B.C. Agricultural Drainage Manual

Chapter 1

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The primary purpose of the B.C. Drainage Manual is to provide farmers as well as water management professionals and consultants with technical information on the design, installation and maintenance of agricultural drainage systems.

Individual chapters may rely on information that is presented in other chapters of the manual. There is a risk that downloading individual chapters may not present all of the required information in its entirety. A complete bound manual is available from the Irrigation Industry Association of BC.

While every effort has been made to ensure the accuracy and completeness of these materials, additional materials may be required to design and implement more advanced subsurface drainage systems. Advice of appropriate professionals and experts may provide additional local or site information that is not covered in this Manual.

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Introduction 1

In some parts of British Columbia, high levels of precipitation and seasonal runoff can cause the soil on which agricultural crops and livestock are being raised to become waterlogged.

Most agricultural crops are adversely affected by ponded water on the soil surface and prolonged saturation of their roots. Furthermore, excess water limits the trafficability of fields for access in the spring. This access is often essential to ensure timely seeding. It also affects soil temperature and germination. Chronic flooding limits the range of crops that can be grown on certain parcels of land, reduces crop yield and in some cases causes disease to plants and animals. Good drainage can help to provide good water management which is generally required to ensure viable farm operations. Proper drainage can also aid controlling erosion and solve salinity problems.

Proper drainage can be achieved by using a combination of soil management practices, surface and subsurface drainage techniques.

A step by step approach to a farm drainage system design should help to ensure that maximum benefits are achieved for the least cost. Particular situations, that are not described in this manual, may require additional measures to ensure proper soil and water management. It is the responsibility of the individual producer to use other soil and water management practices that will protect soil and water resources. A qualified professional in soil and water management should review these options before they are implemented.

1.1 Drainage in B.C.

Drainage improvements have long been a preoccupation for B.C. farmers. Ditch works from pioneers and early settlers are still found in B.C.'s interior. Many older wood drains, as is shown in background picture, are still found in the Lower Mainland. A few of the major construction works of this province have been related to drainage and flood control. In the 1920's, more than 4 million dollars was raised from the sale of new land and special taxes to reclaim land on the Sumas Lake bottom. This protected farms, roads, and bridges from freshet flooding from the Chilliwack and Sumas River systems. At this time, not only did this project diminish B.C.'s reliance on other areas for food, but it also opened major transportation, power, and communication corridors to the interior of the province.

Poorly Drained Lands

Poorly drained lands are scattered throughout B.C. Table 1.1 provides a rough estimate of the area of poorly drained lands in different regions.

Table 1.1 Poorly Drained Lands in BC

Region	Area (Hectares)
Fraser Valley	50 000
Vancouver Island	4500
Kootenays	1000
Okanagan	3000
Cariboo	42 000
Peace	412 000

From: Water Constraint Study Talisman 1984

Drains Installed

From 1946 to 1977, subsurface drainage systems in B.C. amounted to approximately 3.05 million m of drains installed. Considering an average spacing of 18 m, the area drained during this time period totals approximately 5700 hectares. Since the expansion of the drainage industry in 1977, with the assistance of the provincial government funding programs such as the former ALDA and ARDSA, an additional 2.75 million m of drain tiles were installed through to 1983. Figure 1.1 illustrates the quantity of subsurface drain installation from 1946 to 1996. The Fraser Valley currently accounts for 60% of the subsurface drainage system installations. Vancouver Island currently makes up for 25% of the subsurface drainage work with the rest of the province accounting for 15%.

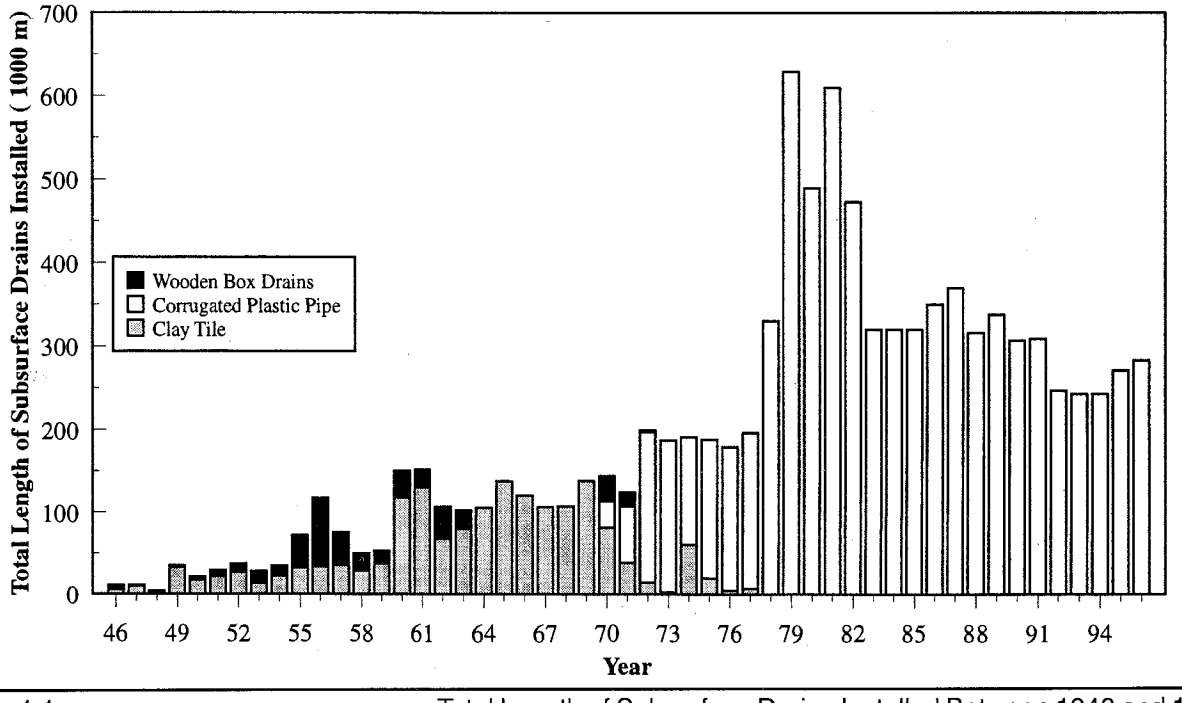

Figure 1.1 Total Length of Subsurface Drains Installed Between 1946 and 1996

1. 2 Manual Content

Soil and Water Fundamentals, Chapters 2 and 3

To understand the principles involved in soil and water management it is essential that the basic principles of soil and water be clearly understood. Terms and concepts that are defined in these chapters are used throughout the rest of the manual.

Identifying a Drainage Problem, Chapter 4

Specific conditions and the nature of a drainage problem will demand different drainage techniques. Soil conditions, crop response to water table levels and cause of the drainage problem should be evaluated before a decision as to how best to drain the land is made.

Drainage Solutions, Chapter 5

Once the cause of a drainage problem is identified, this chapter will discuss the most appropriate methods to improve drainage. Not all agricultural land requires drainage. Different drainage methods are explained and suggestions to solve various soil and water management problems are given.

Drainage Benefits, Chapter 6

To understand the importance of drainage systems, the benefits accrued to agricultural land must be understood. A step by step approach to a farm drainage system design can aid in achieving maximum benefits for the least cost.

Economic of Drainage Systems, Chapter 7

Often, land that is waterlogged during prolonged periods cannot be farmed profitably. On the other hand, drainage improvements can be very expensive. Since drainage conditions can vary from poor to excellent, benefits associated with drainage improvements will also vary accordingly. This chapter provides examples of economic assessment.

Drainage Planning Requirements, Chapter 8

The design and installation of an efficient drainage system requires information on soils, crops, climate and topographical data. Tools for hydrologic and soil investigations are given. A proper drainage plan is essential for the installation of a drainage system and equally important for future maintenance and upgrading. Examples of proper soil maps and drainage plans are given.

Surface Drainage Design, Chapter 9

Agricultural drainage systems often require ditches to convey water away from the drained area. Information on calculating ditch size and grade is given. In some areas of the province (like the Peace and Cariboo), techniques such as grassed waterways have been used to remove surplus water from fields during spring melt or intense rainfall events. Information on sizing, shaping and selecting a type of grassed waterway is included. Just as important as the design of these systems is the maintenance of surface drainage works. Details of techniques used to control erosion, stabilize stream banks and minimize the impact of ditch cleaning are explained.

Subsurface Drainage Design, Chapter 10

The design of a subsurface drainage system must account for soil, crop and climatic parameters. Methods of determining drain depth, spacing, size, and filter requirements are given in this chapter. The layout and placement of interception drains is explained. The success of a drainage system depends on the outlet condition. Both gravity and pumping outlet design parameters are given. Considerations and methods to evaluate iron ochre clogging potential is included. Drainage equipment, installation, maintenance and material specification are also discussed.

Controlled Drainage and Subirrigation, Chapter 11

Due to seasonal variations in precipitation, some crops and soils of B.C. would benefit from controlled drainage or subirrigation. Detailed design parameters, installation methods and benefits are given.