Appendix C outlines the types of waste discharge authorizations an AD facility may require. It also describes a system of tiers and schedules for categorizing projects based on percentages of “non-agricultural” feedstock and the type of feedstock, respectively. Appendix D shows a flowchart outlining the various tiers and corresponding authorization requirements. Changes were last made to this draft document in May 2010.

### 10. The Ontario Experience

The Ontario Nutrient Management Act, 2002 (O.Reg 267/03) was amended in 2011 to include Part IX.1 Anaerobic Digestion for regulating the use of AD in Ontario. This part of the regulation covers the following items:

- Receipt of off-farm anaerobic digestion materials,
- Storage of off-farm anaerobic digestion materials,
- Treatment of anaerobic digestion materials,
- Storage of anaerobic digestion output,
- Land application of anaerobic digestion output, and
- Records, re anaerobic digestion.

Specifically, Part XI.1, section 98.9(1) of the Ontario Nutrient Management Act, 2002 states that:

- at all times, at least 75 per cent, by volume, of the total amount of anaerobic digestion materials that are being treated in the facility must be on-farm anaerobic digestion materials, and that
- at all times, at least 50 per cent, by volume, of the total amount of on-farm anaerobic digestion materials that are being treated in the facility must be comprised of manure.
The Ontario *Nutrient Management Act, 2002* is unlike any regulation currently established in British Columbia. The Act requires that generators of prescribed materials have a nutrient management strategy for those generated materials to ensure that they are being managed appropriately. A nutrient management strategy may include one or more nutrient management plans. A nutrient management plan is a plan for managing materials containing nutrients that may be applied to lands and is it prepared in accordance with regulations. *Ontario Regulation 267/03* outlines the preparation, approval, registration and notice requirements for these and other related documents.

AD facilities in Ontario are currently operating under one of two authorizations. In general, most systems are accepting up to 25% “non-agricultural” material and are operating in accordance with the *Nutrient Management Act, 2002*. Alternatively, there are more than six AD systems operating with a Certificate of Approval from the Ministry of Environment that allows for up to 50% “non-agricultural” material.

OMAFRA has reported that the AD systems accepting up to 50% “non-agricultural” materials are operating well. The nuisance risk of “non-agricultural” materials reception at these facilities has been minimized by good diligence of covering tanks and using carbon filters, etc. These systems are typically at livestock facilities and are treating significant volumes of manure. AD stakeholders in Ontario are reporting that a limit of 25% “non-agricultural” material volume is limiting the economic viability of AD at medium-sized livestock farms. The argument is that the farms need more than 25% “non-agricultural” material relative to the amount of manure they have to make the systems economical.

The Ontario Ministry of Environment is considering a Renewable Energy Approval process that would streamline approvals for AD facilities to use higher volumes of “non-agricultural” material. Information on this modernization attempt has not been made public, but stakeholders expect that it will include a checklist of items that, if met, will streamline the approval process.

The above information is with respect to the provincial regulation of AD in Ontario. It is important to keep in mind that the intent of this discussion paper is to develop a set of criteria that can be used by local governments to approve AD facilities on farmland. In British Columbia, the ENV is responsible for regulating the waste control aspects of AD.

From an Environmental Farm Plan, perspective, OMAFRA, suggests calculating the ratio of nutrient units⁷ (NU) per unit area. OMAFRA recommends less than 0.6 NU per acre will satisfy manure application needs; whether through land rental, manure agreements or land ownership, this ratio allows application to crops that will have economic benefit from the nutrients applied. Where the NU per acre are greater than 1, consider renting additional land or obtaining manure agreements; some cash crop farmers in Ontario are willing to pay for the nutrients from manure or in some cases for the organic matter benefit.

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¹ OMAFRA uses the term “off-farm” to describe “non-agricultural” as defined and used in this document.

² A Nutrient Unit (NU) is the amount of nutrients that give the fertilizer replacement value of the lower of 43 kg (95 lbs) of nitrogen or 55 kg (121 lbs) of phosphate.
Part 4 – Anaerobic Digestion on Farmland – Proposed Criteria

Part 4 outlines a draft set of criteria that AGRI suggests for discussion purposes to be appropriate for regulating the use of anaerobic digestion on farmland in BC. The purpose and goals from Part 1 served as a foundation for creating the criteria. Information was obtained from local governments dealing with permitting AD systems, from project proponents and other provincial agencies including the ENV and the ALC.

Off-farm AD systems are outside the jurisdiction of AGRI.

11. Definitions

The following definitions are provided to clarify the meaning of certain words that are used in the criteria. The definitions are drawn or adapted from the Farm Practices Protection (Right to Farm) Act, ‘Guide for Bylaw Development in Farming Areas’, BC Assessment Act, and various local government bylaws.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD facility</td>
<td>an anaerobic digester (AD) and all necessary works to conduct anaerobic digestion for the conversion of organic matter into bio-gas and eventually bio-methane, heat or electricity</td>
</tr>
<tr>
<td>AD Specific Nutrient Management Plan</td>
<td>a technical document prepared by a qualified professional to manage the source, placement, form, and timing of nutrient and soil amendment applications to land to optimize nutrient utilization efficiency while minimizing environmental impact and/or risk.</td>
</tr>
<tr>
<td>Agricultural Waste</td>
<td>as defined in the “Agricultural Waste Control Regulation” (i.e., manure, agricultural vegetation waste, spoiled feed, etc.)</td>
</tr>
<tr>
<td>Farm Class</td>
<td>a designation given to a lot or part of a lot that is classified as “farm” under the BC Assessment Act.</td>
</tr>
<tr>
<td>Farm Operation</td>
<td>as defined under the “Farm Practices Protection (Right to Farm) Act” see ‘Guide for Bylaw Development in Farming Areas’ for complete definition.</td>
</tr>
<tr>
<td>Farm Unit</td>
<td>an area of land used for a farm operation consisting of one or more contiguous or non-contiguous lots, that may be owned, rented or leased, which form and are managed as a single farm.</td>
</tr>
<tr>
<td>“Non-agricultural” Feedstock</td>
<td>material that is not defined as an agricultural waste</td>
</tr>
<tr>
<td>“Off-farm” Agricultural Feedstock</td>
<td>agricultural waste that does not originate from the farm unit on which the AD facility is located</td>
</tr>
</tbody>
</table>
12. **Criteria**
Local governments are encouraged to incorporate these criteria into their bylaws.

1. **Farm Class**
   - The farm lot where the AD facility is to be located must be classified as ‘farm’ under the BC Assessment Act.

2. **Minimum Parcel Size**
   - The minimum parcel size on which an AD facility can be located is 4 hectares.

3. **“Non-agricultural” Feedstock**
   - Less than 25% of the total feedstock (by volume) to be digested in the AD facility is “non-agricultural” feedstock, or
   - Less than 50% of the total feedstock (by volume) to be digested in the AD facility is “non-agricultural” feedstock in areas with low concentrations of livestock nutrients (see Figure 4, Appendix E), or if justified\(^b\) by an AD specific nutrient management plan.

4. **“Off-farm” Agricultural Feedstock**
   - At least 25% of the total feedstock (by volume) to be digested in the AD facility is agricultural waste originating from the farm unit on which the digester is located.
   - Other farms may contribute the remaining volume of “off-farm” agricultural feedstock needed to operate the AD facility.

5. **Acceptable Feedstock**
   - Acceptable feedstock as per Schedule A and B of the On-Farm Anaerobic Digestion Waste Discharge Authorization Guideline and Ministry of Environment approval.
   - Unacceptable feedstock as per Schedule C of the On-Farm Anaerobic Digestion Waste Discharge Authorization Guideline.

6. **AD Specific Nutrient Management Plan**
   - An AD specific nutrient management plan is required for both the AD facility and any land receiving digestate.
   - The plan must be updated annually by a recognized nutrient management planning advisor or qualified professional and be made available to regulating authorities upon request.
   - The plan must be prepared and enforced in accordance with BC Ministry of Environment regulations and policy when established.

7. **Storage**
   - No more than 200 m\(^3\) of “non-agricultural” feedstock may be stored on the AD facility site at any given time.

\(^b\) The AD specific nutrient management plan requires that the digestate nutrients equivalent to the non-agricultural feedstock nutrients are moved off farm land or outside the high nutrient concentration area of the Lower Mainland (refer to Figure 4, Appendix E)
• The AD facility may only import or store “non-agricultural” feedstock when the digester is producing bio-gas that is being upgraded to renewable natural gas or combusted to produce electricity.
• Storage of “non-agricultural” feedstock must be conducted using best management practices and must avoid attracting vectors or releasing odours.
• The AD facility and/or participating farms must have sufficient storage capacity for 6 months of digestate production.

8. Operation and Record Keeping
• The AD facility must operate and keep records in accordance with an Operational Certificate or a Waste Discharge Authorization issued by BC the Ministry of Environment.
• The AD facility must operate and keep records in accordance with local government regulations.

9. Business License
• A business license must be obtained from the respective local government to operate the AD facility.

13. Discussion – pros and cons of the criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm Class</td>
<td>• Limits AD to bona fide farm operations</td>
<td>• This criterion alone is not adequate</td>
</tr>
<tr>
<td></td>
<td>• Reduces risk that the AD facility is used for non-farm purposes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Easy requirement for farm to meet</td>
<td></td>
</tr>
<tr>
<td>Minimum Parcel Size</td>
<td>• Ensures that the AD only occurs on larger parcels</td>
<td>• Variable needs of farm operations may not be adequately addressed</td>
</tr>
<tr>
<td></td>
<td>• Allows room for AD operation</td>
<td></td>
</tr>
<tr>
<td>“Non-Agricultural” Feedstock</td>
<td>• Allows AD projects to become economically feasible</td>
<td>• Increases risks associated with importing nutrients and foreign material onto farmland</td>
</tr>
<tr>
<td></td>
<td>• Provides opportunity to re-use organic waste streams in a beneficial manner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Recognizes that % non-ag feedstock should be limited in nutrient rich areas</td>
<td></td>
</tr>
<tr>
<td>“Off-Farm” Agricultural Feedstock</td>
<td>• Ensures that AD is an accessory activity on farms</td>
<td>• Risks associated with returning digestate to farms contributing agricultural wastes</td>
</tr>
<tr>
<td></td>
<td>• Aligns “agricultural waste” with definition in AWCIR</td>
<td></td>
</tr>
<tr>
<td>Acceptable Feedstock</td>
<td>• Allows use of agricultural wastes without creating unnecessary burden (Schedule A)</td>
<td>• Concern about animal disease protection if contaminated manures are mixed and then returned to farms as digestate without killing disease (specifically Johne’s Disease)</td>
</tr>
<tr>
<td></td>
<td>• Ensures food safety protection (Schedule B)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ensures farm land preservation (Schedule C)</td>
<td></td>
</tr>
<tr>
<td>AD Specific Nutrient Management Plan</td>
<td>• Brings awareness to issue of nutrient loading</td>
<td>• Depends on future work to ensure plans are enforced</td>
</tr>
<tr>
<td></td>
<td>• Good record keeping practice</td>
<td>• Is a step above current expectations for manure spreading</td>
</tr>
<tr>
<td></td>
<td>• Stays ahead of expected regulations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provides a tool for protecting farmland and the environment from excessive nutrient loading</td>
<td></td>
</tr>
</tbody>
</table>
| Storage | • Manageable size  
• Minimizes traffic  
• Avoids odour and pollution | • Does not address other inputs and/or post AD generated products that result from add-on nutrient extraction technologies |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation and Record Keeping</td>
<td>• Aligns with ENV procedures and recommendations</td>
</tr>
<tr>
<td>Business License</td>
<td>• A tool for local governments to regulate AD requirements, particularly that the nutrient management planning is in place and current</td>
</tr>
</tbody>
</table>
Resources


# Appendix A – ENV Feedstock Schedules

**Schedule A: Acceptable Feedstock for On-farm Anaerobic Digestion**

<table>
<thead>
<tr>
<th>Type of Feedstock</th>
<th>Specification</th>
</tr>
</thead>
</table>
| Agricultural waste and agricultural vegetation waste  | - manure  
- used mushroom medium  
- residues from primary crop production  
- organic waste matter derived from the drying or cleaning of field crops or nut crops on farms  
- non-food vegetative matter resulting from gardening operations, landscaping, and land clearing on farms  
- animal bedding derived from straw, paper, hog fuel, wood chips, bark, shavings or sawdust |
| Brewery waste/winery waste                             | - used or diverted grain, malt, hop flowers, berries, fruit, leaves and twigs and yeast resulting from brewing or wine making process                                                                                                                   |
| Cooking oil from restaurants and food processors       | - used or un-used food grade cooking oil that has been collected in a separate container and kept separate from all other waste streams until unloaded at the anaerobic digestion facility                                                                 |
| Milk                                                   | - Clean milk (without antibiotics), that has passed specification (e.g. oxidized, lack of refrigeration, etc.)                                                                                                  |
| Organic by-products from ethanol or biodiesel facilities| - corn, canola-based mash, glycerine, etc.                                                                                                                                                                    |
| Plant matter                                           | - fruit, vegetable and vegetative material derived from fruit and vegetable processing or retail locations  
- herbaceous plant waste from flower shops, off-farm nurseries and retail locations  
- non-food vegetative matter resulting from gardening operations, landscaping, and land clearing  
- spent algae specifically grown in a controlled environment |
| Waste products from animal feeds                       | - waste products from animal feeds listed in Classes 1, 2, 3, 4 and 5 of Part 1 of Schedule IV to the Feeds Regulation, 1083 (SOR/83-593) made under the Feeds Act (Canada), excluding any materials that contain an animal product that has not been denatured  
- Also includes materials that previously would have been a product described above but are no longer suitable for use in feeding of farm animals for reasons that do not include contamination by another material. |
| Whey                                                   | - whey and whey permeate, the watery part of milk that remains after the manufacture of cheese                                                                                                                 |

Source: Figure 3 Schedule A: Acceptable Feedstock for On-farm Anaerobic Digestion, BC Ministry of Environment – On-farm Anaerobic Digestion Waste Discharge Authorization Guideline - Draft 2010 (Pg 52 & 53).
### Schedule B: Limited Feedstock for On-farm Anaerobic Digestion

<table>
<thead>
<tr>
<th>Type of Feedstock</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biosolids</td>
<td>- stabilized municipal sewage sludge resulting from a municipal waste water treatment process or septage treatment process which has been sufficiently treated to reduce pathogen densities and vector attraction to allow the sludge to be beneficially recycled in accordance with the requirements of Organic Matter Recycling Regulation (OMRR).</td>
</tr>
<tr>
<td>Dissolved air flotation (DAF) waste</td>
<td>- floc and scum from dissolved air flotation systems in food processing industries</td>
</tr>
<tr>
<td>Domestic septic tank sludge</td>
<td>- sludge removed from a septic tank used for receiving, treating and settling domestic sewage</td>
</tr>
<tr>
<td>Fat, Oil and Grease (FOG)</td>
<td>- grease trap fats, oils and grease from food processing and preparation</td>
</tr>
<tr>
<td>Fish wastes</td>
<td>- fish carcasses and parts from harvested wild stocks, commercial aquaculture operations and fish processing facilities. This would include offal, viscera and mortalities from fish and shellfish. It would also include faeces captured from commercial aquaculture net pens.</td>
</tr>
<tr>
<td>Food wastes</td>
<td>- recyclable food for humans that has been diverted from residential, commercial or institutional sources</td>
</tr>
<tr>
<td>Hatchery waste</td>
<td>- broken or unhatched eggs, unhatched chicks, membranes, embryonic fluids (Eggshell is not a recommended anaerobic digestion feedstock as it may harm equipment and settle in tanks.)</td>
</tr>
<tr>
<td>Milk processing waste</td>
<td>- sludge or biomass from treatment of milk or fluid milk which has been diverted from human food consumption</td>
</tr>
<tr>
<td>Paunch manure</td>
<td>- manure present in the digestive tract at the time of slaughter</td>
</tr>
<tr>
<td>Pet food, pet food residues</td>
<td>- waste streams and residues from preparation and processing of pet food as well as pet food that has gone off specifications or has expired</td>
</tr>
<tr>
<td>Poultry wastes except those that have died from infectious diseases</td>
<td>- carcasses, offal and viscera of domestic fowls, such as chickens, turkeys, ducks or geese, raised for meat or eggs</td>
</tr>
<tr>
<td>Red-meat waste except those that have died from infectious diseases</td>
<td>- carcasses, offal and viscera, of red-meat animals such as cattle, swine, sheep, fallow deer, farmed game and farmed bison. Note: Specified Risk Material is an unacceptable feedstock; see Schedule C.</td>
</tr>
<tr>
<td>Waste products from animal feeds</td>
<td>- listed in Classes 1, 2, 3, 4 and 5 of Part 1 of Schedule IV to the Feeds Regulation, 1033 (SOR/83-593) made under the Feeds Act (Canada), including any material that contain an animal product that has not been desanitized.</td>
</tr>
</tbody>
</table>

1 The feedstock listed in Schedule B requires pasteurization, e.g., 70°C for 1 hour, or as specified by a qualified professional and approved by MOE.

Source: Figure 4 Schedule B: Limited Feedstock for On-farm Anaerobic Digestion, BC Ministry of Environment – On-farm Anaerobic Digestion Waste Discharge Authorization Guideline - Draft 2010 (Pg 53 & 54).
### Schedule C: Unacceptable Feedstock for On-Farm Anaerobic Digestion

<table>
<thead>
<tr>
<th>Type of Feedstock</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catering waste from means of international transport</td>
<td>- airplane food waste, cruise ship food waste, etc.</td>
</tr>
<tr>
<td>Hazardous waste</td>
<td>- as defined by the Hazardous Waste Regulation</td>
</tr>
<tr>
<td>Mortalities that have died from infectious diseases</td>
<td>- e.g., transmissible spongiform encephalopathy</td>
</tr>
<tr>
<td>Organic wastes that are or contain:</td>
<td></td>
</tr>
<tr>
<td>• Solvents containing volatile organic compounds</td>
<td></td>
</tr>
<tr>
<td>• Fuels and petroleum products</td>
<td></td>
</tr>
<tr>
<td>• Resins and plastics</td>
<td></td>
</tr>
<tr>
<td>Specified risk material (SRM) or waste containing</td>
<td>- as defined by the Canadian Food Inspection Agency</td>
</tr>
<tr>
<td>SRM</td>
<td></td>
</tr>
</tbody>
</table>

If the intended feedstock is not listed, contact the regional Ministry of Environment office to clarify the requirements for that feedstock.

Source: Figure 5 Schedule C: Unacceptable Feedstock for On-farm Anaerobic Digestion, BC Ministry of Environment – On-farm Anaerobic Digestion Waste Discharge Authorization Guideline - Draft 2010 (Pg 54)
Appendix B – Project Approval Flowchart

Source: Figure 3 Project Approval Flowchart, BC Ministry of Environment – On-farm Anaerobic Digestion Waste Discharge Authorization Guideline - Draft 2010 (Pg 21)
### Appendix C – ENV Authorizations

<table>
<thead>
<tr>
<th>Feedstock</th>
<th>Scenario</th>
<th>Authorization Type</th>
<th>Categorization in the Waste Discharge Regulation</th>
</tr>
</thead>
</table>
| Non-agricultural waste exclusively or non-agricultural waste mixed with agricultural waste. | This categorization applies to facilities digesting non-agricultural waste or co-digesting non-agricultural waste with agricultural waste and the facility is not required to be authorized via a regional district’s waste management plan and the subsequent operation certificate issued by ENV (see B above). | Permit | Commercial Waste Management or Waste Disposal Industry (WDR Schedule 1)  
This means establishments primarily engaged in the commercial collection, handling, storage, treatment, destruction or disposal of waste soil, solids or liquids. |
| Any feedstock | This categorization is an option for facilities producing more than 5 MW of electricity and not required to be regulated by a waste management plan. | Permit | Electrical Power Industry (WDR Schedule 1)  
This means establishments that (a) are engaged in the production of electricity by the combustion of fuel, and (b) have a rated production of more than 5 MW under peak load |
| Non-agricultural wastes exclusively or non-agricultural waste mixed with agricultural waste. | This categorization applies to facilities digesting non-agricultural waste or co-digesting non-agricultural waste with agricultural waste. | Waste management plan and subsequent operational certificate issued by ENV. May require amendment to the regional district’s solid or liquid waste management plan. | Municipal Solid Waste Management (WDR Sch 1)  
This means activities and operations for the management, treatment or discharge of refuse that (a) originates from residential, commercial, institutional, demolition, land clearing or construction sources, or (b) is included in a waste management plan. |
| Agricultural waste only, as defined in the regulation (includes manure, used mushroom medium, and agricultural vegetation waste). | This categorization applies to facilities digesting 100% agricultural waste. The digestate may be used on that farm or sold off-farm (following applicable laws and regulations). The biogas may be used on that farm or sold to a utility.  
The farm must be classified as a farm by the Assessment Act. | Agricultural Waste Control Regulation (AWCR)  
*Note: It is expected that in addition to following the requirements in the AWCR, project proponents will also practice due diligence and follow the recommended best management practices (BMPs) set out in this guideline.* | Agricultural Operations (WDR Schedule 2)  
This means operations or activities carried out on farms for purposes of agriculture, including, but not limited to, (a) producing or keeping livestock, poultry, farmed game, fur bearing animals, crops, grain, vegetables, milk, eggs, honey, mushrooms, horticultural products, trees, tree fruits or berries, and (b) operating machinery and equipment for agricultural waste management or for applying fertilizers&soil conditioners. |

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*Figure 7 ENV Authorizations, BC Ministry of Environment – On-farm Anaerobic Digestion Waste Discharge Authorization Guideline - Draft 2010 (Pg 24 & 25)*
Appendix D – ENV Quick Start Guide

On-farm Anaerobic Digestion Quick Start Guide

Requirements

- Facility Categorization (Chapter 12)
  - % of Total Waste Digested by Volumes

- Feedstock Pretreatment (Chapter 14 or 15)
  - Feedstock Heavy Metals Testing
  - Feedstock Pretreatment

- Digestate Treatment and Land Application (Chapter 13, 14 or 15)
  - Nutrient Management Plan
  - Digestate Pathogen Testing

- Land Application of Digestate
  - Post Harvest Soil Testing

What is your feedstock?

- 100% Agricultural waste (manure, used mushroom medium, or vegetative ag waste)
- Up to 25% Non-agricultural waste
- More than 25% Non-agricultural waste

Tier 1
- Follow provisions of the Agricultural Waste Control Regulation (AWCR)

Tier 2 (Apply for Authorization)
- Prior to delivery on-farm, test all non-agricultural feedstock for heavy metals
- Prior to addition into the digester, pre-treat all Schedule B feedstock (e.g., pasteurize at 70°C for 1 hour)

Tier 3 (Apply for Authorization)

Develop a Nutrient Management Plan (NMP). The following tests are recommended:
- Digestate: NH₃-N, TNK, Total P, Total K, moisture content
- Soil: Available P, Available K, NO₃-N

In accordance with the AWCR, NMP, Environmental Farm Plan, and Mature Spreading Advisory Committee

In accordance with qualified professional (QP) approved NMP

Test soil, post harvest for NO₃-N

Source: Figure 8 ENV Quick Start Guide, BC Ministry of Environment – On-farm Anaerobic Digestion Waste Discharge Authorization Guideline - Draft 2010 (Pg 19)
Appendix E – Map of high livestock nutrient concentration

British Columbia’s mountainous geography has focused a lot of the agricultural and urban development in the valley bottoms. Over 80% of the population and over 80% of BC’s gross farm receipts are generated in two areas of the province (Figure 3) which are less than 3% of the total provincial land base. The Lower Mainland of B.C. has a high concentration of livestock, particularly poultry and dairy in a relatively small area.

Figure 3. Concentration of population and farming into two triangles

As mentioned in Section 10 “The Ontario Experience” OMAFRA recommends that less than 0.6 nutrient units (NU) per acre will satisfy manure applications needs and allows an application to crops that will have economic benefit from the nutrients applied. Where the NU per acre are greater than 1, the recommendation is to consider renting additional land or moving manure out of these areas.

Table 1 shows the conversion of livestock to NU. Table 2 shows the NU per acre calculated using livestock numbers and total farmed area reported in the agricultural census in 2006 for British Columbia
for each Census Consolidated Subdivision (CCS). Figure 4 shows a map of the Lower Mainland of BC with the ALR and the CCS areas.

Table 1. Livestock Nutrient Units

<table>
<thead>
<tr>
<th>Livestock</th>
<th>NU / single animal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulls, 1 year and over</td>
<td>1</td>
</tr>
<tr>
<td>Dairy Cows</td>
<td>1.42</td>
</tr>
<tr>
<td>Beef Cows</td>
<td>1</td>
</tr>
<tr>
<td>Heifers, 1 year and over</td>
<td>0.5</td>
</tr>
<tr>
<td>Heifers for beef herd replacement</td>
<td>0.5</td>
</tr>
<tr>
<td>Heifers for dairy herd replacement</td>
<td>0.417</td>
</tr>
<tr>
<td>Heifers for slaughter or feeding</td>
<td>0.33</td>
</tr>
<tr>
<td>Steers, 1 year and over</td>
<td>0.5</td>
</tr>
<tr>
<td>Calves, under 1 year</td>
<td>0.25</td>
</tr>
<tr>
<td>Horses and ponies</td>
<td>1</td>
</tr>
<tr>
<td>Goats</td>
<td>0.078</td>
</tr>
<tr>
<td>Mink</td>
<td>0.01</td>
</tr>
<tr>
<td>Bison (buffalo)</td>
<td>1</td>
</tr>
<tr>
<td>Deer (excluding wild deer)</td>
<td>0.25</td>
</tr>
<tr>
<td>Elk</td>
<td>0.25</td>
</tr>
<tr>
<td>Llamas and alpacas</td>
<td>0.25</td>
</tr>
<tr>
<td>Boars</td>
<td>0.286</td>
</tr>
<tr>
<td>Sows and gilts for breeding</td>
<td>0.303</td>
</tr>
<tr>
<td>Nursing and weaner pigs</td>
<td>0.05</td>
</tr>
<tr>
<td>Grower and finishing pigs</td>
<td>0.167</td>
</tr>
<tr>
<td>Broilers, roasters and cornish</td>
<td>0.0033</td>
</tr>
<tr>
<td>Pullets and pullet chicks, under 19 weeks</td>
<td>0.002</td>
</tr>
<tr>
<td>Laying hens, 19 weeks and over</td>
<td>0.0067</td>
</tr>
<tr>
<td>Laying hens in hatchery supply flocks</td>
<td>0.0067</td>
</tr>
<tr>
<td>Turkeys</td>
<td>0.0075</td>
</tr>
<tr>
<td>Other poultry</td>
<td>0.0095</td>
</tr>
<tr>
<td>Rams</td>
<td>0.0333</td>
</tr>
<tr>
<td>Ewes</td>
<td>0.143</td>
</tr>
<tr>
<td>Total lambs</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Source: Table 1 Livestock Nutrient Units, OMAFRA, Nutrient Management Tables for Ontario Regulation 267/03 Made under the Nutrient Management Act
Table 2. Livestock nutrient concentration

<table>
<thead>
<tr>
<th>Region</th>
<th>Includes the communities of</th>
<th>Total area of farmed (Acres)</th>
<th>Nutrient Units/Farmed Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbotsford (CCS)*</td>
<td></td>
<td>67,447</td>
<td>1.36</td>
</tr>
<tr>
<td>Fraser Valley E (CCS)</td>
<td>Chilliwack</td>
<td>42,019</td>
<td>1.34</td>
</tr>
<tr>
<td>Fraser Valley G (CCS)</td>
<td>(Nicomen Island)</td>
<td>9,477</td>
<td>1.08</td>
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<tr>
<td>Fraser Valley D (CCS)</td>
<td>Kent</td>
<td>12,250</td>
<td>0.92</td>
</tr>
<tr>
<td>Langley (CCS)</td>
<td></td>
<td>32,050</td>
<td>0.71</td>
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<tr>
<td>Surrey (CCS)</td>
<td></td>
<td>22,998</td>
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<tr>
<td>Cowichan Valley B (CCS)</td>
<td></td>
<td>6,667</td>
<td>0.52</td>
</tr>
<tr>
<td>Comox-Strathcona C (CCS)</td>
<td></td>
<td>15,000</td>
<td>0.39</td>
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<tr>
<td>Spallumcheen (CCS)</td>
<td></td>
<td>42,391</td>
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<tr>
<td>Nanaimo C / D (CCS)</td>
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<td>2,571</td>
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<tr>
<td>North Okanagan F (CCS)</td>
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<td>30,568</td>
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<td>Saanich (CCS)</td>
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<td>Pitt Meadows (CCS)</td>
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<td>Delta (CCS)</td>
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<td>18,582</td>
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<tr>
<td>Columbia-Shuswap D (CCS)</td>
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<td>Central Kootenay C (CCS)</td>
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<td>Capital H (Part2) (CCS)</td>
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<td>Fraser Valley F (CCS)</td>
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<td>Central Kootenay B (CCS)</td>
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<td>Comox-Strathcona K (CCS)</td>
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<td>Fraser Valley B (CCS)</td>
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<td>Okanagan-Similkameen B (CCS)</td>
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<td>31,256</td>
<td>0.12</td>
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</table>

* Rows highlighted in yellow are part of the BC Lower Mainland.

Using the 2006 census figures, the average NU per acre is 0.11 for all of B.C. The nutrient density in the Lower Mainland of BC is 0.91 NU/acre (refer to Figure 4). Table 2 shows that the highest concentrations of livestock (NU/acre ratio greater than 1) are generally in Abbotsford, Chilliwack, and
Nicomen Island. Kent, Langley and Surrey also exceed the 0.6 NU/acre. The next highest livestock concentrations occur in the Cowichan Valley, Comox, and Spallumcheen; all have NU/acre ratios below the 0.6.

With the NU/acre ratios and the geography of the province, it would appear that the Lower Mainland of BC has sufficient livestock nutrients to support crop growth in the area. It is noteworthy that some of the Lower Mainland crop land does not use manure. Also soil testing has revealed high levels of phosphorus even in areas of the Lower Mainland such as Delta where livestock concentrations are lower. Due to high livestock concentration and phosphorus levels on a regional basis, it would appear that the Lower Mainland farm land has sufficient nutrients from livestock manure. If non-agricultural nutrients were imported onto farm land in this area, these nutrients could displace livestock nutrients. For the purposes of nutrient planning, the Lower Mainland is considered an area of high livestock nutrient concentration and the rest of the province would be considered of low livestock nutrient concentration.

Figure 4. Area of high livestock nutrient concentration on farm land