

Drainage FACTSHEET



BRITISH
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PLANNING FOR AGRICULTURAL DRAINAGE

Watershed Management

The management of water on land by drainage is essential to agriculture, soil conservation and the environment. Watersheds must be considered as a whole, as one part of a watershed cannot be isolated from another. Water management planning must consider the impacts of urban and other upland runoff on to agricultural lowlands.



Figure 1

Urban Development Above Agricultural Land

Farmers have the ability to control the conveyance of most natural flows of water to their lands using on-farm drainage. When water flows are amplified by upland development farmers have difficulty managing these excess flows. Chronic flooding limits the range of crops that can be grown on certain parcels of land, reduces crop yields and in some cases leads to disease and pest management problems. Good drainage is required to ensure that farmers produce marketable crops.

The watershed's capacity to absorb rainfall through infiltration into the soil and uptake through root systems is diminished with upland development and the removal of forest cover.

A forested watershed allows the water to be slowly released to the lowlands through infiltration and small streams. With the addition of impervious covers, such as pavement and roofs, the volume of runoff in a short period of time is dramatically increased. In addition small rainfall events, that had little effect on the lowlands before development, can continuously add water to lowland systems that are not equipped to handle it.

Upland development must take into consideration these increased water flows, the duration of flooding and the effects on agriculture in the lowlands.

Agricultural Benefits of Good Drainage

Protection of the environment, increased yields, higher crop values, a reduced cost of production and stormwater protection are just some of the benefits from improved soil drainage.

Plants develop better in well drained soil where the root system is able to better utilize fertilizers, withstand drought, resist plant disease and compete with weeds. Other factors such as a longer growing season also contributes to an increased crop yield. Farmers also gain greater flexibility in the choice of crops that can be grown. Land that was previously only suitable for crops resistant to flooding may now support higher value crops.

If soil is well drained the farmer is able to get onto the fields earlier in the spring to prepare for seeding. Trafficability is increased in the fall providing a better chance to harvest late crops and an opportunity for fall field work. In saturated soils the soil structure is damaged by compaction and smearing from farm machinery or surface crusting from ponded water. Good drainage also allows cover crops or green manure crops to be grown over winter. These crops protect the soil from erosion and can provide wildlife benefits.

Soil erosion occurs whenever water fails to percolate into the soil and begins to move across the land as runoff. Well drained soils have the ability to absorb rainfall providing some reduction in the risk of runoff.

Environmental benefits of good drainage include less sedimentation in channel from overland flows and better water quality as water from surface runoff may contain higher concentrations of soil bound fertilizers or pesticides. Also, plants in well drained soils have better nutrient uptake thus reducing the amount of nutrients leaching into the ground water.

Good drainage also provides stormwater protection within a region. It is in the best interest of a municipality to maintain a large freeboard in drainage channels to providing a good outlet for on-farm drains. In areas with on-farm drainage systems the water table is lowered more quickly than areas without drainage. Thus the storage capacity of the soil is increased. During a large storm event the soil would be able to store more water before it becomes saturated, therefore reducing surface runoff. However, if the freeboard in the channel is not available the storage capacity is lost.

Regional Agricultural Drainage Criteria

(Also known as the ARDSA criteria)

The most important issue for stormwater management with respect to agriculture is the duration of inadequate drainage. The length of time that the crops roots are in saturated soil is usually more important than the severity of flooding. Agricultural crops will usually survive flooding for very short periods of time.

The regional drainage criteria for agricultural areas are:

- To remove the runoff from the 10 year, 5 day storm, within 5 days in the dormant period (November 1 to February 28);
- To remove the runoff from the 10 year, 2 day storm, within 2 days in the growing period (March 1 to October 31);
- Between storm events and in periods when drainage is required, the base flow in channels must be maintained at 1.2 m below field elevation.
- The conveyance system must be sized appropriately for both base flow and design storm flow.

The **On-Farm Drainage** section in this factsheet explains the importance of a base flow with a 1.2 m freeboard to farm operations and farm drainage system design.

See Factsheet 535.100-2 [Agriculture Drainage Criteria](#) for a complete explanation of the criteria.

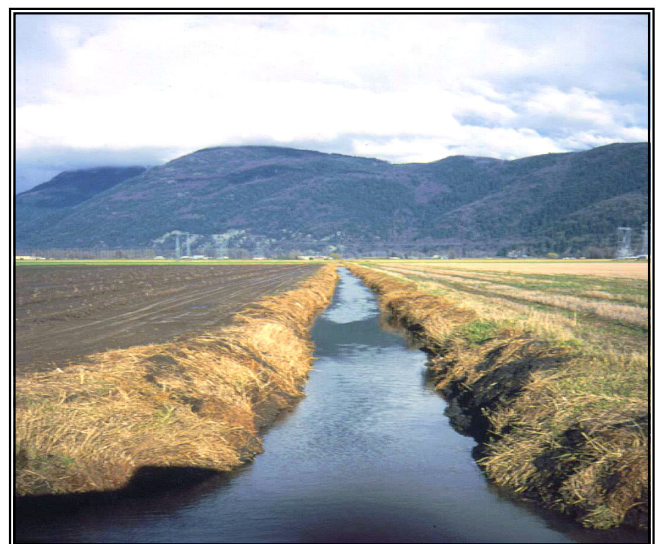


Figure 2 Lowland Drainage system

On-Farm Drainage

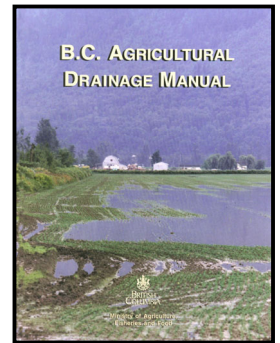
On-farm drainage can be improved by changing cropping practices, installing subsurface perforated drainpipes or using surface drainage, such as ditches.

The **Agricultural Drainage Criteria** suggests a freeboard of 1.2 m should be maintained for drains to flow freely. This means the surface elevation of the water in the channel at base flow should be 1.2 m below the surface of the lowest point on the adjacent land. A minimum freeboard of 0.9 m may be acceptable under certain conditions.

As the freeboard gets smaller, that is the water in the channel gets closer to the surface, the amount of time it takes for on-farm drain pipes to drains increases.

This means the land will not drain as quickly and could result in saturated soil for extended periods of time.

The *B.C. Agricultural Drainage Manual* provides comprehensive information on designing an on-farm drainage system. The design takes into consideration, the crop to be planted, the soil type, depth of water table and other local conditions.



Agricultural Assessment

Where impacts on agriculture are expected and can not be avoided an agricultural assessment should be completed to assess how the water levels will affect the types of crops that can be planted and/or the amount of compensation to the landowner should their land be made unproductive.

Ideally when assessing the changes in a watershed the mitigation measures to reduce these changes should reduce the post-development flows to be at most equivalent to pre-development flows in both volume and duration. It is recognized that to achieve equivalent pre-development flows is difficult. To reduce the effects of the increased volume the water conveyance systems downstream of the development must be properly sized.

Landowners and other interested parties should be provided with a report of how upland development or drainage improvements will affect the region.

Drainage improvements must also consider the management and preservation of water quality, wildlife and fisheries resources.

When to do an Agricultural Assessment

In every regional drainage project where agriculture is affected, the affects of the proposed works on agriculture should be assessed under the **Agricultural Drainage Criteria**. BCMAFF understands that the criteria may not be met in all areas of the region and encourage the drainage assessment study to also look at the areas that will meet the flooding duration criteria up to a freeboard of 0.9m and 0.6m. 0.6m is very minimal, it is only acceptable under exceptional circumstances

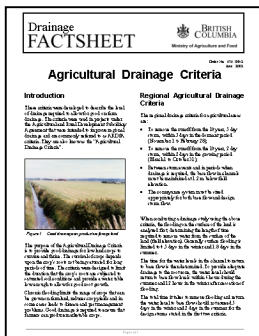
By having this information it is then possible to determine how the level of drainage that is available and how agriculture will be affected.

Once the drainage of the area is assessed under the **Agricultural Drainage Criteria** there is good information to help the local farming community and other stakeholders make decisions and look for options to improving drainage.

It is important to show the farming community the areas that will and won't meet the drainage criteria.

Applications to programs that have funds to support drainage projects benefiting agriculture will often not be accepted without a proper assessment under the Agriculture Drainage Criteria

Factsheet 535.100-2 **Agricultural Drainage Criteria** contains more information on how to conduct an agricultural assessment.



Assesment Summary

Summarizing the affects of changes in the drainage system or drainage improvements in tabular and map form is a convenient method of displaying all the options. The table should include the changes that could be expected in flows, flooding duration and the land area affected

To clearly show how changes to water flows in the area will affect landowners a map should be prepared to show the expected changes in water levels in conveyance systems and land area affected.

These maps should be produced to for all drainage scenarios and proposed drainage solutions. The maps should show which areas will meet the agricultural drainage criteria and which will not.

A qualified registered professional can determine the economic impacts on agriculture. The assessment would look at crop suitability, growing season length and productivity.

This analysis will allow comparison between costs of drainage improvements and benefits to agriculture that the drainage improvements will achieve. This can be used when assessing how the changes in upland development will effect farmland.

Additional Information

Freeboard Criteria

In cases where the base flows cannot meet the freeboard criteria of 1.2 m the anticipated freeboard and the effects on agriculture must be determined. A base flow freeboard of 0.9 m is tolerable in some conditions. **However, there is more risk of soil degradation, lower crop productivity or less choice of crops to be grown in that area.**

Special Considerations for Vegetable Crops

In areas where some vegetables are grown winter flooding is desirable. However it should be noted that perennial crops will not survive flooding in the winter.

The Reality of Economics

For undulating land in a flood plain isolated depressions may be difficult to drain. Discussions with landowners and BCMAFF should be held to determine what is a realistic drainage improvement goal for these areas.

Some areas may not be able to meet the level of drainage specified in the criteria or the cost of meeting that level of drainage would be too high.

In these cases the drainage system is designed to provide a level of drainage meeting the Agricultural Drainage Criteria where it is economically feasible. Note that to determine the area that it is economical to drain an agricultural assessment is required.

References

Lalonde, Vincent and Hughes-Games, Geoff. 1997. *B.C. Agricultural Drainage Manual*. B.C. Ministry of Agriculture and Food, Resource Management Branch, Victoria, B.C.

Wilson, Ken. 1980. *Design Criteria for the Farm Drainage Outlet Assistance in the Lower Fraser Valley*. B.C. Ministry of Environment, Lands and Parks.

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Resource Management Branch

www.agf.gov.bc.ca/resmgmt

Linking to our

[Publications and Conceptual Plans](#)

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