

Weather and Water: Whether or Not?

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Introductions IrrigationNZ activities

The INZ Team

- Venessa - CEO
- Stephen - Technical/Training
- Julie - Commercial
- Lynn - Administration
- Ella – Communication
- Policy – Student interns



About IrrigationNZ



What we do

- We advocate on policy matters impacting irrigators
- We set industry standards, codes of practice and guidelines for the irrigation industry
- We provide training to those wanting to irrigate more effectively and efficiently





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Presentation Overview

Water efficiency

- National Water Security
- Irrigation Best Practice - Water Efficiency
- Irrigation Performance Assessments & Commissioning
- Dairy effluent, nutrient management and infrastructure
- Water Measurement/Metering Blue Tick Program
- Industry training opportunities
- Post Cyclone Gabrielle, issues and solutions (group discussion)

Water Security

- The easy water is gone

- Generally stored water will be expensive
- Land use will have to be focused on higher value outputs to afford it
- Need better national directives from a National Water Availability and Security strategy
- Would guide freshwater plans and consenting pathways at a regional level



National Climate Adaptation Plan (NAP)

Authors - MfE, MBIE and Te Waihanga the Infrastructure Commission

Extreme weather events (storms, heatwaves, heavy rainfall) are likely to be more frequent and intense

Drought is predicted to increase in frequency and severity

Ensure all new infrastructure is fit for a changing climate

[National adaptation plan | Ministry for the Environment](#)



MPI Water Availability and Security in New Zealand



- Land use now versus future land use change enabled by water
- Restricted by allocation policy, ability to fill, affordability
- For credibility needs best practice demand management and water use efficiency
- Funding, role of public versus private sector

[Water availability and security | NZ Government \(mpi.govt.nz\)](https://www.mpi.govt.nz)

National Infrastructure Plan

- Fast Track Bill
- RMA amendments
- Regional Infrastructure Fund (RIF)

[National Infrastructure Plan | Te Waihanga](#)

[About the Regional Infrastructure Fund | Grow Regions](#)



Northland intensive land development example

12 ha avocado orchard

5m deep x 50,000m³ dam

Surface water capture

Land would have been unviable to
develop without water



Water Storage and Distribution co-benefits [Taitokerau and Waimea]

- ✓ Enables land use change decisions
- ✓ Underpins safe, reliable and nutritious food production
- ✓ Increases efficiency of natural resource allocations
- ✓ Provides community drinking water security
- ✓ Increases certainty for secondary process water
- ✓ Readily accessible source of fire fighting water
- ✓ Environmental flow stabilisation in low flow periods supports biodiversity
- ✓ Hydro energy generation (and solar)
- ✓ Recreation options on reservoir and canals

Water efficiency – using just enough to achieve production goals

#1 Know Your Crop

Issue that impact irrigation decisions

- Growth stage
- Critical vegetative and fruit development periods
- Stress points, bad and good
- Yield response to stress
- Market requirements; quality, quantity, and timing



Water and plants?

Top reasons to irrigate!

- ✓ Water present in chemical processes;
- ✓ Water is part of the “living material” in the cells;
- ✓ Water transports nutrients and organic compounds;
- ✓ Water keeps leaves stiff (turgid) to intercept sunlight and take in carbon dioxide;
- ✓ **Top reason - Water cools the leaves through transpiration;**



Root hairs

– the smallest pipe on an orchard!

But the most important....

- The only entry point for water into a plant
- The main entry point for nutrients
- Very sensitive to soil “humidity”, the moisture in air-filled pore spaces
- Once wilted must regrow to take up water and nutrients

- 3micron diameter
- Up to 300 hairs per mm²
- 5mm -20mm behind tip





#2 Know Your Soils

It's the sponge that holds your water reserves

Importance of soil texture and structure in irrigation efficiency

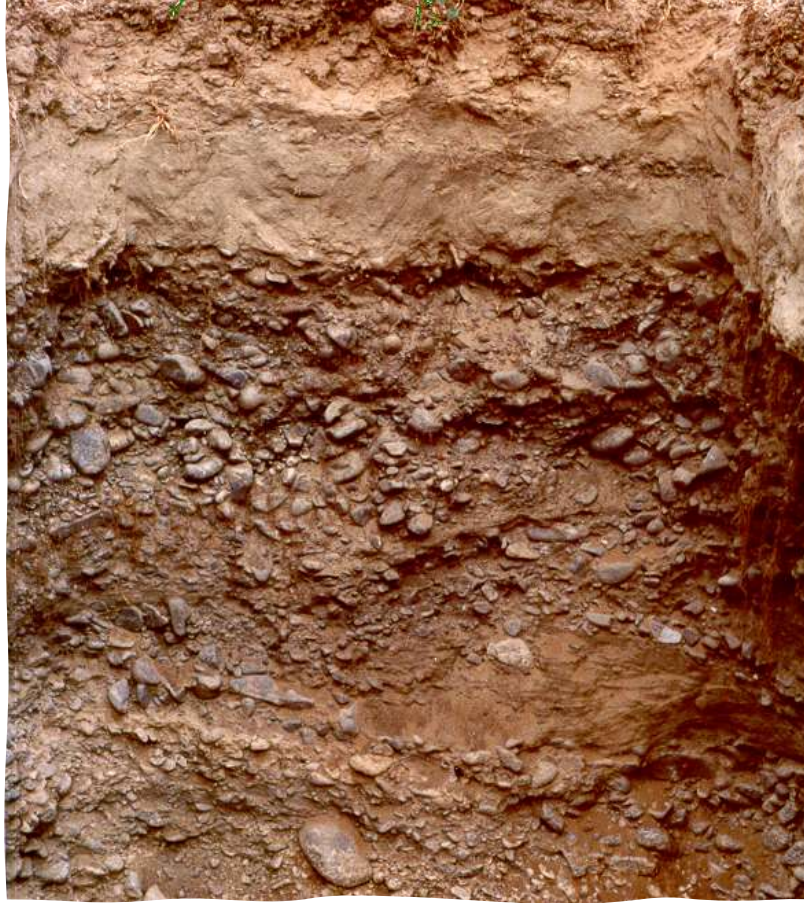
- Understanding soil types and layers
- Soil water-holding capacity



Soil

- Soil is more than just sediment!
- The components in order of particle size are - sand, silt and clay
- About half of soil is solids
- And about half is holes
 - “Macropores” act as drains and air pockets, getting oxygen to roots is just as important as water, most affected by sand and structure
 - “Micropores” store water and is mostly determined by the silt and clay content
- Highly variable across New Zealand





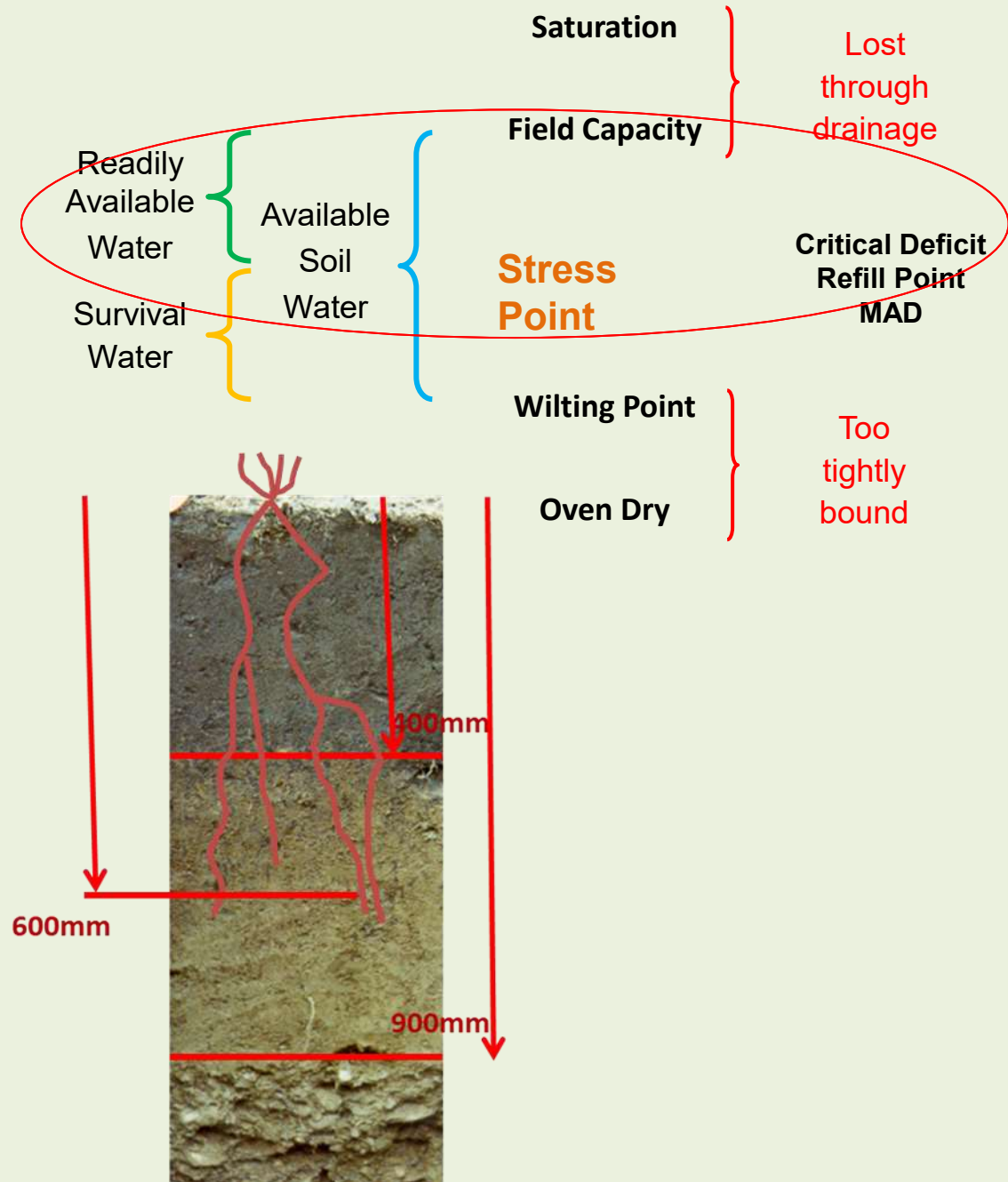
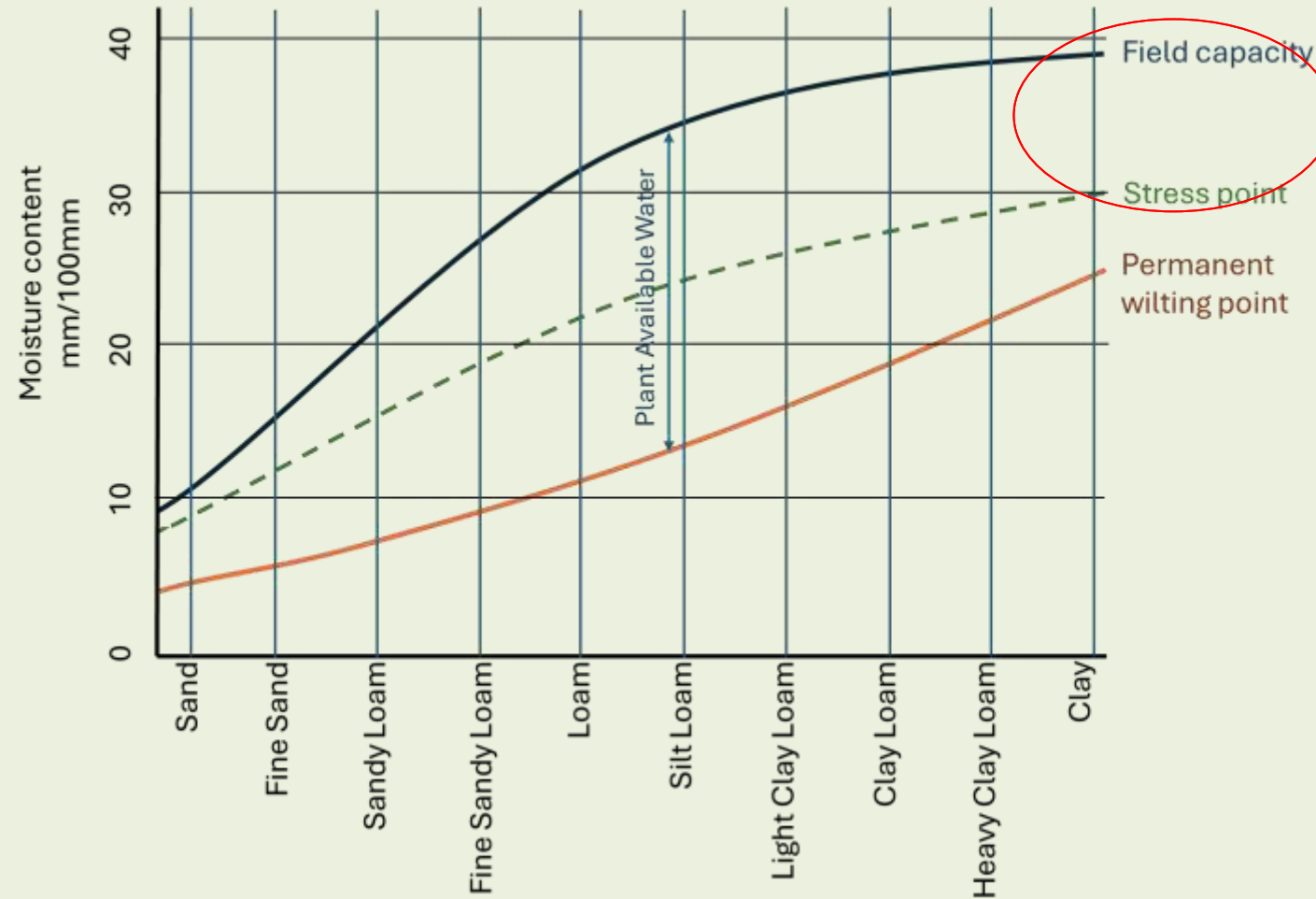
What soil have you got?

- Dig a Hole – take time to have a look, feel, smell!!
- Take a closer look at different points on your operation.

How much water do soils hold?

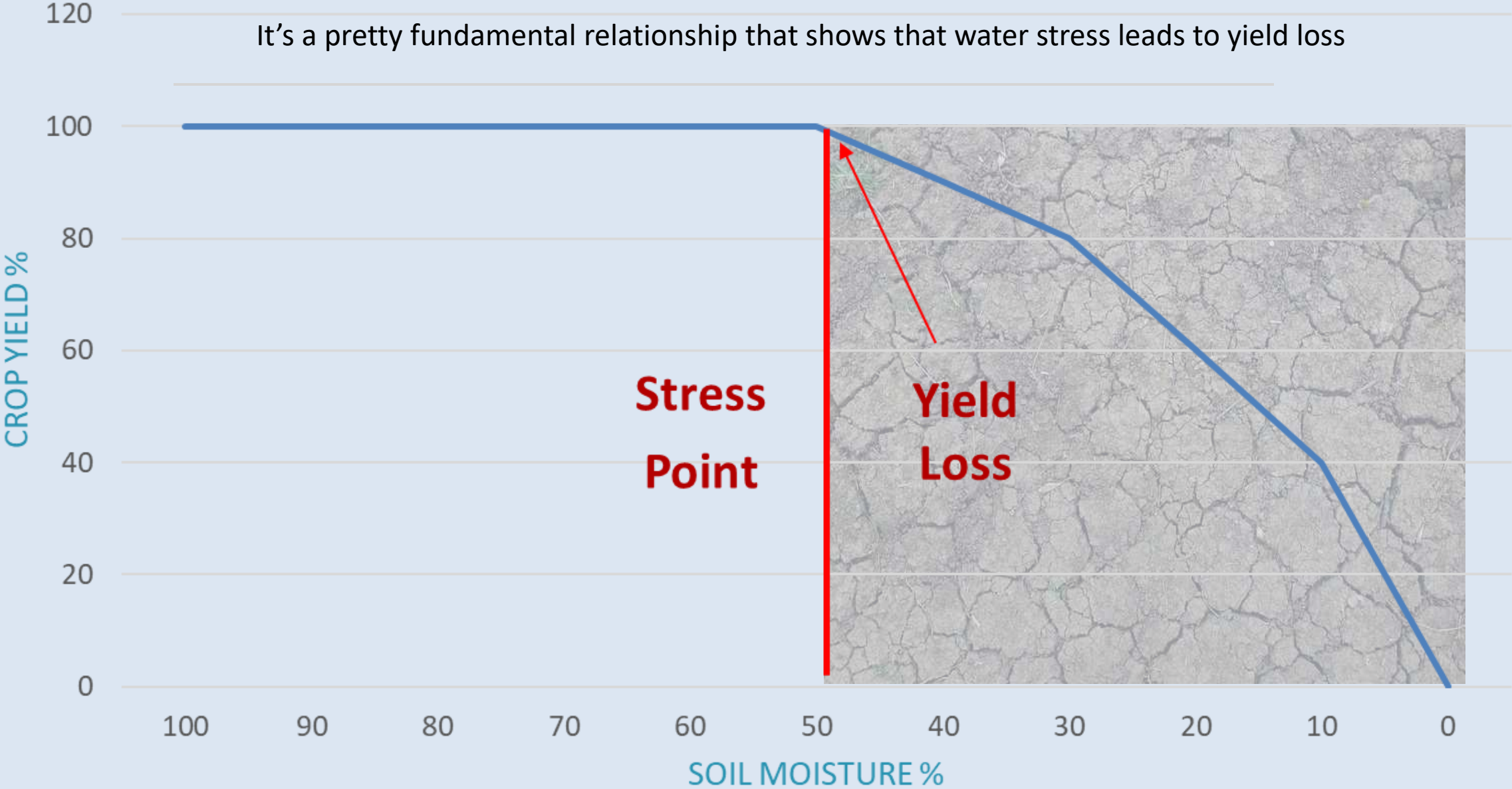
Our focus is managing the readily available water content

Water Holding Capacity and Soil Texture



Soil Moisture vs Yield loss

It's a pretty fundamental relationship that shows that water stress leads to yield loss

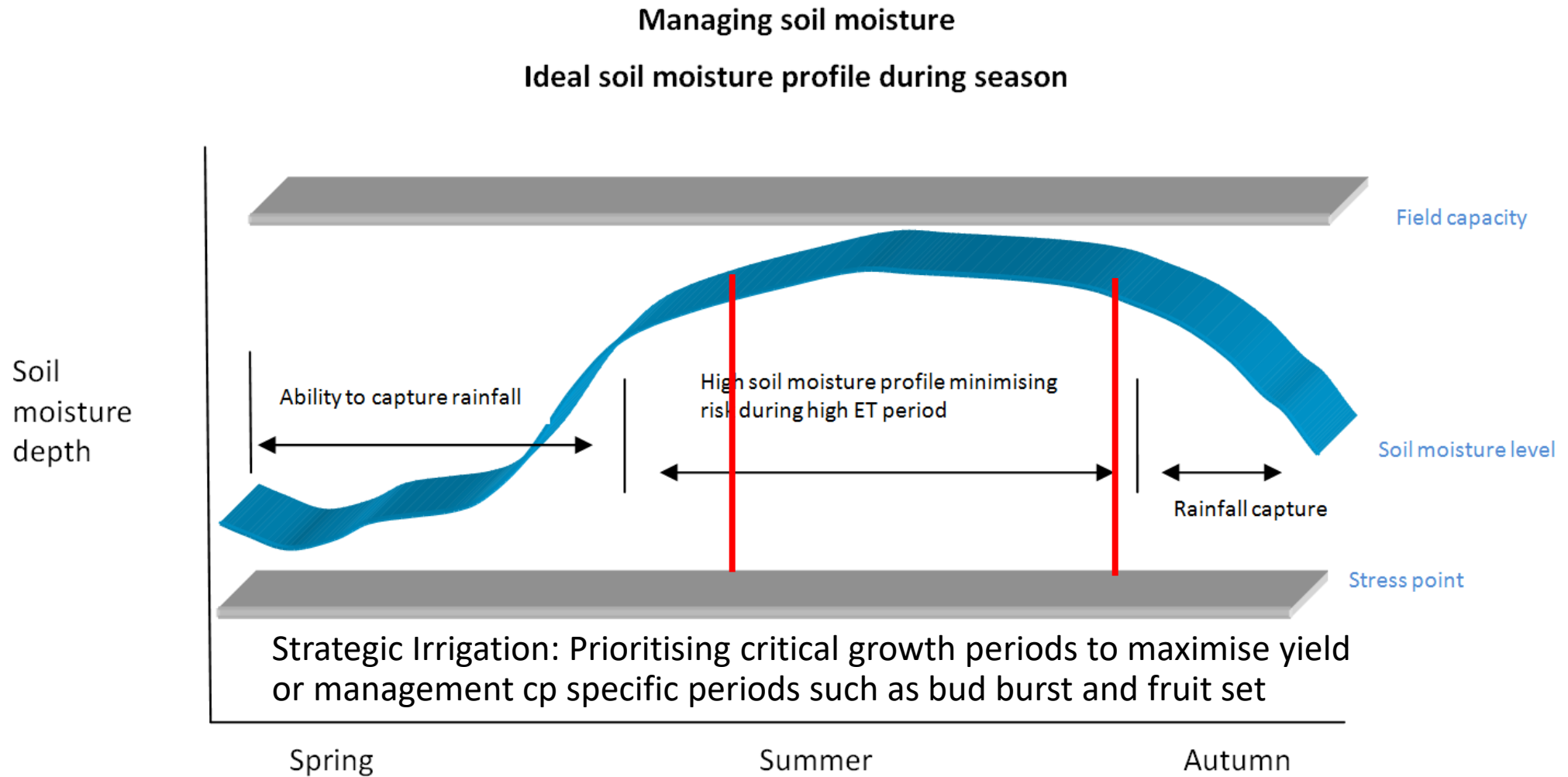


#3 Know Your Local Conditions

- Rainfall, Evapotranspiration, Wind, Humidity, sunshine hours, temperature
- They all affect the rate of water loss from the soils reserves
 - Monitoring local weather conditions
 - Using good weather data for better decisions
 - Site specific as possible
 - Having the highest level of confidence in data will assist decision making



Your local conditions, crop and soil types will establish your Seasonal Demand



#4 Focus on achieving good Scheduling



Why Schedule Irrigation?

- Matching water supply with crop demand
- Adapting to changing weather conditions
- Optimising water use efficiency
- Enhancing crop yield and quality
- Reducing operational costs, pumping water unnecessarily costs money!



Soil Water Budgets.

The concept of managing the soil reserves



- Need to know your Soil Water Holding Capacity
- Need to keep track of:

How much is added

Rainfall and irrigation

How much is lost or used

Evapotranspiration and Drainage

- Measured locally and specific to site

Date	Credits / Inputs (mm)			Debits / Outputs (mm)			Balance
	Rain	Irrigation	Deposits	PET	Crop factor	Withdrawals	40.0
1/09/2018	2.0		0.0	5.0	1.0	5.0	35.0
2/09/2018	5.0		5.0	3.0	1.0	3.0	37.0
3/09/2018	10.0		10.0	1.0	1.0	1.0	40.0
4/09/2018			0.0	3.0	1.0	3.0	37.0
5/09/2018			0.0	4.0	1.0	4.0	33.0
6/09/2018			0.0	5.0	1.0	5.0	28.0
7/09/2018			0.0	7.0	1.0	7.0	21.0
8/09/2018			0.0	6.0	1.0	6.0	15.0
9/09/2018			0.0	6.0	1.0	6.0	9.0

Just-in-Case vs. Just-in-Time Water Usage

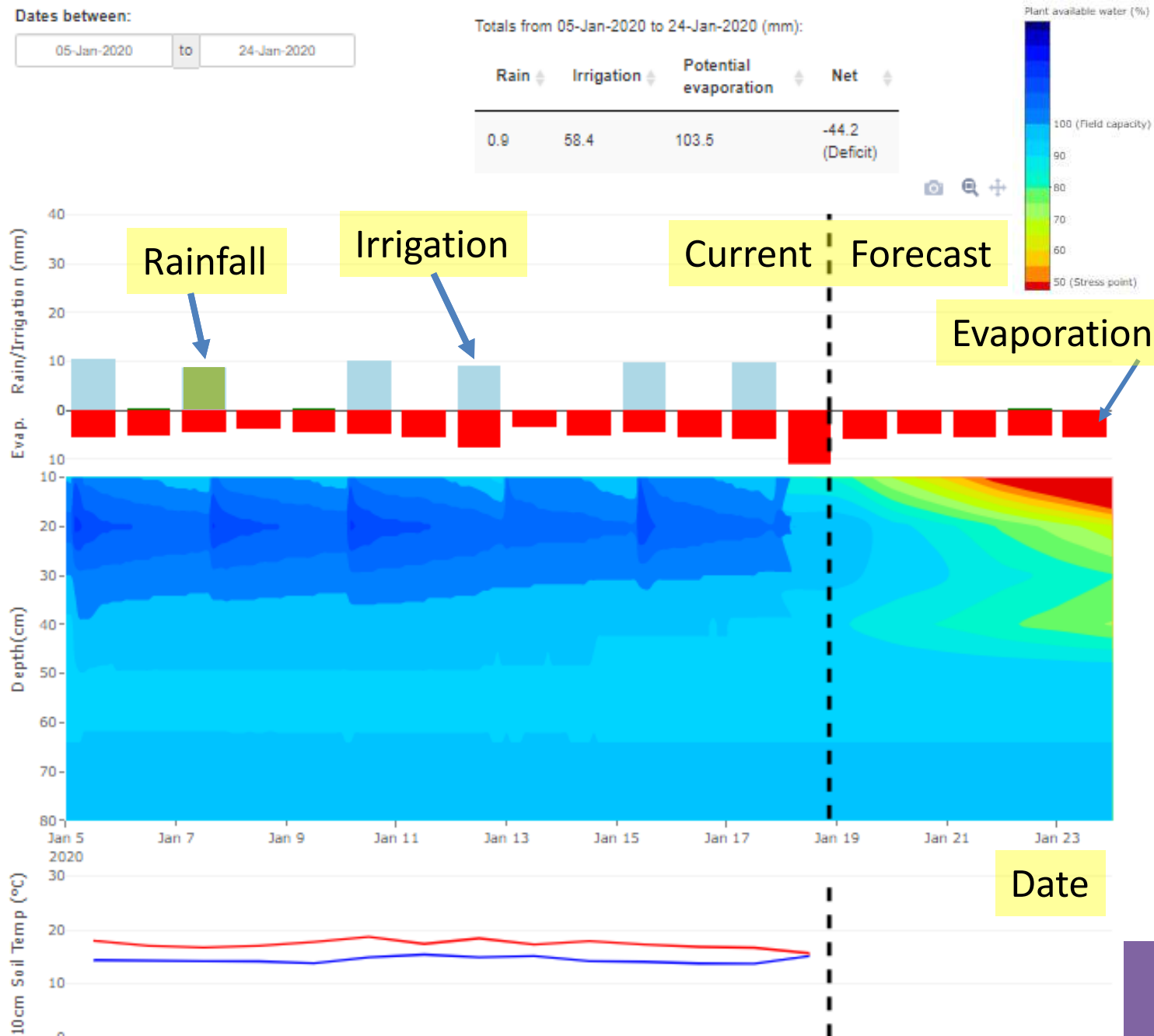
Strategic Water Use Approaches

- Reserving water for potential future needs
- Applying water just as needed, or
- Applying water to manage risk to supply

- Considerations:
 - Crop types
 - Soil characteristics
 - Weather patterns
 - Allocation

- High supply reliability or having stored water makes a huge difference in that decision, a just-in-time approach has proven to consume less water





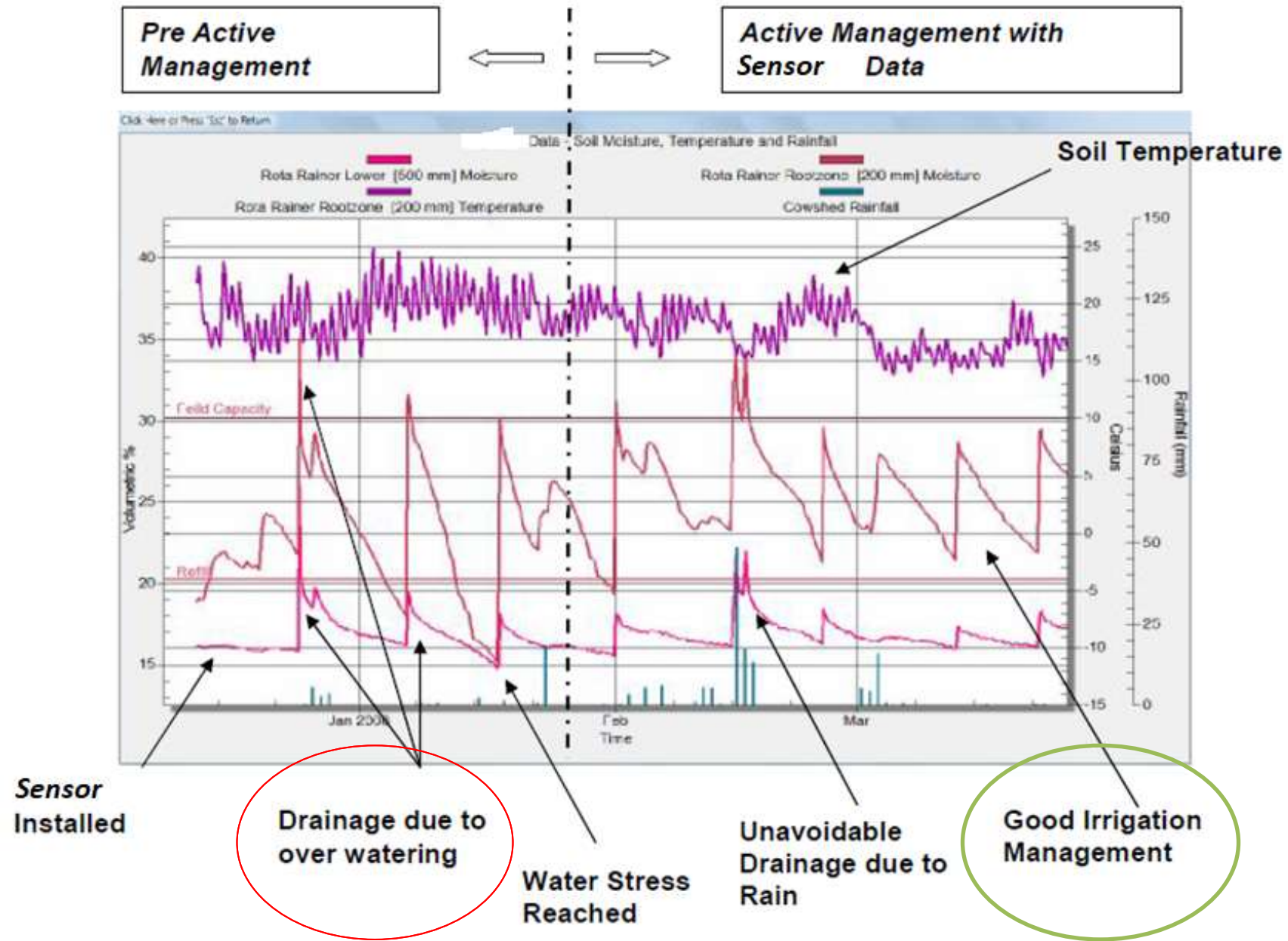
IrriMATE Justified Irrigation

- Balances risks and makes daily decisions whether to irrigate today or wait
- Uses current (immediate past period) data and the 3 day forecasts to simulate likely future outcomes at a daily timescale
- Model looks at drainage, economics, and production based on decisions across the irrigation rotation
- NIWA, DairyNZ, Fonterra, Perrin Ag, AgResearch, IrrigationNZ, LIC, MBIE

Good practice soil moisture technology

– using the right sensor in the right place and understanding the right data interpretation

– fewer drainage and runoff events occur with active management



#5 Know Your Irrigation Equipment

Is it functioning correctly?

- Regular maintenance and checks
 - Field testing and observations
 - Troubleshooting common issues
- INZ CoP Performance Assessment
[Performance Assessment : IrrigationNZ](#)



The future of precision irrigation



AI DECISION SUPPORT TOOLS – PROCESSING LARGER AND FASTER RATES OF DATA TO SUPPORT LAND MANAGER INTUITION



ADVANCES IN SOIL MOISTURE MONITORING SYSTEMS – GROUND PENETRATING RADAR USED FOR WIDER SWEEP OF SAMPLING



NUTRIENT MONITORING SENSORS DEPLOYED INTO SOILS TO MEASURE FLUX OF NUTRIENT REDISTRIBUTION



DIRECT SENSING OF PLANT RESPONSES TO GROWING CONDITIONS (SUCH AS CROPTIDE)



ROBOTIC SYSTEMS TO ALLOW REPETITIVE TASKS – SUCH AS CROP AND WEED MANAGEMENT, REDUCING WATER DEMAND



IMPROVED AVAILABILITY OF INFORMATION, TRAINING AND VOCATIONAL EDUCATION [CAREER PATHWAY OPTIONS]



The Performance Assessment COP

- Provides standardised guidelines to measure and benchmark performance of irrigation.
- Applies to assessments of pressurised irrigation systems, performed on-site under set protocols

Generic indicators that apply to all systems include:

- **the depth of irrigation applied during an irrigation event**
- **the intensity of application and**
- **how uniformly the irrigation is distributed**



What is Calibration (Do I have a Problem)

- collect a minimum amount of information
- only some of the potential performance indicators are determined.
- causes of poor performance are not identified

- four step process:
 - Gathering information about the system (bucket test)
 - Calculating performance indicator values
 - Comparing results with expectations
 - Adjusting irrigation system settings as required to achieve intended performance.



Full Assessment

Irrigation full assessment would include:

- Visual inspection
- Assessment of pump, pipe and filter performance including energy use
- Depth, rate and uniformity tests and determination of water application efficiency
- Seasonal irrigation efficiency estimation.



Full Assessment

Water use efficiency

- Crop irrigation demand
- Management allowable deficit
- Return interval
- Application uniformity
- Application intensity
- Application depth
- Adequacy of irrigation
- Application efficiency
- Distribution efficiency
- Headwork efficiency
- Supply reliability
- System capacity.

Other efficiency indicators

- Energy
- Labour
- Capital
- Capital cost
- Operating cost
- Effectiveness
- Productivity
- Returns
- Environment
- Average system efficiency
- Drainage
- Runoff.





Pressure gauges – as an irrigation system manager, you can't have too many!!

Water measurement- Soil Moisture monitoring

- IrrigationNZ updating its resources end of 2024
- Standard Operating Procedure Soil Moisture Monitoring Recommendation Guide to achieve Best Management Practice
- The standard that would allow the maximum benefit to decision making from soil moisture monitoring
- Situation > technology > how and where > location

[Practical Resources : IrrigationNZ](#)



Metering - Blue Tick

[Water Measurement: IrrigationNZ](#)

- Installation
 - Verification
 - Data Management
 - Blue Tick organisations and council workshop October
- Blue Tick – history, purpose and future vision
 - Water Meter Data – Beyond Compliance
 - MfE – update on policy and implementation, data insights
 - Verification field trip – looking at flow rig verse clamp on, manual data processing and flow check software
 - Data Quality Coding
 - Blue Tick Accreditation training update
 - Mass telemetry adoption – industry and council perspectives
 - Consent Condition Complexity and the rise of the API
 - Horizons LOWRA network
 - Blue Tick Data Management – relationships between installer, host and council, is it working how we expected in 2018?
 - Telemetry Micro Credential – how could it fit into Blue Tick?

Dairy effluent, nutrient management and infrastructure

- Published versions of the DNZ FDE CoP and PN21 need updating
- Will address areas to take into account, changes in technology [particular consideration to be given to tanks and bladders used for FDE storage], management practices and regulatory framework.
- Will refer to an industry Expert Advisory Group
- Substantially complete this work by December 2024 to enable publication in early 2025.



Opportunities for further learning

[Event Directory : IrrigationNZ](#)

- *NZ Certificate in Irrigation System Design*
- *IAL CERT III in Irrigation Technology*
- *NZ Certificate in Irrigation System Performance Assessment*
- *NZ Certificate in Irrigation Management*
- *Site Safe Civil Passport (Irrigation)*



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Collaborative management of irrigation water

Canterbury scheme audited self-management
with Ecan

Global consents for water take and discharge
conditions

Joint objective setting for intergenerational
changes

Agreed performance monitoring, audits and
reporting

Celebration of individual successes

Opportunities for water sharing and trading of
allocations according to land use cycles

Opportunities for further learning

- **NZ Certificate in Irrigation System Performance Assessment** – level 4 – 40 NZQA credits
 - Know how a system should perform and how to assess KPIs (distribution or emitter uniformity, depth of application, intensity)
 - Bucket testing, field observation, data analysis and reporting, useful for compliance reporting – based on INZ Code of Practice for Performance Assessment.
- **NZ Certificate in Irrigation System Design** – level 5 – 100 NZQA credits
 - The entire design process from assessing client needs, detailed hydraulic design and pumping, commercial proposal, to installation planning and commissioning – based on INZ Code of Practice for Design.
- **CERT III in Irrigation Technology**
 - Delivered in partnership with Irrigation Australia – not yet NZQA, still working with NZ WDC and AQF
- **Water measurement installation and verification** (and new for 2024 **micro credential in data handling**)
 - Used in the Blue Tick Accreditation program adopted by most Regional Councils for compliance with Water Measurement Regulations 2010 and 2020 amendments on telemetry
- **Site Safe Civil Passport (Irrigation)** - new for 2024
 - Necessary for access to some work sites

[Customised Workshops : IrrigationNZ](#)

Q&A??

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