IRRIGATION NEW ZEALAND
TECHNICAL & TRADE

The New Zealand Piped Irrigation Systems Design Standards

Contents

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Introduction

Purpose

Irrigation New Zealand, in consultation with its stakeholders and as part of its mission to promote excellence in irrigation, has initiated the development of *The New Zealand Piped Irrigation Systems Design Standards*.

This document provides a set of design standards to measure the adequacy of piped irrigation systems in New Zealand. It also describes the design standards, and gives corresponding performance indicator values which should be aimed for during the design process.

This document is intended to be used in conjunction with *The New Zealand Piped Irrigation Systems Design Code of Practice* (INZ, 2012). The design code of practice assist designers through the process of developing an irrigation system; providing a general design approach aimed at meeting the design standards and corresponding performance indicator values set out in this document.

The design process described in the design code of practice, and the standards contained in this document, are intended to be applied to agricultural irrigation systems. They do not amend or replace other industry performance indicators, guidelines, codes of practice or standards.

Audience

This document is intended for designers of piped irrigation systems. This may include engineers, equipment suppliers, and specialist irrigation designers.

It is also envisaged that this document will be used by those interested in assessing the performance of installed irrigation systems.

Intent

This document is intended as an industry best practice guideline. Designers should interpret it according to the requirements of individual properties and owners. All decisions made must also comply with statutes, regulations, and other legal requirements and industry standards.

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Design Standards

1 Irrigation system performance indicators

The requirement to specify performance indicators has been described in *The New Zealand Piped Irrigation Systems Design Code of Practice* (INZ, 2012).

Table 1 provides a summary of the target performance values that irrigation designs should achieve.

Table 1: Performance indicators and relevant standards.

Performance Indicator	Unit(s)	Design Standard
	Water Use Efficiency	
System capacity: (based on 24 hours)	ℓ/s/ha mm/day	Meets the reasonable needs of the crop
Ratio of system capacity to peak season crop irrigation demand	%	80–120%
Application depth	mm (range)	< MAD
Ratio of applied depth to the design maximum management allowable deficit (MAD)	%	<100%
Return interval	Days hours	Corresponds to system capacity and application depth. See Section 2.6
Ratio of application intensity to soil infiltration rate	%	< 100%
Application uniformity	% ratio	CU_c > 85%, DU_{lq} > 80%
Adequacy of irrigation	ratio	87%
Potential application efficiency	%	Depends on system type as relates to field distribution
Distribution efficiency	%	100%
Mainline efficiency	%	> 95%
Headwork efficiency	%	90%, < 3 m pressure loss. See Section 4.8
	Energy Use Efficiency	
System pumping efficiency	%	Best possible efficiency for the particular situation
Pump Operating Cost	$/ha/yr $/m^3	System dependent

2 Water application

2.1 PEAK FLOW RATES AND SEASONAL ALLOCATIONS

Designers must consider all of the relevant factors that determine how much water the irrigation system will be designed to apply and how often, and then design a system that meets those requirements in an efficient manner. Designers must also ensure that the peak flow rate of the system, and seasonal crop water requirements, meet irrigation scheme or regional council requirements.

If resource consents are required for the taking and using of water, designers must ensure that the system meets all relevant conditions of consent.

2.2 IRRIGATION AREA

When choosing an irrigation area, the designer must consult the purchaser and take into account any site-specific constraints, as discussed in *The New Zealand Piped Irrigation Systems Design Code of Practice* (INZ, 2012).

2.3 SYSTEM CAPACITY

The designer must select an irrigation system capacity (W) to meet the reasonable needs of the crop, as discussed in *The New Zealand Piped Irrigation Systems Design Code of Practice* (INZ, 2012).

2.4 APPLICATION EFFICIENCY

The design application efficiency (Ea) must be ≥ 80%. If site constraints dictate the need for a system with lower E_a, the designer must clearly explain the on-going energy, water use, leaching potential, crop and cost implications to the purchaser.

2.5 APPLICATION DEPTH

The gross depth of application (D_g) must take into consideration the design application efficiency (E_a), as follows:

$$D_g = \frac{100 \times D_n}{E_a}$$

The net application depth D_n must not be greater than the expected soil moisture deficit unless saline soils are being irrigated or irrigation water contains a significant amount of salt. In these situations additional water may be applied to leach salts through the soil profile. In these scenarios, the leaching requirement may be added to the gross depth of application to determine total application depth.

2.6 RETURN INTERVAL

The interval between irrigation events must be short enough that the soil will not dry below the management allowable deficit (MAD).

The return interval must not exceed the interval determined by the following formula:

$$Return\ interval = \frac{D_n}{W \times f}$$

Where:

D_n is the net application depth (mm)

W is the system capacity (mm/day)

f is the crop factor

2.7 APPLICATION INTENSITY

A spray irrigation system must be designed to apply water at an intensity that does not cause surface runoff or excessive ponding on the soil surface during irrigation or after irrigation has ceased.

On flat land, the average application intensity (R_a) over the time water is applied must not exceed the average infiltration rate of the soil over the same time period.

On land with a slope >5%, both the average application intensity (R_a) and the instantaneous intensity (R_i) must not exceed the infiltration rate of the soil.

The design infiltration rate must be adjusted for slope, as described in Section 3.7 of *The New Zealand Piped Irrigation Systems Design Code of Practice* (INZ, 2012).

2.8 APPLICATION UNIFORMITY

Spray irrigation

All spray irrigation systems should be designed to achieve a minimum DU_{lq} of 80% or CU_c of 85%.

When applying fertilisers or chemicals through the system, CU_c must be at least 85%, (0.76 DU), regardless of the method of irrigation used.

For shallow rooted crops and frost fighting, the minimum should be CU_c > 90% and DU_{lq} > 82%.

When applying wastewater, CU_c must be at least > 85%.

If site constraints dictate the need for a system with lower uniformity, the designer must clearly explain the on-going energy, water use, crop and cost implications to the purchaser.

Micro-sprinkler and drip irrigation

The minimum design emission uniformity (EU_{des}) for different micro irrigation types is shown in Table 2.

Table 2: Minimum EU_{des} for microsprinkler and drip irrigation

Crop type	Emission uniformity (%)
Microsprinkler	85
Drip – point source	90
Drip – inline emitters	90

2.9 ADEQUACY OF IRRIGATION

Adequacy of irrigation is a measure of the proportion of the target area in which the soil is restored to a predetermined moisture content. This is calculated as the ratio of the mean DU_{lq} applied, to the mean required (target) depth.

2.10 IRRIGATION SYSTEM SELECTION

Select an irrigation system type that is capable of meeting all water application criteria. It must also meet the purchaser's expectations as outlined in *The New Zealand Piped Irrigation Systems Design Code of Practice* (INZ, 2012).

The designer must provide a description of the performance of the system and how well it meets the crop and enterprise needs.

3 Hydraulic design

3.1 WATER VELOCITY

Maximum water velocity

Table 3 lists the recommended water velocity thresholds in different pipe systems. Designers must ensure that these thresholds are not exceeded, unless a surge analysis or manufacturer's literature shows that this is acceptable.

Table 3: Recommended maximum water velocities

Condition/location	Velocity (m/s)
Less than 150 mm, open ended, controlled start and stop	3.0
150 mm or greater, open ended, controlled start and stop	2.0
Less than 150 mm, uncontrolled start and stop	1.5
150 mm or greater, uncontrolled start and stop	1.0

Minimum water velocity

Designers must specify pipe diameters and flow rates that allow for a minimum operational water velocity according to Table 4. This will ensure that any sediment or solids are flushed through the lines.

Table 4: Minimum water velocities

Condition/location	Velocity (m/s)
Flushing fine sediment (e.g. in tapes)	0.4
Flushing coarse sediment	0.5
Flushing air, particularly in small diameter pipes	0.6
Flushing water containing solid material	1.0

3.2 SURGE AND WATER HAMMER

Designers must consider possible effects of surge and water hammer. A surge analysis may be necessary and mitigation measures specified to lessen the risk of damage.

3.3 PRESSURE AND FLOW VARIATION

The design must specify a way to measure the pressure, and if required the flow, at each outlet or block of outlets.

Agricultural spray irrigation

The design pressure variation at the outlets must not exceed:

- 20% of the outlet operating pressure at any point in the system, and
- 15% of the outlet operating pressure over 80% of the outlet positions within an irrigation zone

Microsprinkler or drip irrigation

Pressures must be set so that the maximum variation in emitter flow within a block or subunit does not exceed ±5% of the average emitter flow.

Turf and amenity irrigation

Pressures must be set so that the maximum variation in flow at the sprinklers within a block or subunit does not exceed ±5% of the design sprinkler flow.

Pressures must be set so that the maximum variation in flow within a block or subunit does not exceed 10% of the outlet operating pressure at any point in the system.

3.4 PIPE FRICTION

Main pipelines should be designed so that friction losses are between 1.5 m and 5 m per 100 m of pipe. This value is reflected in the hydraulic efficiency figure in Table 1.

3.5 AIR RELEASE

Specify one air release valve for the highest point in the headworks.

For irrigation systems with long pipelines, include at least one additional air relief valve for every 1,000 m of pipe.

For irrigation systems located in undulating terrain, include air release valves at all high points where air may build up.

Sizing and type of air valve should follow manufacturer's recommendations.

3.6 PRESSURE OR VACUUM RELIEF

The design must specify if pressure or vacuum relief valves are necessary. It must also specify the type of valve to be used, and the location in which it should be installed.

Sizing and type of valve must comply with manufacturer's recommendations.

3.7 FILTRATION

Filter size

The maximum velocity through filters must not exceed manufacturer's recommendations.

Filters for sprinkler irrigation

In manually controlled systems, the size of the mesh orifices must be no greater than one quarter of the sprinkler outlet diameter.

In systems with automatic valves, the manufacturer's specification must be followed, or a minimum of 80 mesh used.

Filters for micro-irrigation

Disc/screen filter openings must be no greater than one fifth of the emitter orifice diameter. The manufacturer's recommendations regarding appropriate filtration for the micro emitter must be followed.

Filters for drip irrigation

The size of the screen or disc orifices must not be more than one seventh of the drip emitter's outlet diameter.

When using a sand filter, a secondary control screen or disc filter must be placed on the downstream side of the sand filter, to catch the impurities in case of damage to the sand filter.

The drip manufacturer's recommendations must be followed when using filters.

3.8 THRUST BLOCKS

Thrust blocks must be specified for each bend, valve, tee, reducer, dead end cap, and blank flange greater than 90 mm in diameter.

Thrust blocks must be designed according to good industry practice, as outlined in *The New Zealand Piped Irrigation Systems Installation Code of Practice* (INZ, 2012).

3.9 DISTRIBUTION EFFICIENCY

Distribution efficiency must be 100%.

3.10 HYDRAULIC EFFICIENCY

Hydraulic efficiency must be ≥ 95%.

4 Pumping stations

4.1 PUMPING EFFICIENCY

Designers must consider the efficiency of both the pump and the motor when making selections for an irrigation system.

Pump efficiency

Pumps with the highest level of efficiency at the operating point must be selected, subject to acceptable economic capital and operating costs.

Pumps must be selected so that they operate at or near their maximum efficiency points as often as is reasonably possible.

Motor efficiency

Electric motors must be selected and matched to pumps so that they operate at greater than 95% of maximum motor efficiency under normal operating conditions.

Minimum Energy Performance Standards (MEPS) are included in Australian Standard AS/NZS 1359.5:2000, which sets out minimum energy performance and labelling of motors in Australia and New Zealand.

When specifying a diesel engine to power a pump, the designer must follow manufacturer's recommendations and remember to derate the engine according to the altitude at which the engine will be operating.

4.2 SAFETY FACTOR

If the designer is selecting the pump, additional capacity to the calculated pump pressure and flow rate should be added as a precaution.

- Flow rate add 5–10% additional capacity
- Pressure add 5% additional capacity

Where an irrigation pump is pumping water of poor quality, such as that containing significant sand (more than 6 specs in a standard cup) or injected abrasive fertilisers, these figures must be doubled.

4.3 SURFACE-MOUNTED CENTRIFUGAL PUMPS

Actual net positive suction head (NPSH) must be calculated and be less than the required NPSH recommended by the pump manufacturer. At no time should total suction lift for centrifugal pumps exceed 7.5 m.

Flexible couplings between pumps and rigid installations (suction or discharge) must be specified to prevent failure due to vibration.

Specify a method of priming the pump.

Specify a valve at the highest point on the pump casing to allow air to escape when priming the pump.

4.4 SUBMERSIBLE PUMPS

When determining the pump duty point, include allowances for drawdown in bores or wells and for fluctuations in groundwater level over time.

The velocity of water in the rising column must not exceed 2.5 m/s.

The velocity of water in the annular space between the pump motor and the well casing:

- Must be at least 0.3 m/s
- Must not exceed 5 m/s,

unless otherwise specified by the pump manufacturer.

If a check valve is to be used in the rising column, it must be set? at a height no greater than 7 m above the lowest expected static water level.

A probe tube must be installed in all wells to allow water levels to be monitored, and water samples to be collected.

4.5 PUMP ELECTRICS

All electrical systems must be designed to meet local and national electrical standards and requirements.

Electrical systems for pumps must include, at a minimum:

- A starter type that meets local lines company and energy supplier requirements
- A manual switch-on and switch-off for each pump
- High and low pressure or flow cut-outs
- High pressure or zero-flow cut-offs on the upstream side of pressure regulating valves, if fitted
- Low water level protection
- Fault indicators (to identify the reason for a fault)
- An external running light installed at the pump shed
- A circuit disconnect for each electricity connection
- Overload protection for every pump motor
- Phase failure and reversal protection
- Voltage and amperage display
- A running timer
- A total hour meter

Care must be taken to minimise electrical interference and noise resulting from the use of variable speed drives. Many electricity providers now require harmonic filters to be installed. Check with local regulations.

All pump starting and control systems must be used only for manufacturer-approved applications.

The maximum voltage drop from the power supply point to the pump motor (includes voltage drop in submersible pump cables) must be compatible with the manufacturer's requirements. If a maximum voltage drop is not specified, it must be the lesser of:

- 5% of nominal operating voltage, or
- 15V

4.6 CONTROL

The design must allow the system to be operated in a way that:

- Meets the purchaser's needs
- Can be easily started and stopped
- Can be run for varying times
- Operates within the constraints of the system

The designer must ensure that the irrigation system can always be operated while maintaining a safe running condition.

4.7 SURFACE WATER INTAKES

All surface water intakes must have an appropriately sized screen or filtration system to exclude any debris present in the water source that may damage pumps. Intake screens must have a total open area of at least five times the area of the suction pipe.

All surface water intakes must exclude fish.

The suction pipe must be of sufficient diameter, and at a sufficient depth below the lowest expected water level, so that air is not drawn into the suction assembly.

The minimum distance from any bends, valves, or pipe reducers to the inlet of the pump must be equal to at least five times the diameter of the pipe.

The suction pipe must be at least as large as the size of the pump inlet.

The water velocity through the suction pipe and intake screen must not exceed the values given in Table 5.

Table 5: Allowable suction line velocities

Location	Velocity
Suction pipe	1.5 m/s
Intake screen	0.4 m/s

The water velocity through a foot valve must not exceed that of the suction pipe by more than 25%.

4.8 HEADWORKS

Control Valve

A control valve must be fitted to all systems.

Do not use valves that can only be fully open or fully closed in situations where the system can be started with empty mainlines.

Always use valves of a diameter at least as large as the pipe in which they are being installed.

Flow Measurement

Refer to Irrigation New Zealand's *Guidelines for the Measurement and Reporting of Water Takes* (2011), which provides a detailed description of requirements for flow measuring devices.

Ensure the system flow rate can be independently measured for compliance purposes. An offtake for water meter verification should be considered or an accessible length of straight pipe for the measurement of flow rate using a portable meter. The length of the straight pipe must be at least 15 times its diameter plus the length of any water meter.

Pressure Gauges

A pressure gauge or pressure test point must be specified on the high pressure and on the mainline side of the headworks.

Headworks efficiency

Pressure loss through the headworks (excluding any pressure control fittings, backflow prevention, or filtration) should not exceed the lesser of:

- 5% of the pressure delivered to the headworks, or
- 3 m of pressure loss

Certain components which may be used in the headworks, such as Reduced Pressure Zone (RPZ) backflow preventors, have a high pressure loss and will cause the head loss across the headworks to exceed 3 m. Reasons for the excessive headloss should be explained to the client.

Layout

The layout of the headworks must allow free access to all critical components (i.e. valves, meters, gauges) for operation and maintenance.

Specify components that allow the headworks to be dismantled easily?

If multiple pumps are linked together, construct the manifold so that each pump can be independently isolated.

Ensure that the check valve and control valve are downstream from the water meter.

Protect sensitive components (e.g. backflow prevention devices) with a filter, as required by the component's manufacturer.

Include a facility to drain the headworks or irrigation system to ground.

Air release

Specify an air release valve at the highest point in the headworks.

Fertiliser injection

Injection points must always be placed downstream of a backflow preventer. See the *Backflow Prevention Guidelines* (INZ, 2012) for further requirements.

Systems including fertiliser injection must also meet all local regulations.

Backflow prevention

Backflow prevention, appropriate to the level of risk, must be installed on all systems where contamination of water supplies is possible. Refer to *Backflow Prevention Guidelines* (INZ, 2012) for further guidance.

5 Measurement and monitoring

FLOW RATES

A flow measuring device, or provision for a flow measuring device, must be installed on the delivery side of the pumping station to measure the volume and flow rate of water. Refer to Irrigation New Zealand's *Guidelines for the Measurement and Reporting of Water Takes* (2011), which provides a detailed description of requirements for flow measuring devices.

The minimum accuracy of measurement for flow measuring devices is

- Piped flow + 5%
- Open channel flow + 10%

It may be necessary to monitor flow rates as a condition of the water take. The type and frequency of records is dependent on the water source, the monitoring requirements of the purchaser, and the monitoring requirements of the resource consent.

PRESSURE GAUGES

At a minimum, specify pressure gauges or pressure sampling points at the following locations:

- Anywhere in the system where pressure monitoring/control is being used (e.g. at pressure transducers and pressure switches)
- The inlet of all surface pumps
- The outlet of all pumps, upstream of any in-line components
- Upstream and downstream of components with a large head loss (i.e. backflow preventers)
- The outlet of headworks, downstream of all in-line components
- The inlet to each irrigator, downstream of all hydrants and connecting hoses
- Near the last outlet of an irrigator if a large head loss is expected through the machine or hose (e.g. at the end of centre-pivots, or at the gun-cart of a hard hose gun system)

The distance from a pressure gauge to any valve must be at least three times the diameter of the pipe.

WATER LEVEL

A method for monitoring water levels in water sources (lakes, ponds, production wells and any associated monitoring wells, if required for compliance) must be specified in the design.

The accuracy of water level measurements shall be ±0.1 m.

6 Documentation

A properly prepared design report and plan must be provided to the client. These must be completed in sufficient detail so that quotations for the supply and installation of the system may be obtained.

A quotation based on the system specification must be supplied to the purchaser, so that all parties are clear about what is going to be provided

Lists of information to include in the design report and quotation are included in *The New Zealand Piped Irrigation Systems Design Code of Practice* (INZ, 2012).

The purchaser must also be supplied with a commissioning report, as built plans, and operation and maintenance manuals upon the final completion of the irrigation system. *The New Zealand Piped Irrigation Systems Installation Code of Practice* (INZ, 2012). provides details about what to include in these documents.

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Definitions

For the purposes of this document, the following definitions shall apply:

Adequacy of irrigation: A measure of the proportion of the target area for which the soil is restored to a target soil water content. This is calculated as the ratio of the mean low quarter depth applied to the mean required (target) depth.

Application depth: The rainfall equivalent depth of water applied to the soil surface during a single irrigation event. It is the depth of water that would be caught in a rain gauge, not the depth of soil that is wetted.

Application efficiency: The percentage of applied water that is retained in the root zone, or in the target area, after an irrigation event.

Application intensity: The rate (mm/hour) at which irrigation is applied. It compares "gentle showers" with "heavy rain". (See specific calculations below).

- **Instantaneous application intensity (Ri)** The rate (mm/hr) at which irrigation is applied by an individual stream, from an individual outlet or nozzle, to a very small area. For example, for a rotating boom it is the flow from a single outlet divided by the area being wetted at any instant by that outlet.
- **Average application intensity (Ra)** The rate of application (mm/hr), averaged over the individual applicator's wetted footprint. For example, for a rotating boom it is the applicator's flow rate divided by the area wetted by one full rotation of the boom.

Application uniformity: The spatial variability of application. This can be defined in a variety of ways. Common examples are:

- Distribution Uniformity (DU)
- Coefficient of Uniformity (CU)
- Coefficient of Variation (CV)

Back flow preventer: Device designed to prevent water from flowing in reverse through the system. Commonly used to prevent added nutrients, chemicals or effluent from mixing with clean water sources.

Capital cost: The overall system purchase and installation cost ($) or cost per unit area ($/ha) as a total or annualised cost. For the purposes of economic analysis, the annualised capital cost may also be expressed as cost per unit volume ($/m^3) based on mean annual irrigation demand.

Design area: The specific land area (e.g. in hectares) which the designer and the purchaser mutually understand is to be irrigated by the irrigation system.

Distribution efficiency: A measure of how much of the water supplied to the property is applied to the land. It is a function of losses incurred in the conveyance or distribution system, from the point of water abstraction to the application system.

Drainage depth: The potential volume of water that percolates beyond the root zone, based on peak irrigation demand. This is typically expressed as a volume per unit area (m^3/ha) or an equivalent depth per unit area (mm/ha).

Effective rooting depth: The depth of soil profile that has enough rooting density for extraction of available water. Roots may be found at depths greater than this value but do not contribute significantly to water extraction.

Evapotranspiration (ET): The rate of water loss from a combined surface of vegetation and soil. It includes evaporation of water from the soil and plant surface, and transpiration by plants.

Field capacity (FC): The soil moisture content after gravitational drainage slows from a saturated condition to a rate that is insignificant (i.e. drainage rate less than 1 mm/day).

This is usually estimated in the field by measuring the soil water content 2–3 days after heavy rainfall, or by measuring the water content of soil cores in the laboratory after they have been equilibrated at a soil matric potential.

In New Zealand the laboratory estimation of field capacity is measured at the nominal -10 kPa soil matric potential, but direct field measurements show that it can vary between -2 kPa to -30 kPa depending on soil texture.

Headworks efficiency: A measure of the hydraulic performance of the intake structure, pump and headworks (excluding pump pressure and elevation differences) to indicate the extent of pressure loss in the water supply system between the water supply point and the mainline entry.

Infiltration rate: The movement of water into the soil profile. Measured as the rate (mm/hour, mm/day) at which a soil absorbs water. It varies with soil type, soil surface condition and moisture content.

Irrigation system: This comprises all of the equipment required to transfer water from the water source to the crops in the design area.

Mainline: A pipeline in a pressurised distribution system that transports water from the water source to sub units or zone control valve in a system.

Mainline efficiency: A measure of the mainline hydraulic performance. It gives an indication of how much pressure is lost between the delivery (mainline entry) and discharge points (machine entry, hydrant, or take-off in drip-micro systems), excluding variations in elevation.

Management allowed depletion (MAD): The proportion of the Crop Available Water that is allowed to be removed before irrigation is applied. The level is a management decision dependent on crop type, stage of crop development, seasonal water demand and other management factors and constraints.

Note: this term is not to be confused with maximum allowable deficit which is another term for the trigger point.

Permanent wilting point (WP): The soil moisture content where plant growth stops.

This is the lower limit of available water below which plant growth ceases completely. The soil matric potential at this point corresponds to about -1,500 kPa (-15 bar). The 'permanent wilting point' is generally governed by the amount of clay in the soil – the greater the amount of clay, the higher (% soil moisture) the 'permanent wilting point'.

Productivity: The marginal increase in productivity resulting from the irrigation system. It is generally expressed as the increase based on mean annual irrigation demand per unit area $/ha (may also be expressed as $/mm/ha). However for economic analysis, maximum and minimum values may also be of interest.

Readily available water (depth) (RAWD): The rainfall equivalent depth of 'readily available water' by a specified crop from its root zone.

The root zone depth in centimetres is shown as a subscript following the acronym (e.g. RAW40 is the 'readily available water' in the 40 cm deep root zone in a given soil).

Return interval (Return period): The typical period between one irrigation event and the next. It is usually calculated for the most demanding period so that the irrigation system can meet water demand most of the time.

Return on water use: The marginal change in returns resulting from the irrigation system. It is generally based on mean annual irrigation demand and incorporates cost and productivity elements above. Values can be expressed as returns per unit area or volume of water ($/ha or $/$m^3$). Values can be positive or negative, dependent on system costs, productivity and crop returns.

Scheduling coefficient: Used to determine how much extra irrigation should be applied to ensure that most of the crop gets sufficient water. It accounts for variances and inefficiencies of application systems.

It is common to use the reciprocal of the low quartile Distribution Uniformity to calculate the extra required. Multiplying irrigation need by the scheduling coefficient determines a target application depth that ensures that 7/8th of the crop will receive at least the required depth of irrigation (some will get considerably more).

Surface runoff: The volume of applied water that does not infiltrate into the soil at the location that it was applied, but runs along the soil surface.

System capacity: System capacity The flow of water per unit of irrigated area normally expressed as litres per second per hectare (ℓ/s/ha) or mm per day (mm/d) calculated on the basis of the system operating 24 hours per day.

Total available water (TAW): All the water that is extractable by plants (plant type may be specified); taken as the difference between soil water at field capacity and at permanent wilting point.

Water holding capacity (WHC): The volumetric ratio of all water contained in a layer or depth of soil at field capacity, including that held too tightly for plants to access.

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REFERENCES

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