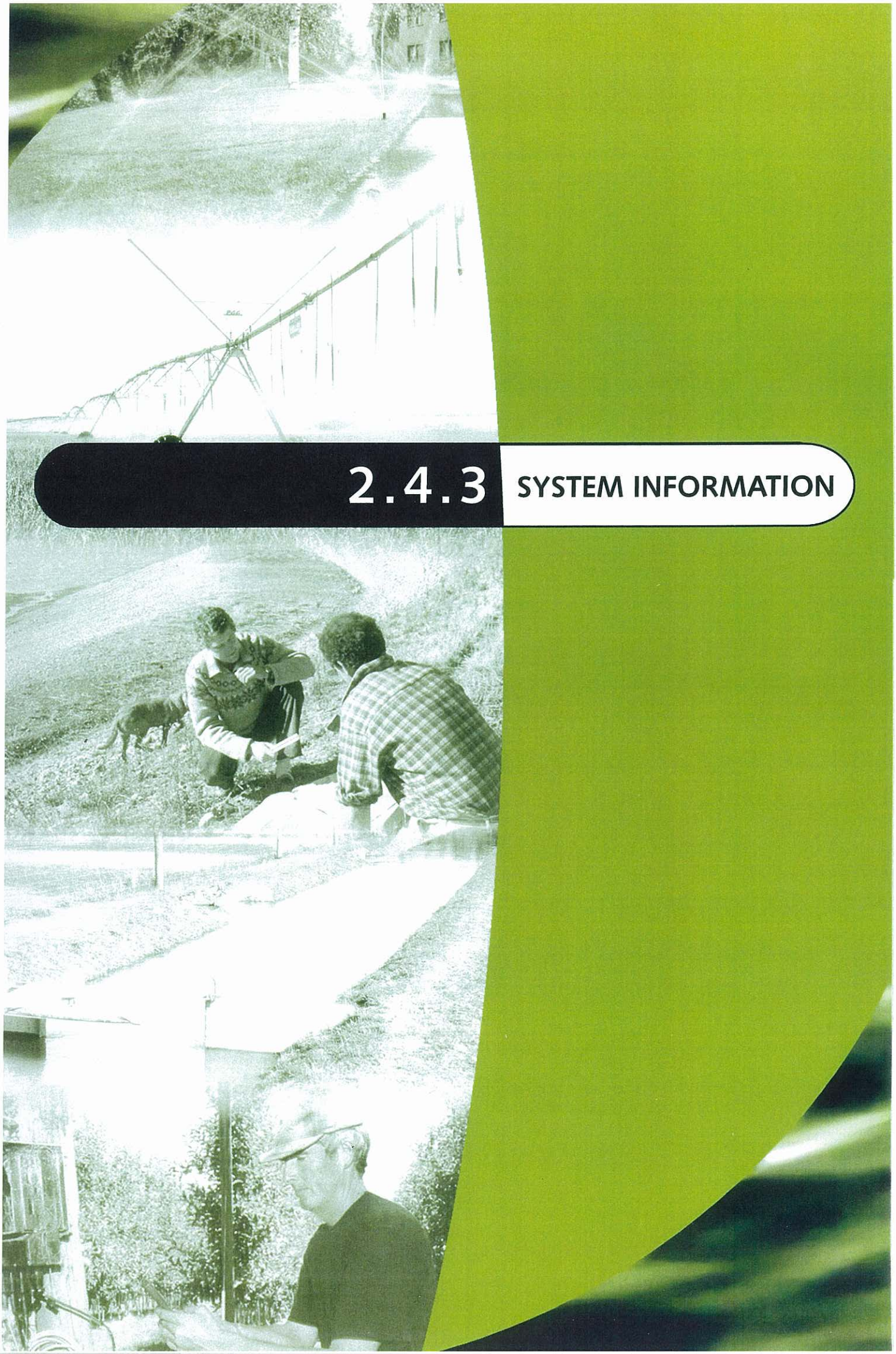

2.4.3 SYSTEM INFORMATION

How to measure water use for piped systems

Water use measurement, because of its association with monitoring of water takes, is often viewed in a negative light. It can, however, provide measurable benefits to farmers by providing useful data for improving irrigation management.

Advantages

- Helps to use water more efficiently.
- Provides accurate measurement of actual water used, rather than estimated use.
- Can save money or improve yields through better irrigation management.
- Provides data for irrigation performance monitoring.
- Can measure what is happening in the paddock – measuring does not need to be at headworks.
- Newer water meters can easily be automated for downloading to computer.
- Can allow more flexible seasonal water allocations.
- Provides more certainty during times of water restrictions.
- Can help to identify the effect of lowering water levels.
- Helps to identify the need for well or pump maintenance.
- Can provide data for consent compliance.
- Can provide data for regional water resource studies.
- Can prevent needless tying up of groundwater resource through apparent over-allocation.

Disadvantages

- Adds additional cost to system.
- Meters may be difficult and costly to fit to existing irrigation systems.
- Eventually need to be tested/re-calibrated.
- In-line meters need up to 15 diameters of straight pipe.
- Some meter types are not suitable for dirty or abrasive water.
- Some types don't meet required standards of accuracy.
- Can be damaged by water hammer.
- Some types add a small amount of friction loss to system.
- May not detect flow variations over short time intervals.
- Have to be read and information recorded.
- In some areas, may freeze if not dried out in winter.

Main methods

In-line propeller meters

These meters are commonly installed in irrigation pipelines and have a small propeller that rotates according to the velocity of flow in the pipe. Newer versions have electronic readouts for automatic monitoring of flow rate and volume. A variation on the in-line unit is a paddle wheel turbine, which is inserted through a socket into the pipe wall. These meters are generally rugged and reliable, but prone to damage by gravel or other material passing down the pipe. Provided they are properly installed, accuracy in field situations should be better than ±5%, which is adequate for all uses. Re-calibration is only required if the meter is worn or damaged. Their biggest disadvantage is the need to be installed in a long section of straight pipe for accurate results.

Calibrating electricity meters

This method requires measuring the volume of water pumped in cubic metres and the electricity used at the meter in kWh over a given time to calculate a power rating. The power rating is calculated by dividing the volume by the units of energy used to give m^3/kWh. Multiplying this factor by the kWh used over a specified time will give the volume of water pumped.

The main advantage of this method is that, once the power rating has been calculated, it is very simple to use. There is nothing to install or wear out. The disadvantage is that an initial calibration is required. Also, if anything significantly changes the pumping rates of the irrigation system, such as falling water levels or different irrigator type or nozzles, the power rating must be re-calculated. For pressure-regulated systems, power ratings should be accurate enough for irrigation management and resource management. For other systems, loss of accuracy can occur, making this method unsuitable for irrigation management and monitoring.

Magnetic flow meters

These meters use a magnetic field to generate a voltage as water passes through them. Two small electrodes embedded in the pipe wall measure the voltage, which is converted to a flow. The meters have no moving parts, no obstructions in the pipe and very low headloss, making them ideal for measuring dirty water. They do not need such a long straight pipe as do propeller meters. They are, however, expensive in small sizes and require an external power supply (AC or DC). Properly installed, they are accurate to within ±2%.

Ultrasonic flow meters

These meters use ultrasound to determine the velocity of flow, which is then converted to flow rate. The units can be either portable or dedicated installations, and are clamped to the outside of a pipe. They have the advantages of zero headloss and ability to be fitted without shutting down the system. They are, however, very expensive, and accuracy is sensitive to correct field installation.

Precautions

Installation conditions have the greatest effect on meter accuracy, and manufacturer recommendations should be closely followed.

Most flow meters need to be installed in or on a section of straight pipe to ensure uniform entry of water into or past the meter. Typical requirements are ten times the diameter of pipe above and five times the diameter of pipe below the meter. Pipes should be the same diameter as the nominal diameter of the water meter.

Meters can usually be installed at any angle, and usually on the discharge side of pumps, below pressure control or other valves. They should be sized to work accurately over the range of expected flow rates. Loss of accuracy will occur at very low or high rates, and excessive pressure losses can occur at high rates.

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