1 INTRODUCTION TO AN IRRIGATION SYSTEM ASSESSMENT

Agricultural irrigation requires reliable supplies of fresh, clean water from ground and/or surface water sources. This Irrigation System Assessment Guide, as part of the Environmental Farm Planning process, will assess the irrigation system requirements of your farm with respect to the quantity and quality of ground and/or surface water.

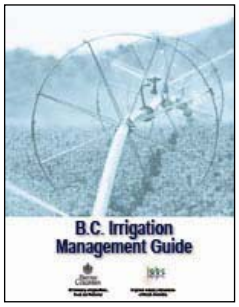
1.1 What is an Irrigation System Assessment?

An Irrigation System Assessment evaluates the irrigation system performance to ensure that it is operated to match the crop, soil and climate conditions present. Irrigation is scheduled to replace the climate moisture deficit in a manner that does not exceed the crop's ability to utilize the water, or the soil's capacity to store the water applied.

A key objective of an Irrigation System Assessment is to ensure that water is used efficiently and will meet the crop's water needs while preventing water loss due to surface flow, leaching or drift. Appropriate irrigation equipment selection and design, as well as good management and scheduling, will conserve water supplies while supporting crop growth. Evapotranspiration (ET) is the driver that determines how much water is being used by the plant. The climate moisture deficit is the difference between the accumulated ET and the effective rainfall. ET is used to determine the irrigation system peak flow rate and annual crop water requirement.

This Irrigation System Assessment Guide includes checks on the peak system flow rate, annual water use, water diversion, conveyance loss, screen area, irrigation water quality and distribution uniformity. The annual water use must be within the amount stated on a water licence or an amount as allocated by a water purveyor. Conveyance losses may be included in water licences, but must be assessed to ensure that they are not excessive. Irrigation systems taking water from surface water sources must ensure that intake screen areas are sufficient to keep flow velocities through the screen within fishery requirements. It is also

imperative to check water quality to ensure the irrigation water is suitable for the soil conditions and crop being grown. The system's distribution uniformity must also be assessed to ensure water is applied at the best uniformity possible throughout the entire field.



The water checks explained in the Reference Guide cover peak flow rate, annual water use and fish screen area for sprinkler and trickle systems. Farmers who irrigate should complete these checks. If the checks indicate that improvements are required, an irrigation system assessment should be done to find out how these problems can be remediated. This Guide provides some basic assessments for sprinkler and trickle systems. Information is available in the **B.C. Irrigation Management Guide** for other system types. In addition to the checks in the Reference Guide, water licence, conveyance loss and water quality checks are explained in this publication.

B.C. Irrigation Management Guide

1.2 Benefits of an Irrigation System Assessment

Irrigation is an essential part of crop production in water deficit areas. Plants require water to grow. Applying the right amount of water at the right time will maximize crop yield. Both too much and too little water can reduce crop yield. An Irrigation System Assessment can benefit farm productivity, enhance protection of the environment, as well as benefit the environment by conserving water and preventing nutrient losses.

Irrigation accounts for a large percentage of consumptive water use during the summer months in British Columbia. Most B.C. farmers pump their own water. Studies conducted in the early 1990's showed that considerable water savings can be achieved on a provincial scale by converting to more efficient irrigation systems and better irrigation management.

For the farm, good water management means:

- Knowing the farm's irrigation requirements and reducing unnecessary water usage. Where water storage is available, saved water may be able to be used later in the irrigation season.
- Saving energy by operating the system efficiently. The energy savings on larger systems may be significant.
- Reducing leaching of nutrients beyond the plant's rooting depth. The nutrients are retained within the root zone and remain available to the plant throughout the growing season.
- Maximizing crop yield.

For the environment, good water management means:

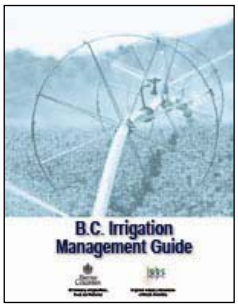
- Saving water which will then be available for other needs in the watershed, such as additional agricultural land that is currently not irrigated, fish, wildlife or other competing uses.
- Reducing runoff from excessive irrigation which may deliver contaminants to surface water supplies.
- Reducing nutrient leaching which will help protect groundwater supplies from contamination

1.3 Irrigation Management Plan

After completing the checks in this document, an Irrigation Management Plan should be completed if your irrigation system:

- does not comply with provincial water licence requirements for peak flow and annual usage and/or purveyor water allotments or restrictions;
- cannot provide enough water to sustain the crop;
- is applying too much water on parts of the farm at times of the year;
- is applying chemicals to the crop through the system; or
- is using reclaimed water

To complete an Irrigation Management Plan, irrigation systems must be assessed for distribution uniformity (DU) and application efficiency. Once irrigation system performance has been checked and improved if necessary, an irrigation schedule can be developed.



DU is a measurement of the evenness of water application over a field, and is expressed as a percentage. Application efficiency is an indication of the percentage of water applied by the irrigation system that is actually available to the crop. Irrigation scheduling is applying irrigation in the correct amount to the right place at the right time.

A comprehensive Irrigation Management Plan is explained in detail in the **B.C. Irrigation Management Guide**. This Guide provides detailed information on performing an irrigation system assessment for sprinkler, trickle, centre pivot and travelling gun systems.

B.C. Irrigation Management Guide

The B.C. Irrigation Management Guide is ***not*** a supplementary document to the Canada-British Columbia EFP program, but is published by the Irrigation Industry Association of British Columbia (IIABC). This Guide is recommended for use by consultants, certified designers and other professionals. The Guide provides in-depth information on irrigation system assessment and the implementation of beneficial management practices.

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1.4 Protecting the Environment while Improving Farm Production

Over-irrigation can have negative effects on the environment and farm production. In drier climates, under-irrigation can limit plant growth and fruit development. Table 1.1 lists the impacts of over- and under-irrigation.

Table 1.1 Impacts of Over- and Under-Irrigation	
Over-Irrigation	**Under-Irrigation**
▪ drowns roots, stressing plants ▪ leaches nutrients and pesticides from the root zone to ground water ▪ reduces nutrient uptake ▪ cools soil; thus, reducing root growth ▪ encourages root disease ▪ reduces crop quality ▪ increases system operating costs ▪ may impact unnecessarily on water resources and impact fish and wildlife resources that rely on adequate and sustained water quality and quantity	▪ reduces crop yield ▪ reduces crop quality (fruit and vegetable size) ▪ reduces plant growth ▪ weakens plant

Considerable amount of nitrogen is lost from waterlogged soil through denitrification and leaching of nutrients below the root zone.

Aside from possible losses of nutrient available to the plant, too much water can also affect plant growth. In poorly-drained areas, it is possible to see that plants with waterlogged roots can be stunted in growth, pale in colour, and may not produce quality fruit. This can also happen to plants that are over-irrigated and their roots remain wet. It is a concern especially in heavy soils that have a high moisture holding capacity.

Plants need to be able to take up oxygen through their roots. Waterlogged soils reduce the oxygen supply by replacing the oxygen in the soil with water. The lack of oxygen impairs the plant's respiration, which in turn limits nutrient uptake. The root growth is also restricted since roots will not grow into areas where oxygen is limited.

Excessive water application increases the cost of energy due to pumping needs, and may increase system delivery infrastructure and associated labour costs.