ATTACHMENT 'A'

IRRIGATION SYSTEM DEVELOPMENT CHECK LIST		
Project Name:	Project No:	Project Date:
Client Name:	Ph:	Email:
Project Address:		

General Aim of the Irrigation System:

The purpose of an irrigation system is to ensure crops/plants maintain healthy productive growth during times of low rainfall and/or high evapotranspiration or in the case of production nurseries and protective cropping the irrigation system will be the only source of water supply to ensure healthy productive growth.

A well-designed irrigation system will:

- efficiently use water and energy
- deliver water at a sustainable rate
- not exceed soil limitations
- optimize crop Water Use Efficiency
- comply with all regulatory requirements, including consent conditions
- ensure the system is robust, reliable, simple and safe to operate
- ensure that the operating and capital costs are minimised
- growing media / substrate (i.e. hydroponic systems)

The Aim of this Document:

This document has a three-fold aim:

- to prompt both the designer and end-user to include all relevant information to meet the needs outlined above
- act as a Quality Assurance document
- provide accurate record-keeping

Primary Reference Documents:

RWUE-IF Standard & Codes of Practice for Rural Irrigation – Design, Installation and Commissioning

PART A – IRRIGATION SYSTEM DESIGN PARAMETERS

The first stage in the development of an irrigation system is to gather the necessary site-specific information needed to complete a functional design.

No.	Item	Description	Relevant SCoP	Comments	√/X	Notes
A1 – SITE LAYOUT						
A1.1	Map	Obtain a copy of the property map incl infrastructure and land features	1.2.1			This can be covered through a series of labelled aerial and farm maps clearly indicating all aspects as listed. If a section is not applicable (N/A), explain why
A1.2	Design Area	Identify the areas that the Irrigator would like to irrigate	1.2.1			
A1.3	Growing Structures Production/ Containerised Nursery Production	Growing structures - greenhouses, shade structures, hail net structures Bed, Bench & Trough types. Size type & quantity of containers	1.2.1			
A1.4	Physical Obstacles	Identify site restrictions or potential logistical limitations (e.g. trees, rivers, roads, proximity to power lines, etc.)	1.2.1			
A1.5	Land Restrictions	Identify protected or any sensitive areas	1.2.2			
A1.6	Topography	Identify land features that may affect the design including slope, hills, gullies, waterways and if required produce a Topo Map	1.2.2			

No.	Item	Description	Relevant SCoP	Comments	√/X	Notes
A2 – WATER SOURCE						
A2.1	Water Quantity	Identify how much water is available, both in terms of flow rate and total volume per season	1.3.1			Any uncertainties in gaining access to water and any requirements for gaining access (e.g. easements) should be discussed prior to beginning any irrigation design
A2.2	Water Source	Identify location of existing and potential future water supply	1.3.2			
A2.3	Water Supply Reliability	Determine if water restrictions are a problem that require water storage or extra capacity in the irrigations system for 'catching up'	1.3.2			
A2.4	Water Quality	Determine if the water quality is physically and chemically suitable for the proposed irrigation development	1.3.3			
A2.5	Energy Source	If power is required, locate the nearest supplies and identify any limitations, such as Peak and Off Peak demand	1.3.4			
A3 – CROP/PLANT INFORMATION						
A3.1	Crop/plant type	Confirm short term and long term cropping plans. Understand basic plant botany, inc growth stages, life span and cultivation practices.	1.4.1			Nurseries may have more than one plant type to be irrigated.
A3.2	Effective Crop Rooting Depth	Determine the depth from which roots extract water from the soil specifically for the range of intended crop and container size	1.4.2			
A3.3	Crop Coefficient	Establish crop coefficient (Kc) & use to define the peak demand of the particular crop being grown.	1.4.3			

No.	Item	Description	Relevant SCoP	Comments	√/X	Notes
A4 – SOIL INFORMATION						
A4.1	Soil Type Growing Media Type / Blend	Identify the types and locations of the soils on the property and if required a Soil Map should be developed. Establish what types of growing media being used.	1.5.1 1.5.2			
A4.2	Readily Available Water (RAW)	Determine the depth of water that is available to plants. Determine container (pot) capacity	1.5.3 1.5.4			
A4.3	Soil / Container Refill Point	Determine how dry the soil / media can become before it requires watering	1.5.5			
A4.4	Infiltration rate (Growing media absorption rate)	Determine the speed at which the soil absorbs water. This may be affected by other soil features such as pans, drains, or stock treading	1.5.6			
A4.5	Drainage	Identify any areas with poor or enhanced drainage. This may include natural or artificial soil drainage	1.5.6			
A4.6	Compaction and condition	Take into consideration current soil condition and if prone to compaction issues	1.5.6			

No.	Item	Description	Relevant SCoP	Comments	√/X	Notes
A5 – CLIMATE INFORMATION						
A5.1	Evapotranspiration	Obtain monthly ET_o data and related parameters for the property	1.6			A statement should be provided that details where the data has been sourced from and the applicability of this to the operation for each parameter
A5.2	Rainfall	Obtain monthly rainfall records for the property, or from the nearest weather station	1.6			
A5.3	Wind	Determine the prevailing wind directions and normal wind speed for the property	1.6			
A5.4	Managed	Consider greenhouse requirements	1.6			
A6 – FARM MANAGEMENT INFORMATION						
A6.1	Livestock	Determine if an allowance for livestock is required in the irrigation area.	1.7			This should include the impacts of feral pests such as wild pigs etc.
A6.2	Other Water Needs	Determine if water is required for other purposes	1.7			I.e. stock water, cooling, frost protection, etc.
A6.3	System Type	Determine if the Irrigator has any preference for system types	1.7			State the reasons why
A6.4	System Compatibility	Is the system compatible with production practices (inc. future), & any existing irrigation system	1.7			
A6.5	Labour	Determine the skill level of the labour available to run the system	1.7			
A6.6	Process Control	Identify the Irrigator's preference for automated checks and controls	1.7			
A6.7	Risk Preference	Determine how much risk of not meeting demand the Irrigator is prepared to accept	1.7			
A6.8	Price Budget	This dictates the quality of the equipment and irrigation effectiveness	1.7			The Irrigator should be informed of the potential impact on all aspects of the irrigation system's performance

No.	Item	Description	Relevant SCoP	Comments	√/X	Notes
A7 – SYSTEM CAPACITY						
B1.1	Location	Determine an appropriate sized and located area	1.8			Aim to irrigate the greatest land area for the greatest benefit
B1.2	Peak Demand	Decide on the peak water demand which is agreed with the Irrigator	1.8			Ideally, the design will meet the peak water demand for each crop in the design area
B1.3	Frequency (Cycle)	Calculate the minimum required return interval	1.8 2.6			If unable to irrigate daily, determine how much & how often
B1.4	Application Depth	Calculate application depth (or rate) range	1.8 2.5			Show calculations
B1.5	System Capacity	Determine capacity of the system based on area & application depth	1.8			
B1.6	Application Efficiency (A_e)	Efficiency must be ≥80% (this will depend on system design, system type & management)	1.8.1 2.4			
B1.7	Designed System Capacity	Determine design capacity allowing for the A_e	1.8.1			Show calculations
B1.8	Pump Utilisation Ratio (PUR)	Establish the factors that will affect the amount of time the pump runs	1.8.2			Detail these factors and show their time values
B1.9	Managed System Capacity	Determine managed capacity allowing for PUR	1.8.2			Show calculations

PART B – DESIGN PERFORMANCE PARAMETERS

The second stage in developing an irrigation system is to determine the level of performance of the future system, and designing the system to achieve these parameters.

No.	Item	Description	Relevant SCoP	Comments	√/X	Notes
B1 – IRRIGATION SYSTEM SELECTION						
B1.1	System type	Determine the best irrigation system type for the performance targets. Take into account water quality	2.3			Is it easy to operate? Is it reliable?
B1.2	Performance	Compare system to the design parameters.	2.3			Does the system match the soil-climate system? Does this meet the needs of the Irrigator?
B1.3	Impact Energy	Identify potential problems with stream impact energy. Ensure the irrigation design minimises these problems	2.3.1			Show selection process
B2 – SPRINKLER / EMITTER LAYOUT						
B2.1	Uniformity	Layout should meet the highest possible DU & CU, and consider future uses such as fertigation	2.7 / 2.8 2.8.1 2.8.2			If constraints dictate a system with lower uniformity than standard, the designer must clearly explain why
B2.2	Wind	Take into consideration the frequency and direction of prevailing winds	2.7.1			Show considerations
B2.3	Intensity	Application intensity meets or exceeds design specification	2.9			Show calculations

No.	Item	Description	Relevant SCoP	Comments	√/X	Notes
B3 – HYDRAULIC DESIGN						
B3.1	Water Velocity	Both maximum and minimum flow velocities should meet standards	2.10.1 2.10.2			Strike a balance between water velocity and pipe cost
B3.2	Pressure	Minimise pressure variation between water outlets to meet standards	2.10.4			
B3.3	Pipe Friction	Friction must meet standard. Velocity standard should take first priority in calculations	2.10.6			Take in to account the effect of pipe type and economics
B3.4	Air/vacuum relief, Pressure Relief & Surges	Air release valves and thrust blocks must be specified	2.10.7 To 2.10.10			As per manufacturers' recommendations
B3.5	Filtration	Match to the water quality and system type	2.11			As per manufacturers' recommendations
B3.6	Efficiency	Losses through fittings not to exceed 10% of total losses	Table 2			Show calculations
B4 – PUMPING STATIONS						
B4.1	Design	Determine the best type for the system	2.12 To 2.12.3			There are many parameters that must be considered, i.e., flow rate, power required, speed, servicing/cleaning
B4.2	Pump Efficiency	The selected pump/s should operate at highest possible efficiency	2.12.4			Show calculations using pump curves for clarity
B4.3	Motors	Motor should operate at highest possible efficiency	2.12.5			Should be matched to pumps so they operate at max efficiency
B4.4	Engines	Select an engine that operates at Best Efficiency Point for the required RPM and HP	2.12.5			Consideration should be given to the climatic temperatures, elevation above sea level and continuous load factor
B4.5	Centrifugal Pumps	Specify the total suction lift, flexible couplings and a method for priming	2.12.6			Design to prevent cavitation

No.	Item	Description	Relevant SCoP	Comments	√/X	Notes
B4 – PUMPING STATIONS						
B4.6	Submersible Pumps	Include allowances for drawdown in the well and fluctuations in groundwater level over time	2.12.10			
B4.7	Pump Electrics	Systems must be designed to meet local and national electrical standards and requirements	2.12.16			
B4.8	Intakes	Use appropriately sized screens or filtration systems to exclude debris	2.12.17			
B4.9	Suction Lines	Ensure suction pipe is of sufficient diameter and is installed at a sufficient depth	2.12.14 2.12.17			Show NPSHa vs. NPSHr calculations
B4.10	Suction & Discharge Pipework	Allow for easy control and monitoring of system operation. Consider water meter, pressure gauge and control valve placement	2.12.18 To 2.12.22			
B4.11	Fertiliser & chemical treatment	Allow for possible fertiliser injection into the system	2.12.23			
B4.12	Backflow Prevention	Must be installed on all systems & especially where contamination is possible	2.12.24			
B4.13	Pump Sheds	All pumping systems must have a shed that complies with standards	2.12.26			
B5 – SYSTEM CONTROL						
B5.1	Control	The design must meet the Irrigators needs and meet the standards	2.13			Show considerations, set out control philosophy

No.	Item	Description	Relevant SCoP	Comments	√/X	Notes
B6 – MEASUREMENT & MONITORING						
B6.1	Flow	Measuring devices must be installed. Determine if there are any specific regulatory requirements	12.14.1			Record instantaneous flow rate and total volume
B6.2	Pressure Gauges	Must be installed on all systems. Must comply with standards (vacuum & pressure)	12.14.2			Design should specify where gauges or sampling points are to be installed
B6.3	Water Level monitoring and control	Include airlines for bores to monitor Standing Water Level and Drawdown	2.14.3			
B6.4	Water Quality	Access point needed	2.14.4			Sampling taps at discharge is recommended
B6.5	Soil Moisture	Discuss monitoring options with Irrigator	12.0 2.2.4			Show how this relates to control philosophy
B6.6	Power Consumption	Monitoring operational power consumption	12.0 Table 2			
B7 – CHECKING PERFORMANCE TARGETS						
B7.1	Finalisation	Prior to finalising the design, check it matches the targets set at the start of the process	2.16 Table 2			

No.	Item	Description	Relevant SCoP	Comments	√/X	Explanatory Notes
B8 – FINAL SPECIFICATION, REPORT, SCHEDULES AND QUOTATION						
B8.1	Documentation	Design report, Plan & Specifications inc. assumptions, operating cost and technical analysis	2.17.1			Must be adequate to show client the key features of the system, departures from Standards and targets
B8.2	Quotation	Bill of Materials / Schedule of Rates	2.17.1			
B8.3	Material Warranties	State the warranty period, conditions and claim procedures	2.17.1			
B8.4	Workmanship Warranty	State the warranty period, conditions, claim procedures and expected response time	2.17.1			
B8.5	Insurance	State insurance cover details of the equipment on site.	2.17.1			Client should be notified 24 hours prior to handover of their insurance responsibility's
B8.6	Professional works cover	Provide copies of current Workers compensation, Public Liability and Indemnity insurance certificates.	2.17.1			