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Project Summary

The focus of this project is to understand the return on investment (ROI) from implementing sub-surface water management options in the waterlogged areas in the Western Region. This investment ultimately aims to assist growers in making informed decisions around the installation of drainage to reduce the impacts of waterlogging on crop production areas, to increase overall farm profitability.

This will be achieved through grower participation in the planning, development, monitoring and maintenance of the drainage installation trial sites. Data (cost of implementation/maintenance, water movement, establishment, biomass, yield etc.) from within the zone of influence of the drainage and outside this zone at each site will be collected over time to give growers a better understanding of the improvements in yield and time to return on investment at each site.

Trial Objectives

Sub Surface Drainage is a soil water management solution that requires substantial upfront investment from growers. Previously the cost versus benefit of subsoil drainage has been too expensive to warrant employing this solution. With investment from the GRDC and the host farming family, SCF will monitor installation costs and yield benefits over multiple years to ascertain the value of subsoil drainage. Throughout this project, SCF aims to give farmers:

- An understanding of the requirements for implementing a sub-surface drainage solution. This includes contractor & site selection, drainage design options, installation techniques, and sub-surface drainage maintenance requirements,
- An understanding of the legislative agreements required when implementing sub-surface drainage for the discharge of water, and
- An understanding of how to calculate Return on Investment when implementing Sub Surface Drainage Solutions.





Why is this important?

Waterlogging is a common problem within the south-west region of Western Australia, particularly in the wetter months of winter and typically occurs when rainfall exceeds the ability for soils to drain away soil moisture (DPIRD 2019). Under these conditions, the excess water within the root-zone creates anaerobic conditions (conditions without free oxygen) and prevents the plant from performing gaseous exchange with the atmosphere or biological activities with the oxygen in the soil, air & water (DPIRD 2019). Left unmanaged, waterlogging can lead to soil structural decline and has the potential to create nutrient deficiencies & toxicities (such as Iron & Manganese toxicity), cause root death/reduced plant growth, or worst case, result in the death of the plant (DPIRD 2019).

Overall, it has been estimated that approximately 3 million hectares of land within the south-west agricultural region of Western Australia has moderate to very-high susceptibility to waterlogging or inundation, which represented an estimated annual opportunity cost of \$35m between 2009/10 to 2013/14 (DPIRD 2019). Early research undertaken by McFarlane & Wheaton in 1990 identified that direct yield losses of up to 2.5 tonnes/hectare could occur within cropping operations, and pasture production can also be affected.

There are methods available that farming operations can utilise to minimise and mitigate against the effects of waterlogging, including the use of either surface water management or subsurface water management methods.

This project, in line with its sister project in the Esperance Port Zone, will help growers whose properties are affected by waterlogging have a good understanding of the yield benefits and time to return on investment at each site.

What are the Options?

Farmers currently have two management type options available for water management: surface or sub-surface drainage solutions. Surface drainage/management options available to growers include options such as raised beds, evaporation basins, & interceptor drains, whereas subsurface options include techniques such as slotted pipe, mole drains & pumping options.

Unfortunately, the challenge with the implementation and adoption of some of these water management methods, is that they often impact farming operations; whether that be due to potential reductions in machinery movements/machine productivity or simply due to the cost of implementation of the drainage method utilised.

Subsurface drainage methods are typically less invasive than surface management options and offer added benefits such as better trafficability without the loss of machine/operations productivity.



Steps to Sub Surface Drainage Implementation & Management:

Implementing sub-surface drainage solutions can be expensive compared to other drainage options, particularly if they aren't implemented correctly. Some of the many considerations required when implementing sub-surface drainage, or measuring its success, include:

Step One – Planning:

To maximise the efficiency of sub-surface drainage, it all comes down to effective planning and a quality install. Some things to consider when planning for sub-surface water management installations include:

Site Planning:

Arguably one of the most important planning phases. When considering sub-surface drainage, some important questions to consider include:

- Is my site suitable for sub-surface drainage?
- What spacing do I need to place the parallel pipes?
- what angle/fall do I need to ensure sufficient flow?
- Have I got high-quality elevation maps to help guide potential installation locations?
- Do I have a good understanding of my soil types, permeability (hydraulic conductivity) and its depths?
- Am I going to be transferring saline or nutrient-dense water, and/or where will my water run to? Will the outlet create an erosion potential?
- Do I also need to implement more than one drainage method?
- How can I effectively monitor my success, post-installation?

Regulatory Planning:

It is important to ensure that the disposal of water follows state regulations, particularly if it is saline or nutrient-dense. Some of the considerations in regard to regulatory planning is considering whether you need to register a "Notice of Intent to Drain".

Contractor Planning:

Plan for your success by selecting a contractor who has the equipment and experience required to implement your sub-surface drainage.

Installation/Logistics Planning:

As installations can be expensive, consider methods that might help reduce costs of implementation. This could include determining where you can source appropriate fill-rubble from or liaising with other growers in the area interested to save on installation mobilisation costs.



Step Two – Installation & Ongoing Monitoring:

Once the drain is installed, monitoring sub-surface water management efficiency can take place in many forms. This can include measuring water quality and flowrates, weed burden/plant competition levels and overall productivity (grain yield or biomass). Yield maps and NDVI imagery can both be a great way to identify success in removing waterlogging issues, and allow comparisons between either treated versus untreated areas or current versus historical results.

Step Three – Maintenance:

It is important to regularly check that installed pipes are free-flowing and free from sedimentation & tree roots. If sedimentation is an issue due to your soil type, consider what your future maintenance or drain cleaning requirements may be. There are options available for cleaning drainage pipes to ensure they remain efficient.

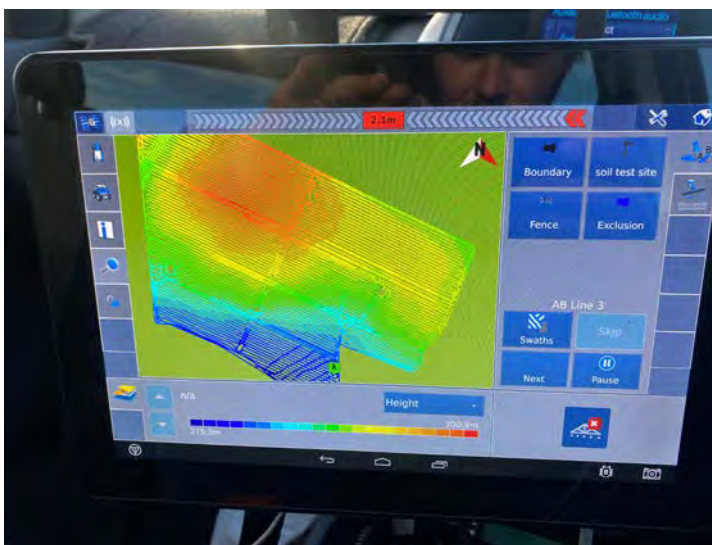




The Preston Family Demonstration Site:

The SCF/GRDC Subsurface Demonstration site will be established at the Preston Family farm, located approximately 20 kilometres west of the Cranbrook townsite. Predominantly a sandy loam over clay soil type, the paddock experiences issues with waterlogging. The family have previously installed a deep-drainage system to intercept excess water traversing down the hill, however, have found that there are still regions affected by waterlogging. These areas distinctly showed in the 2020 harvest yield map.

In early January 2021, the growers' paddock was elevation mapped by Stirlings to Coast Farmers, utilising Trimble RTK GPS equipment which collected elevation data in approximately 12-metre swaths. This data was put through a GIS (Geographic Information System) platform, to create a wide range of layers suitable for helping design drainage. Some of the layers created included contour maps, watershed maps, streamflow accumulation and pooling point maps. A baseline survey involving soil testing will also be undertaken at the demonstration site, along with georeferenced penetrometer readings to determine current levels of compaction across the trial site.



Starting in mid-February 2021, Drainage Downunder will install slotted pipe at depth in the pre-selected trial area. The process involves running a "trench-cutter" type machine through the ground, inserting the slotted pipe into the ground, and then in-filling above the pipe with Limestone caprock to allow water permeability. Careful consideration has been taken into consideration to ensure that there is sufficient fall in the pipe to allow the water to flow freely without impediment. A control, "non-drained" site will be located both adjacent to the sub-surface drainage installation site, as well as a second control, referred to as a "control-control" will be situated further uphill to demonstrate the paddocks full yield potential.

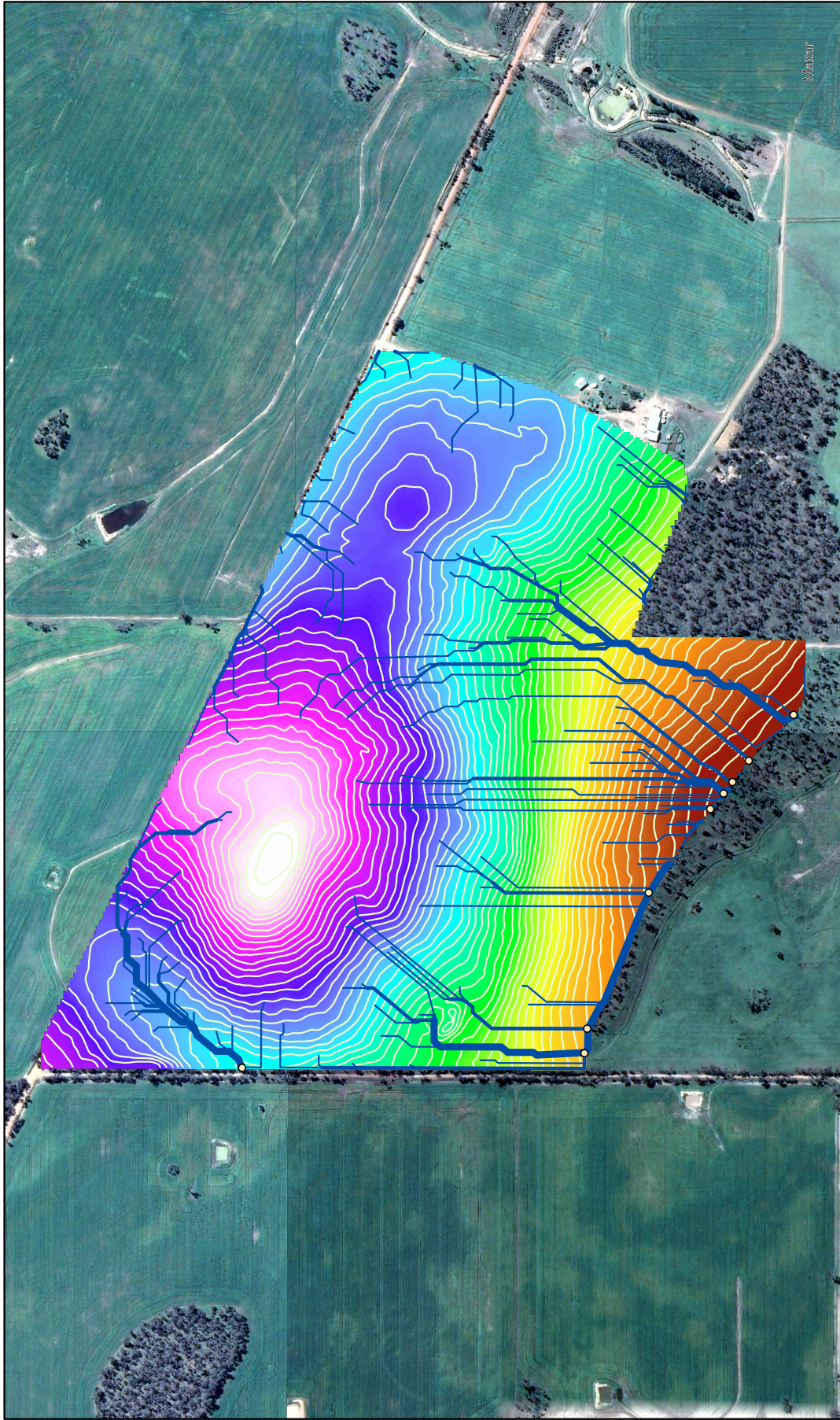
Stirlings to Coast Farmers have installed a dedicated weather station to record seasonal conditions across both demonstration sites. Post drainage installation, 2x soil-moisture probes will also be installed, allowing the potential to compare soil volumetric water content across both demonstration plots. Annually and throughout each growing season (2021, 2022 & 2023), SCF staff will perform a range of monitoring activities at the

SCF Sub Surface Drainage Site



- Existing Drainage**
 - Existing Drainage (thick black line)
 - 50cm Contours (thin yellow line)
- Predicted Stream Features**
 - Low Intensity (thin magenta line)
 - Medium Intensity (medium magenta line)
 - High Intensity (thick magenta line)

SCF Sub Surface Drainage Site



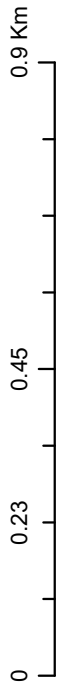
Predicted Stream Features

- Low Intensity
- Medium Intensity
- High Intensity

50cm Contours

Topography

300.945
274.522





How can you be involved in the trial?

JOIN US ON THE JOURNEY!

Are you interested in learning more about sub-surface drainage? Not sure where to start, or what is involved? Come join SCF on the journey!

Throughout the next four years, SCF will be hosting a range of interactive workshops & demonstration days and producing a wide range of fact-sheets and videos that help guide our farming members throughout the whole sub-surface drainage process from start to finish.

To register your interest in attending these events, please contact Philip Honey on 0428 768 589 or via email, philip.honey@scfarmers.org.au.

SCF Weather Station Access

Stirlings to Coast Farmers have installed a Metos 3.3 weather-station at the demonstration site, to collect rainfall and climatic data. This station consistently records rainfall events, temperature/humidity, solar radiation, wind speed & direction; logging data to the FieldClimate platform every 15-minutes.

Shortly, SCF will also be installing soil moisture probes in both the 'drained' and 'undrained' sections of the paddock, allowing the ability to record and compare the differences between the two treatments.

A leaf wetness sensor will also be installed, to help monitor disease potential within the paddock throughout the growing season.

To view the weather-station & soil moisture recordings for this paddock, log into the SCF Members Portal to access the login link, weather station username and password.

SURVEY:

We would love to hear your thoughts and experiences in water-management on-farm. To share your experiences and to stay in the loop on the project's news and activities, simply visit <https://bit.ly/GRDCdrain>

Acknowledgements: The development of the SCF Sub Surface Drainage Demonstration Site was made possible through funding support from the Grains Research & Development Corporation, demonstration site support from Preston Farms & equipment support from Drainage Down Under.



Disclaimer: While every care has been taken in preparing this publication, Stirlings to Coast Farmers inc. accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained within. To the best of our knowledge, the content was correct at the time of publishing and SCF highly recommends seeking professional advice before implementing drainage design & installation.